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**Australian Communications
and Media Authority**

Australia's regulator for broadcasting, the internet, radiocommunications and telecommunications

www.acma.gov.au

Trends in Communications and Media Technology, Applications and Use

March 2009

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Overview

Trends in Communications and Media Technology, Applications and Use provides an overview of infrastructure, applications, social and economic trends and developments, and anticipated developments over the next five to ten years.

The report focuses on developments since the release of ACMA's [Top Six Trends in Communications and Media Technologies, Applications and Services – Possible Implications](#),¹ in May 2008. Some continuity is provided through references to incremental advances in trends and developments identified previously. This report includes recent developments and expectations in technologies, applications and use that were introduced in the May 2008 report, such as spectrum sharing, deep packet inspection, the semantic web and social web.

While the primary focus of this report is on technology, a section on the social and economic implications of technology developments has been added. This new section recognises that the social and economic use of technology also enables innovation and change.

This overview section also provides a high-level outline of potential regulatory issues arising from developments in technology and use.

The views set out in this report are not put forward as predictions and there is no attempt to pick technology winners or losers. The report contributes to work ACMA is undertaking to inform its understanding of the operation of regulation in the communications and media markets and as part of its statutory responsibilities to be informed and advise on technology developments and service trends. It offers an opportunity to identify and engage with change, and to anticipate the need for possible action by ACMA.

Research was conducted using desktop analysis over the period April to November 2008, focusing on developments of significance reported over the period. ACMA will continue to update this report regularly and welcomes your feedback.

Key findings

Technology and service developments over 2008 were consistent with the established trend of network and service convergence. Developments identified in this report provide evidence of ongoing technology development, continued evolution of the web, and social and economic change driven by use of the social web. These expectations must however be qualified given the consequences for capital and R&D intensive information and

¹ http://www.acma.gov.au/WEB/STANDARD/pc=PC_311145

communication technology (ICT) sectors that have arisen or that may arise from the global economic slowdown.

The report provides evidence of the ongoing convergence of networks and services, particularly through:

- increasing use of IP video, providing further impetus for the integration of professionally produced content on the internet and
- the continued evolution of cellular and other wireless networks and mobile operating systems capable of supporting packet-based transmissions and new software applications.

There is evidence of more profound change evolving through:

- a more personalised web experience
- a rapid expansion of social media and a consequential surge in new media influencers and
- social networking and the use of web-based computing systems like cloud computing developing in ways that change the way people work and business is conducted.

Some of these changes continue established regulatory pressure points, particularly:

- the increasing demand for and use of use of radiofrequency spectrum to support IP-based services and the evolution of high-speed data on mobile networks
- potential privacy concerns arising from network management practices that incorporate location aware services and use of personal information for behavioural marketing
- change in the way content is produced and distributed across multiple platforms highlighting where there is differential treatment of content across distribution platforms.

New regulatory challenges include:

- increasing public interest in data portability between web service providers, and the management of online identity, data and reputation
- the evolving cyber-crime economies which operate across the internet.

Summary of developments and trends

INFRASTRUCTURE

Continued growth in internet traffic is expected, driven mainly by an increasing use of IP video, data centres and virtualised computing. Growth in internet traffic has been forecast to increase four-fold over 2008–2012.²

The main driver of internet traffic internationally is expected to be web-based video including streaming or downloading from a file-hosting site. Australian developments

² <http://www.emarketer.com/Article.aspx?id=1006586>

include streamed on-demand video targeted at broadband subscribers, and a subscription radio service streamed to 3G mobiles.

Internet-enabled digital TV sets may provide further impetus to the integration of professionally-produced content to the internet, along with greater consumer control and interaction.

Performance improvements in Australian broadband networks are expected from the migration from an underlying range of transmission protocols to a native IP over ethernet³ protocol and higher-speed broadband networks.

Mobile networks and operating systems are increasingly capable of supporting packet-based transmission and mobile software applications, and have some compatibility with other radio and fixed-network access systems. More consumer electronics and laptops are expected to be manufactured with the hardware required to connect with cellular mobile networks.

Open source mobile operating systems have emerged as alternatives to proprietary systems. Internet connectivity for mobile devices together with new mobile operating systems and third-party applications for mobiles have been made available without organised support from equipment vendors and network operators. Consumers may benefit from handsets with more functionality and greater ease of use.

The GSM Association⁴ (GSMA) successful trialling of voice calls using the SIP-I protocol foreshadows the migration of mobile voice calls from circuit-switched to packet-based voice between mobile networks.

Mobile phones equipped with near field communications capabilities are now available in some countries including Australia. This is a very specific short-range wireless technology that is expected to drive increasing uptake of mobile commerce and payments services in Australia within the next few years and bring Australia into line with developments that are already occurring in Asia.

Spectrum-sharing developments have taken on more momentum with proposals for the release of spectrum 'television white space' under consideration in the United Kingdom and USA. The allocation of radiofrequency spectrum for the development of intelligent transport systems is under consideration in several jurisdictions including Australia. These developments reflect ongoing changes in radiocommunications spectrum management globally that respond to an increasing sophistication and diversity of radio technologies, along with congested and contested spectrum.

Green IT developments and initiatives are also expected to reduce carbon dioxide emissions and energy use in activities related to information technologies during this period.

APPLICATIONS

The web continues to evolve through developments in location-based services, and more personalisation of web experiences.

³ Packet transmission without the layer of legacy telecommunications transmission protocols such as asynchronous transfer mode (ATM) and Frame Relay.

⁴ A global trade association representing the interests of GSM mobile phone operators and vendors <http://www.gsmworld.com/>

The first generation of the web was characterised as the Information Age that enabled search functions. With the emergence of the second generation (Web 2.0) over the early part of this decade, the story of the web has largely been about interaction. It became known as the social web. Currently in the early stages of development, the semantic web (or Web 3.0⁵) is expected to provide a more personalised web experience by anticipating and delivering information of interest to individual users.. While the full potential of the semantic web is not expected to be realised until 2010– 2020, advances in standards development have enabled some early applications to be made available.

Location-based services (LBS) are one example of this type of personalisation of the web. In Japan, South Korea and the United States location-based services are now a firm part of mobile services marketing.⁶ Wider take-up is possible should leading social network sites add location-aware services. Demand for LBS in Australia has been limited in comparison, although this may change with the increased availability of mobile broadband services and GPS-enabled handsets, and as operators seeking to provide value-adding services.

Another potential growth area is new revenue streams earned from monetising⁷ information about users. Behavioural-targeting software is used to harness and direct relevant information of interest to users. Where these new revenue streams are directed towards infrastructure upgrades there are potential benefits to consumers, but there are potential risks to privacy.

A report published in October 2008 outlined the top five global e-security threats and challenges for 2009 and beyond. These include:

- malware threats (due to poorly designed and maintained web sites)
- botnets (malware delivery systems gaining in sophistication and obfuscation techniques)
- cyber warfare (direct denial of service attacks by antagonist nations)
- voice over internet protocol (VoIP) spam and phishing
- the evolving cyber crime economy incorporating data theft and fraud.⁸

Recent developments in human computer interaction (HCI) point to a possible future where computers are more usable and responsive to user needs. A number of telepresence videoconferencing systems are now available in Australia. Evolving tele-immersive systems are expected to provide much richer forms of virtual reality communications.

USE

Developments in digital media offer consumers more control, more choice and more opportunities for social interaction through control over what they watch, how they watch it and who they share the experience with. This is leading to changes in the social and economic use of the internet and IP-based services, which in turn is driving an expansion of social media and the development of new media influencers.

Understanding or monitoring user web experiences has become more complex. Factors to consider include the:

⁵ Although Web 3.0 has not yet been defined the term is inclusive of semantic technologies.

⁶ <http://www.directionsmag.com/press.releases/index.php?duty=Show&id=26647&trv=1>

⁷ To 'monetise' is to make money from information that users post online

⁸ <http://www.gtisc.gatech.edu/pdf/GTISC%20Cyber%20Threats%20Report.pdf>

- practices of website developers, owners and ISPs
- users' choice (and maintenance) of computing hardware and software, and
- users' own level of digital literacy.

Moreover, these variables are not static but subject to ongoing change, which makes understanding and monitoring user web experiences more challenging. Nevertheless, the exercise is important as accessing digital media and communications services via the web is increasingly part of everyday life. Users need to be able to recognise risks in this environment and adopt protective behaviours.

One response to these issues is the formation of interest groups such as the [Data Portability Project](#)⁹ which is an advocacy group formed to promote the idea that individual users have control over personal data and how data is used by service providers. The project seeks to use open-source solutions and promote the use of existing open standards that enable data portability through influencing industry developments.

Further evidence of the internet's transformative effect is that readership of blogs is now a mainstream online activity internationally. The number of blogs tracked internationally by blog search engine Technorati reached 133 million by September 2008. However, Technorati's figures may disguise total blogging activity. In China (which now has the world's largest internet user population of 253 million) the number of regular blog users rose to 107 million in 2008, up 116 per cent over 2007.¹⁰ There is evidence to show that blog readership in Australia is following international trends.

The functionality and popularity of social networking sites continues to expand. Facebook reported it had 3.36 million Australian users (18 per cent of the population) by the end of July 2008, an increase of 43 per cent over the preceding six months.

Social networking is being deployed within enterprises as well. Online social networks are being used for web-based business networking, job hunting and for connecting with customers online. Web-based collaboration through blogs, wikis and social networking sites enables enhanced employee collaboration, inside and outside an organisation. The functionality of social networking is expanding as online social network providers add mobile interfaces to their services.

Social media provides individuals and organisations with a low-cost medium for producing and distributing content in ways that were previously only available through traditional media (TV, radio and print). The participative web has empowered consumers to become part of the value creation process. This is evident in online marketing sites (for example, eBay and Amazon) and 'community of practice' involvement in after-sales service.¹¹

Web-based computing systems, applications and services may transform the IT industry through enabling use of centralised computing services. Cloud computing (the use of web-based computing systems, applications and services that are accessed independently from the underlying infrastructure or geo-physical location) enables computing services to be available where and when needed. With recent economic factors driving uptake (including the falling costs of storage and business looking for IT savings or efficiencies), cloud

⁹ <http://www.dataportability.org/>

¹⁰ <http://www.cwrblog.net/1224/chinese-iwom-landscape-by-cic-data.html> Data was sourced from the Chinese Internet Information Center: <http://www.cnnic.cn/en/index/index.htm>

¹¹ <http://www.thinkstudio.com/text/chain20.pdf> A 'community of practice' involves learning through social interaction between people who have similar goals and objectives.

computing has the potential to profoundly change the way people work and the way companies operate.

Regulatory challenges

RESOURCE AND INDUSTRY MANAGEMENT

Technology and service developments over 2008 were consistent with the established trend of network and service convergence. High-speed fixed and mobile broadband networks are increasingly used for video communications and the distribution of media content over multiple platforms.

To achieve higher data rates for mobile broadband networks, more radiofrequency spectrum will be needed to supplement technological advances. Industry anticipates that there will be a requirement for 20 MHz channels for LTE-Advanced (the proposed further enhancements to mobile networks that go beyond those of the existing global standard for third generation wireless communications) compared with 5 MHz channels for HSPA and WCDMA networks.

Increasing demand for data capacity over broadband networks is expected to drive the need to improve the efficiency and flexibility of the available infrastructure. Interference issues need to be managed if spectrum is to be licensed to enable more flexible use of the frequency. Potential spectrum management implications arising from shared use include the potential for a greater reliance on class licenses and the development of self-management arrangements between users of the same spectrum. On the other hand, the rights of incumbent spectrum rights holders will need to be protected. These issues underscore the importance of technology and service neutrality to allow for competing interests in spectrum use. Industry regulation based on assumptions of segmented, independently operated services is also open to challenge.

Privacy and security concerns about the use of behavioural-targeting and location-aware services to track consumer interests and activities may develop over time. Striking a balance between promoting innovation and protecting user privacy are important policy considerations. Intervention may not be required should users acquire sufficient control of privacy settings through industry-led trust and verification software. The development of new industry codes of conduct has been proposed as a flexible regulatory tool to keep up with new services and avoid more prescriptive regulation.¹² It is still early days for applications hosted in the cloud computing environment.¹³ Nonetheless, it is apparent that the internationalised nature of cloud computing can pose challenges to the reach and effectiveness of data regulation across jurisdictions.

Cybersecurity is a growing concern to consumers, business and the public sector because of the increasing importance of IT processes in society. Cybersecurity threats are likely to be addressed by a combination of:

- e-security regulation to set limits on the behaviour of industry participants, and
- technology standardisation that could reduce the probability of equipment and data being misused.

¹² *Is there a need for converged TV regulation*, Ernst & Young, www.ey.com

¹³ The cloud is used here as a metaphor for the internet.

Multi-faceted regulatory strategies are necessary to address the nimble and innovative developments in cybercrime economies.

CONSUMER PROTECTION AND SAFEGUARDS

As social networking and the use of social media become more widespread, consequential issues of interest to users that are likely to arise include online identity management; personal and commercial data management; reputation management; and the influence of social media.

Recent developments in the semantic web foreshadow an increasing interest in data portability between web pages and between web service providers. Web users may want to take their online identity, media, contacts and content to web services of their choice. The useability of social networking may be enhanced if it were possible for data to be easily transferred from one web service to another (for example, personal contact details to be updated in one location with updates to other social networks flowing automatically). Relevant considerations include questions about commercial incentives in the use of data and the ability of individuals to have control over their data. Meanwhile, industry initiatives and user-led initiatives like the Data Portability Project may help to resolve data control and portability issues. Monitoring the level of user interest in data portability and industry performance in enabling portability may be of interest to ACMA because of the ongoing growth of social networking.

New influencers from the blogosphere and social networking sites have an increasing role in informing and shaping public opinion and attitudes.

Digital literacy, consumer education programs and industry performance monitoring and reporting will need to recognise the fact that web users' experiences are complex and fast changing. Cybersecurity threats and risks can be addressed in part through education to make users more aware of the care that should be taken in using IT processes.

Managing quality of service expectations is also likely to become a more prominent as growth in the use of applications that are particularly sensitive to jitter and latency, such as VoIP, video streaming and real-time gaming, may make consumers more sensitive to the quality of their service experience.

Infrastructure

This section provides an overview of trends and developments in communications and media infrastructure, including computing and digital media hardware and software, network operating systems and physical networks.

Computing and digital media

COMPRESSION AND ENCODING

There have been some developments internationally in compression standards development and encoding systems for the transmission and storage of video. This is a key development to enable more content to be delivered to customers and to enable customers to handle more content efficiently.

While compression techniques enable more efficient delivery of video content, the process requires a compromise between the transmission/storage requirements and the user experience. Too much compression may noticeably distort images by reducing the level of detail on display, a situation that is likely to be more noticeable in high-action video such as sporting events. Alternatively, uncompressed high definition (HD) video provides higher-quality viewing, but needs higher bandwidth broadband connections well in excess of that required for compressed video. Compression techniques will continue to be of significance because of the increasing demand from users to access content regardless of the format in which it was created and because of the interest in tailoring content to the variety of display terminals that can be used to access content.

Recent developments in this area include work of the International Telecommunication Union (ITU) Study Group 16 – Multimedia coding, systems and applications which established a special team known as the Joint Video Team (JVT). The JVT consists of experts from ITU-T Video Coding Experts Group (VCEG) and Moving Picture Experts Group (MPEG). Study Group 16's JVT was responsible for developing the H.264 standard which has seen widespread support by Apple (iTunes), Adobe Flash Player, the BBC and ABC iView streaming. H.264 can deliver the same video quality as an older standard MPEG-2 (used for DVD video) while only using half the storage space.¹⁴

Study Group 16 will focus on a definition and begin algorithm design for H.265, the next video compression standard. H.265 will not be an extension of the existing H.264 standard, but a new process with a focus on simplicity and more efficient encoding. According to

¹⁴ http://www.itu.int/newsroom/press_releases/2008/23.html

Study Group 16, the final recommendation of H.265 is expected to be delivered around 2009–2010 with a complete standard expected around 2012.¹⁵

In a separate initiative, a new encoding system offering the ability to stream HD video was launched by IBM and Broadcasting International in the USA in April 2008.¹⁶ It is claimed that the system allows for an 80 per cent reduction in the amount of bandwidth needed to stream HD video. Broadcast International has been reported to be targeting HD video encoding at 1.5 Mbit/s and Mobile TV at 46 kbit/s.¹⁷

COMPUTER PROCESSING POWER

Advances in computer processing power will allow for higher performance applications to run on customers' terminals. A future option for increased computer processing power, known as tera-scale computing, will use multiple cores (currently up to 80) embedded on a single central processing unit (CPU) chip.

In recent developments by Intel, the tera CPU can calculate one tera-flop (one trillion floating point calculations) per second.¹⁸ However, more processor cores does not necessarily equate to better performance. According to a study reported in *New Scientist*, when more than eight cores are added to a chip, there is no performance improvement. This is due to the processing required to schedule the tasks of the separate cores and combine their separate outputs. However, research into the integration of memory and processors continues as chip processes improve. The results of this research have been described as 'promising'.¹⁹

These developments are important as they could enable 'supercomputer-level'²⁰ processing to become increasingly available in commodity computer hardware. Modern graphics cards containing dedicated graphics processors and memory are relatively cheap and can add one or two orders of magnitude performance increases over standard multi-core processors.²¹ While their present use is predominantly for gaming and scientific purposes, the potential for rapid solving of cryptographic and artificial intelligence problems is evident. Reductions in data processing costs could also enable more processes to be implemented at the edge of the network enabling more efficient uses of network transmission facilities.

CROSS-PLATFORM MEDIA

Digital media content distribution is increasingly being distributed via IP-based streaming to a variety of devices— mobile phones, games consoles, media gateways and computers. This is significant as different users can link into the same content and topical content can be available instantaneously to a variety of users. Content distributors are experimenting with different platforms and suggest that we can expect to see new and creative ways to

¹⁵ <http://www.itu.int/net/ITU-T/info/answers.aspx?Fp=faqs.aspx&Qn=31>
<http://www.h265.net/>

¹⁶ http://www.pcworld.com/article/144581/ibm_streams_hd_video_at_3mbps.html

¹⁷ <http://www.investorvoices.com/bcst/2008-0404>

¹⁸ <http://techresearch.intel.com/articles/Tera-Scale/1421.htm>

¹⁹ <http://www.spectrum.ieee.org/nov08/6912>

²⁰ 'The term supercomputer itself is rather fluid, and today's supercomputer tends to become tomorrow's ordinary computer. Today, parallel designs are based on "off the shelf" server-class microprocessors, such as the PowerPC, Opteron, or Xeon, and most modern supercomputers are now highly-tuned computer clusters using commodity processors combined with custom interconnects'.

<http://en.wikipedia.org/wiki/Supercomputer>

²¹ <http://www.ddj.com/architect/207200659>

make the best use of distinctive platforms, without the need to reformat the information in some cases.²²

Increasing use of the web and IP processes for multimedia has been achieved with the relatively limited bandwidth available over broadband networks to date.²³ Notwithstanding improvements in video streaming picture quality (from compression and encoding developments) some expect that higher bandwidth broadband networks will be necessary for better quality viewing. Much higher bandwidth networks may be necessary to support anticipated developments in super and ultra HD content and 3D video over the next 10 years and beyond.²⁴

VIRTUALISATION AND CLOUD COMPUTING

Developments in computing, storage and networking resources point to a possible future of 'real-time infrastructure' where enterprises and individuals may access a virtual computing system²⁵ and run web-based applications as required. The important developments come from new and greater web-based ability to link remote computing and storage infrastructure to create the required services and the new ability to deliver information or services to users. With cloud-computing, access can be via a high-speed connection so that there are fewer limitations on the data that can be exchanged with the server. Global connectivity enables the user to have access to computing facilities and data storage that could be located anywhere around the globe. Although data storage within the internet is not new, the term 'cloud computing' has now taken hold.

Technical factors behind the growth of cloud computing include the more widespread deployment of wired and wireless broadband networks, improvements in storage capacity and the proliferation of hand-held devices with powerful processors that can access the web.

An important business and social benefit of virtualisation comes from the effective use of what would be under-utilised computing resources. Virtualisation of data centres is not a new concept, but the focus now is shifting from virtualisation of servers to virtualisation of all other service providing resources (for example, switches, routers, and storage) within data centres. Virtual resources will combine physical resources that can be accessed across the data centre, the network or the world. To the application, it will seem like a single, stand-alone local resource.²⁶

DIGITAL DISPLAY

The adoption of new TV display technologies in Australia tends to take place over many years. About 39 per cent of Australian households were estimated to have an HD LCD, HD Plasma or Full HD 1080p television set as at June 2008.²⁷ There are a number of potentially important technical developments that could impact on the adoption of new display units. The developments are important because of the potential for improving the user experience

²² [TelecomTV, IBC2008](#)

²³ The average advertised download broadband speed for the 30 [OECD](#) member countries was 13.7 Mbit/s at October 2007.

²⁴ Estimated bandwidth requirements for Ultra HD video are as high as 480 Mbit/s:
<http://www.wired.com/techbiz/it/news/2008/04/broadband2>

²⁵ Virtualisation enables one computer in a data centre to do the job of many computers.

²⁶ http://newsroom.cisco.com/dlls/2008/ts_012808.html

²⁷ *Sony High Definition Benchmark, Reporting Period: 2nd Quarter, 2008*, GfK Marketing Services Australia Pty Ltd, August 2008

for existing media businesses and because they could enable developments in the displays used in public areas.

Gradually over the next few years, Organic LED (OLED) is expected to challenge conventional LCD display technology. OLED has been implemented already in several mobile phones and car stereo systems. OLED directly emits light onto a screen with only a microsecond response time, giving a crisper image.

Another technology currently under development known as a Surface-conduction Electron-emitter Display (SED) offers a fast response time in contrast to a Cathode Ray Tube (CRT) display. SED technology features include low power consumption, low-cost production and a slim LCD type design.²⁸

Currently under development, Phosphorescent Organic Light-Emitting Diode (PHOLED) uses an organic matter to emit light onto a screen when an electric current is applied. PHOLED can convert more of its energy into light compared to OLED. A typical application might include producing a large-screen television by covering an entire wall with PHOLED.

As well as the developments in screen technology outlined above, digital signage operators might become significant players in the media sector. Digital displays are now being located in more and more places where people gather such as cafes, on public transport, university campuses, workplaces and public areas. Displays with internet connectivity, Bluetooth, touch screen and potentially facial recognition technology may be used for interactive services and advertising targeted at particular demographic segments.²⁹

DIGITAL URBAN LIVING

‘Connected communities’ is a term used to describe an emerging form of digital media in urban spaces. Using infrastructure comprising screens, digital surfaces, media facades, computing software and participatory art forms, public areas can be transformed into spaces for users to create media that they and others can enjoy in ways that aid community interaction. An illustration of what might lie in the future was showcased at Melbourne’s [Federation Square in October 2008](#). Using media tools already incorporated into the architectural design, the event demonstrated moving images and was the first ‘urban screen’ event to be held in the Asia-Pacific region.³⁰

The streaming of high-quality video to outdoor display screens has been flagged as a potential market in Australia for evolved HSPA (eHSPA) technology.³¹

GREEN IT/GREEN COMPUTING

The term Green IT refers to the means to cut emissions and energy use in all activities related to IT. It applies not only to operational efficiencies such as lowering power consumption and cooling requirements for equipment, but extends into whole-of-life considerations. This will become of increasing importance if environmental issues weigh heavier amongst community concerns.

²⁸ http://www.canon.com/technology/canon_tech/explanation/sed.html

²⁹ <http://www.findbiometrics.com/article/533>

³⁰ <http://www.urbanscreens08.net/>

³¹ <http://www.itwire.com/content/view/21539/127/>

Research firm Gartner has estimated the global ICT industry is responsible for two per cent of the world's carbon dioxide emissions.³² Gartner's analysis is inclusive of desktop computers, servers, cooling, fixed and mobile telephony, local area networks, office telecommunications and printers.

More efficient and environmentally friendly power supplies such as fuel cells are reaching the market. There is also renewed interest in thin client³³ workstations as replacement for desktop computers. Their attraction is that they use about half the electricity of a typical desktop computer but the principal energy saving relates to data centres. There is increasing emphasis on energy-efficient servers and more effective cooling. Virtualisation is an efficiency technique that is finding increasing application for data centres (outlined in the data centres section above).

Cloud computing may have a positive impact in reducing emissions should users forego use of their own computing resources in favour of more efficiently utilized centralised computing services.

Other carbon footprint reduction initiatives include implementing sensor networks to monitor and improve energy use, and replacing physical products and services with online services. The process has been referred to as 'dematerialisation'.

One of the things that IT users can do to make a significant difference is to use power management applications on computers and other digital devices (for example, where devices are set to enter a sleep mode or power off when not in use).

HOME NETWORKS

From a technical perspective, home networks are becoming increasingly sophisticated, comprising central file storage systems, media centre boxes, networked personal video recorders with multiple digital television tuners and hard-disk storage, VoIP services and multiple computers. HD television programs can be recorded digitally without loss of resolution and distributed within the home network for later playback. Video content from the internet can not only be viewed on the computer screen but can be sent to the personal video recorder or media centre for playback on a television.

According to ABI Research, although having a wireless networks within a home is still an early-adopter's practice, there is potential for considerable growth over the next five years. Home networking will become essential if customers are to enable in the domestic environment, the degree of service and future integration that is available with mobile devices or in the business environment. As more wireless systems appear in homes, 'word-of-mouth benefits will spread, boosting acceptance levels'.³⁴ The Consumer Electronics Association claims that more than 30 per cent of US households have a wireless home network, and that nearly three-quarters of consumers would like to replace the wired connection between their TV set and digital appliances, such as DVD players, with a wireless connection.³⁵

³² <http://www.gartner.com/it/page.jsp?id=503867>

³³ A computer with thin client software reliant on a server in place of applications stored on a hard disk drive to perform data processing

³⁴ http://www.channelnews.com.au/Networking_And_Wireless/Wireless_And_Networking_Issues/C5L2H7D6

³⁵ *5 Technology Trends to Watch*, www.ce.org

IP-BASED AUDIO-VISUAL DISTRIBUTION

The main driver for internet traffic growth internationally is forecast to be online video, according to analysis by Cisco Systems and eMarketer. Online video includes video that is downloaded or streamed for viewing on a desktop or to a TV screen, and video for communications. The upsurge of traffic is through the combined effects of increased online viewing along with more HD streams as shown in Figure 1 below.

| Monthly Consumer Internet Traffic Worldwide, by Segment, 2006-2012 (% of total and petabytes*) | | | | | | | |
|---|--------------|--------------|--------------|--------------|---------------|---------------|---------------|
| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
| P2P | 59.6% | 51.4% | 44.4% | 39.8% | 36.6% | 34.5% | 33.2% |
| Online video via PC | 11.8% | 19.0% | 25.3% | 28.4% | 29.5% | 30.1% | 30.6% |
| Online video via TV** | 0.6% | 2.9% | 6.2% | 9.8% | 13.1% | 15.7% | 17.4% |
| Web, e-mail and data | 22.3% | 20.9% | 18.8% | 17.3% | 16.4% | 15.6% | 15.2% |
| Gaming | 4.0% | 3.9% | 3.5% | 3.3% | 3.0% | 2.7% | 2.4% |
| Video communications | 0.7% | 0.7% | 0.7% | 0.6% | 0.6% | 0.7% | 0.8% |
| VoIP | 1.0% | 1.1% | 1.1% | 0.9% | 0.8% | 0.7% | 0.6% |
| Total (petabytes) | 2,280 | 3,397 | 5,315 | 7,735 | 10,884 | 14,950 | 20,331 |

*Note: *1 petabyte equals 1,000 terabytes; **includes video delivered via Internet to a TV screen, by way of an Internet-enabled set-top box or equivalent device*
Source: Cisco Systems, "Cisco Visual Networking Index - Forecast and Methodology, 2007-2012," June 16, 2008; eMarketer calculations, August 2008

097580 www.eMarketer.com

Figure 1: Monthly consumer internet traffic, by segment

According to the forecasts in Figure 1, total internet traffic worldwide will grow from 5,315 petabytes in 2008 to 20,331 petabytes by 2012, representing a near four-fold increase in total traffic. Peer-to-peer applications (P2P) traffic is forecast to increase as well, but online video via PC and TV traffic is forecast to replace P2P as the leader in bandwidth consumption by 2010. A similar annual increase in global internet traffic (50 to 60 per cent) has been forecast by Minnesota Internet Traffic Studies (MINTS). However, by November 2008, MINTS reported evidence of a slowdown in traffic growth, although there is evidence of a much higher rate of growth on wireless networks.³⁶

In other research carried out over the third quarter of 2008, P2P technologies are reported to still account for a significant portion of global network downstream traffic.³⁷ But P2P has lost ground to video streaming, that is, video sharing, internet TV, catch-up TV and video on demand to desktops, laptops or internet enabled mobile devices. According to the researchers, internet subscribers are turning to alternatives such as file hosting/online storage web services: ‘Often, it is faster to download a large file, such as an HD movie or a full season of TV series, from a file hosting site than from a P2P network. As these sites become more familiar to a wider range of subscribers, their contribution to global

³⁶ http://www.dtc.umn.edu/mints/news/news_19.html

³⁷ <http://www.sandvine.com/general/documents/2008%20Global%20Broadband%20Phenomena%20-%20Executive%20Summary.pdf>

bandwidth consumption will only increase.’ The report noted that real-time content such as peercasting,³⁸ streaming and gaming are particularly sensitive to jitter and latency.

ACMA’s analysis of consumer benefits in the telecommunications sector in 2007–08 shows that Australian internet users increased the volume of data downloaded per subscriber by 37 per cent, from 21.1 GBs in 2006–07, to 29.9 GBs in 2007–08.³⁹ A number of Web TV and radio developments in Australia and internationally over August–October 2008 indicate that data usage is likely to increase, including:

- The ABC launched [iView](#) providing free, high-resolution streamed on-demand video to PCs or web-enabled TVs. The service was created for broadband subscribers with high-speed internet access of at least 1.1 Mbps (available using an ADSL2 connection). Other technical requirements are either a Pentium PC or PowerMac, and Adobe Flash Plug-in. According to the ABC, 35 per cent of Australian internet users subscribe to broadband internet speeds of 1.1 Mbit/s or faster.⁴⁰
- With the opening of an Australian television division, MySpace announced its intention to develop original online television shows in addition to TV shows that are [already available](#).⁴¹
- Internet portal ninemsn released its first made-for-web drama series.
- Social network site Bebo launched a global online television series. An original Australian television series may be produced by Bebo in 2009.⁴²
- [BlinkxTV](#) launched a broadband TV offering Blinkx BBTV that enables users to browse or interact online with other websites while watching video through their browser.⁴³
- [Stripe](#), an Australian subscription radio service commenced business. Distributed over 3G networks, Stripe can be accessed from mobiles, laptops or desktops.

Sam Doust, creative director of ABC’s Innovation Group, claimed that just seven weeks after the launch of iView, usage levels were 2,000 to 3,000 hours per day. In addition to the ‘send to a friend’ function, the next version is expected to have more social media functions.⁴⁴

Two competing technology-based trends were on display at the International Broadcasting Convention (IBC) held in September 2008. On the one hand there were HD and 3D technologies that improve picture and sound quality—essentially a continuation of one-to-many broadcasting. Also on display were technologies that use multiple delivery channels involving user interaction and on-demand video, where flexibility and reach, and access to

³⁸ Peercasting is a method of [multicasting streams](#), usually audio and/or video, to the [internet](#) via [peer-to-peer](#) technology. <http://en.wikipedia.org/wiki/Peercasting>

³⁹ Chapter 6, ‘Economic benefits resulting from changes in telecommunications services’, *ACMA Communications Report 2007-08*, http://www.acma.gov.au/WEB/STANDARD/pc=PC_311549

⁴⁰ <http://www.abc.net.au/tv/iview/requirements.htm#whydo>

⁴¹ <http://profile.myspace.com/index.cfm?fuseaction=user.viewprofile&friendid=377307659>

⁴² <http://www.theaustralian.news.com.au/story/0,25197,24214787-7582,00.html>

⁴³ <http://www.blinkx.com/article/blinkx-launches-web-based-version-broadband-television-offering~837>

⁴⁴ ABC IPTV hits 3,000 hours a day, *Communications Day*, 11 September 2008

underlying telecommunications infrastructure, are matters to be grappled with along with picture size and quality.⁴⁵

Some have expressed the view that the future lies in digital two-way, IP-based networks that provide interactivity and personalisation—TV will be ... ‘just another broadband application, something you can consume in a number of places and on a variety of devices’.⁴⁶

Developments in digital media offer consumers more control, more choice and more opportunities for social interaction. According to ScreenPlays, the Beijing Olympics represented a sea change in viewing experiences. Viewers had more control over what they watched and how they watched it, ‘... whether at home on TV, in the office on their computer or on the go on their mobile phones’.⁴⁷

Expectations of internet-enabled TV sets seem to be building. One recent suggestion by Duncan Riley (an Australian new media developer and professional blogger) was that leading consumer electronics firms are likely to offer internet-enabled TV sets internationally from 2009. By 2015, new TV sets would be expected to have internet connectivity enabled.⁴⁸ Moreover, according to research firm In-Stat, ‘... digital TV will be the second largest category of consumer electronics stationary devices shipped with WiFi ...’ by 2012.⁴⁹ Meanwhile, in Australia, there are plans to offer internet-enabled TV sets by the first quarter of 2009.⁵⁰

Potential developments in internet-enabled digital TV sets from 2009 would provide further impetus for the distribution of broadcaster-produced content to the internet, along with greater consumer control and interaction.

A service is now available in the US that provides media player users with greater navigational control similar to operating a DVD fast forward, rewind, time-shift or play in slow motion. Adaptive streaming technologies (where the content provider serves multiple streams at varying bit rates and the client application is able to actively monitor bandwidth and select the most appropriate stream) allows delivery of the highest-quality video available, based on the local conditions of the end user’s system as opposed to stalling or buffering as bandwidth varies.⁵¹

IPv6

IPv4 addresses are predicted to run out at some point between 2009 and 2012. The IPv6 protocol has been mature for nearly 10 years⁵² yet there has been little deployment of it to date. While IPv4 addresses have been available there has been little incentive for network operators to deploy the enhanced version of the internet protocol which offers more efficient routing, better provision for both quality of service and mobility, enhanced security and enough address space to enable an ‘internet of things’.

⁴⁵ [TelecomTV](#), IBC2008: a snapshot of how broadcasting is meeting the digital network

⁴⁶ *Changing the way we look at Television*, Ericsson,

<http://media.ericsson.pl/PressOffice/getFile.PressRelease.102931.po?oid=85340>

⁴⁷ ScreenPlays Information Marketplace, Olympics is Landmark in Transition to Multi-Device Programming Era, Broadband Information Resources, 14 August 2008

⁴⁸ <http://www.inquisitr.com/2799/by-2015-every-new-television-will-be-internet-enabled/>

⁴⁹ <http://www.instat.com/press.asp?ID=2392&sku=IN0803980WS>

⁵⁰ <http://www.smh.com.au/news/digital-life/home-entertainment/articles/internet-enabled-tvs-to-hit-lounges-soon/2008/09/08/1220725929055.html>

⁵¹ <http://www.movenetworks.com/wp-content/uploads/move-media-player.pdf>

⁵² <http://www.ietf.org/rfc/rfc2460.txt?number=2460>

Whilst increasing use of Network Address Translation (NAT)⁵³ (including the deployment of Carrier NATs which provide for larger scale few-to-many public - private address mapping) and the possible emergence of an IPv4 address market may stall its uptake further, it is expected⁵⁴ that IPv6 will increasingly be deployed alongside IPv4 using dual stack network elements and tunnels (the encapsulation of one protocol within another).

Legacy systems will ensure IPv4 networks remain for some time yet, but IPv6 should become the predominant network layer protocol, so as to meet not only the growing demand for realtime video, mobile and ubiquitous services, but also for communicating with the growing number of internet hosts, especially in the developing countries.

VOICE OVER IP

In July 2008, the GSMA announced the successful trial in Europe of voice calls using the SIP-I protocol (which has some similarities with the protocol used by fixed VoIP network operators). This development is another indicator of the growing use of IP networks. In the trial, SIP-I was used to control the transmission of voice calls from a circuit-switched mobile network on to an IP-based backbone network and then back to a circuit-switched mobile network. According to the GSMA press release, 'The SIP-I trials form part of the GSMA's IPX initiative to develop a private global Internet Protocol (IP) backbone designed specifically to provide guaranteed levels of quality of service and security to customers of mobile operators and other service providers'.⁵⁵

Consumers should benefit from increased service quality and network operators should benefit from reduced operating costs. Information about possible implementation in Australia was not available at the time of preparing this report.

Fixed and mobile broadband

FIXED BROADBAND NETWORKS

The growth in demand for broadband-based services and the speed at which they can be delivered continues to drive infrastructure requirements in the access, backhaul and international transmission networks.

Recent upgrades to one hybrid coaxial fibre (HFC) network to the DOCSIS 3.0 standard⁵⁶ has enhanced speeds up to 30 Mbit/s and provides a faster broadband service for those with access to this network. Network operators have continued to invest in digital subscriber line access multiplexer (DSLAM) infrastructure and are increasingly offering Naked DSL (a DSL service without a PSTN service) options that can be more attractive to both customers and operators. These technologies will continue to improve in speed particularly over shorter lengths of copper. Fibre to the premises remains the preferred fixed-line technology for greenfields deployments.

Broadband access, core and backhaul networks in Australia are improving in performance due to the progressive migration from an underlying range of transmission protocols to a native IP over ethernet protocol. Native IP over ethernet in access networks is commonly

⁵³ <http://www.ietf.org/rfc/rfc3022.txt?number=3022>

⁵⁴ <http://www.ipv6.org.au/summit/>

⁵⁵ <http://www.gsmworld.com/newsroom/press-releases/2008/1125.htm>

⁵⁶ Data over cable service interface specification standard developed to increase transmission speeds and support for IPv6 <http://en.wikipedia.org/wiki/DOCSIS>

referred to as metro ethernet.⁵⁷ Using native IP over ethernet has the advantage of improving speed and bandwidth efficiency, reducing costs of deployment and operation and providing a more logical connectivity to IP core networks. This is achieved by reducing the number of embedded protocol stack layers that are currently used in legacy transport protocols such as asynchronous transfer mode (ATM). It also reduces the overall network complexities by moving away from connection-oriented channels to a packet-switched transport technique that is more flexible.

The majority of Australia's broadband internet traffic flows via the US. The increase in broadband demand has seen a rise in demand for international submarine cable transmission capacity. Consequently, there is a trend by existing carriers to upgrade their submarine cable capacity.

MOBILE BROADBAND NETWORKS

The evolutionary path to provide high-speed data on existing 3G–GSM-based mobile networks is well defined by [3GPP's](#)⁵⁸ roadmap for the GSM technology family. Mobile core networks have also undergone system architecture optimisation for high-speed packet mode operation and in particular for the IP-Multimedia Subsystem (IMS) which supports all mobile and fixed-access technologies. Its proponents describe IMS as an open system architecture that supports a wide range of IP-based multimedia services over packet and circuit-switched networks.

3GPP has also proposed further enhancements (termed LTE-Advanced) that would feature:

- worldwide interoperability, roaming and flexibility to support a wide range of services and applications in a cost-efficient manner
- compatibility of services within IMT-2000 (the global standard for third generation wireless communications) and with fixed networks
- compatibility of interworking with other radio access systems and
- enhanced peak data rates to support advanced services and applications (100 Mbit/s for high mobility and 1 Gbit/s for low mobility were established as targets for research⁵⁹).

Currently in Australia, the major mobile carriers are engaged in deploying or planning deployment of either eHSPA or HSPA/HSDPA to their 3G wireless networks. Peak downlink speeds of up to 21 Mbit/s for eHSPA were proposed by the end of 2008. Combined with the rollout of ethernet backhaul, network upgrades are intended to deliver '... truly high-speed connectivity on the move.'⁶⁰

More consumer electronics and laptops are expected to be manufactured with the hardware required to connect with cellular mobile networks. The GSMA announced in September 2008 that 16 of world's leading mobile network operators and IT companies will support an initiative to pre-load mobile broadband connectivity into notebook computers.⁶¹ The

⁵⁷ <http://metroethernetforum.org/AbouttheMEF>

⁵⁸ The 3rd Generation Partnership Project (3GPP) describes their role as uniting telecommunications standards bodies. <http://www.3gpp.org/about-3gpp>

⁵⁹ Data rates sourced from Recommendation ITU-R M.1645 – 'Framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000'.

⁶⁰ TotalTelecom, *Telstra's 21 Mbps Next GTM network on schedule*, Telstra Corporation Limited, 06 October 2008.

⁶¹ <http://web20.telecomtv.com/pages/?newsid=43915&id=e9381817-0593-417a-8639-c4c53e2a2a10&view=news>

installation of connection manager software is not without its potential software conflicts, however, particularly where users want to install or use competing versions of connectivity clients.⁶²

To achieve higher data speeds for mobile broadband networks, more radiofrequency spectrum will be needed to supplement the technological advances. Industry anticipates that there will be a requirement for 20 MHz channels for LTE as opposed to 5 MHz for HSPA networks. However, future embellishments of the LTE specification could have the potential to enable disparate spectrum blocks to be used in combination to provide the speeds achievable with a single continuous 20 MHz block of spectrum.

WiMAX networks and products continue to enjoy growth overseas due in part to the WiMAX Forum's certification for mobile WiMAX in the 2.5 GHz radiofrequency spectrum band and associated products. The Forum planned to certify WiMAX products for the 3.5 GHz band by the end of 2008. Certification should enable interoperability that contributes to a healthy vendor ecosystem thus creating greater competition and choice of equipment for operators and end-users. This should enhance the focus on additional options for the mobile IEEE 802.16e certification in the 3.5 GHz band.⁶³

Near Field Communications (NFC) is a short-range wireless technology that evolved from a combination of existing contactless identification and interconnection technologies, also known as ISO 18902. A recent report into mobile payments anticipates a high growth rate over the next six years for mobile money transfers and NFC-enabled handsets to buy goods. According to the report, development of the market is subject to handset availability, workable business models and financial legislation.⁶⁴ Trialling of NFC-enabled handsets in Australia commenced in January 2008.⁶⁵ In November 2008, the trials in Australia and in other parts of the world were reported to have been positive and the GSMA called for mass market handsets to be available by mid-2009.⁶⁶

MOBILE OPERATING SYSTEMS/OPEN SOURCE SOFTWARE

Advances in mobile operating systems (OS)⁶⁷, processing power, mobile broadband, power and storage capability have resulted in the mobile internet gaining traction over 2008 and the outlook is for a steep increase in mobile browsing internationally.⁶⁸

The OS of the mobile phone defines the key characteristics of the device, including its stability, performance, service enablers, user interface (the means by which people interact with digital devices) enablers and security. As convergence with the web becomes increasingly important, the OS and the software platform will be central to the next generation of 'web aware' mobiles; these platforms will blend online service with offline applications, removing the discontinuity of accessing the web through application silos and presenting a more consistent and integrated experience. Software platforms will need to

⁶² <http://disruptivewireless.blogspot.com/2008/02/problem-with-mobile-broadband-operator.html>

⁶³ First 2.5 GHz mobile WiMAX products certified, 20 June 2008, Julien Grivolas, Ovum.

⁶⁴ <http://news.zdnet.co.uk/communications/0,1000000085,39539056,00.htm>

⁶⁵ http://www.zdnet.com.au/news/communications/soa/Around-the-world-in-NFC-and-contactless-payments/0,130061791,339285175,00.htm?feed=pt_wireless

⁶⁶ <http://www.nearfieldcommunicationsworld.com/2008/11/19/3235/gsma-calls-for-mass-market-nfc-handsets-by-mid-2009/>

⁶⁷ A mobile operating system is a software platform on top of which other computing programs run

⁶⁸ http://www.economist.com/science/tq/displaystory.cfm?STORY_ID=11999307

<http://arstechnica.com/news.ars/post/20080709-report-mobile-internet-use-has-reached-critical-mass.html>

provide the flexibility for third parties to integrate their service directly and also allow users to choose to integrate the services they are already familiar with on the fixed-line web.

In an article about Apple's iPhone, *Wired* magazine claimed that the device '... has forever changed the mobile phone business, wresting power from carriers and giving it to manufacturers, developers and consumers'.⁶⁹ The iPhone has brought to the fore the phenomenon whereby some customers identify with their handset rather than their mobile operator. A similar phenomenon was apparent in the business sector with Research In Motion's Blackberry device.

Mobile network operators in the USA have entered into shared revenue arrangements with manufacturers and developers along with ceding control over marketing, design and operating systems.⁷⁰

The growing dependency on mobile OS has raised operational challenges. It has become more difficult and costly to develop and maintain all the software required to drive a mobile phone, including the OS, middleware and the user interface. Handset manufacturers, mobile operators and applications developers are actively exploring the use of open source software platforms to reduce costs and create market advantages.

In June 2008, Nokia announced its intention of forming the [Symbian Foundation](#)—a not-for-profit organisation with the goal of making Symbian OS, plus its UI platforms available royalty-free. The foundation is expected to involve a number of mobile platform developers and mobile network operators in the development of a single open source platform. The foundation is expected to begin operating in the first half of 2009.

Google released Android as [open source code](#) in October 2008.⁷¹ In offering an operating system, middleware and mobile applications, Android represents another alternative to the use of proprietary mobile operating systems.

SMART NETWORKS

Using technical specifications developed by the IPsphere Forum,⁷² the trialling of networks capable of delivering IP services end-to-end across network boundaries at agreed quality of service levels is underway in Australia and Europe.⁷³ The specifications enable multiple parties involved in content and carriage to deliver services to users at agreed quality of service levels with commercial arrangements in place to cover relevant charges.

Many operators consider that the full benefits of IP networking can be achieved on a long-term basis only if the different quality of service requirements for the traffic on IP networks becomes an integral part of technical and commercial arrangements between all the parties involved in purchasing and delivering the services. If the network requirements to control the quality of service can be rationalised then network operators are also expected to benefit from operational cost savings through reductions in nodes and interconnections.

⁶⁹ http://www.wired.com/gadgets/wireless/magazine/16-02/ff_iphone?currentPage=1

⁷⁰ http://www.wired.com/gadgets/wireless/magazine/16-02/ff_iphone

⁷¹ <http://source.android.com/>

⁷² The IPsphere Forum membership is drawn from telecommunications network operators and vendors. According to information posted on their website, IPsphere was created in mid 2005 to develop a standardised way to deliver IP services end to end. <http://www.ipsphereforum.org/>

⁷³ 'Telstra takes the lead in IPsphere Forum trials', *Exchange*, vol. 20 no 25 November 2008

WIFI

The term WiFi (meaning ‘wireless fidelity’) refers to a well-established wireless local area network technology that provides short-range, high data rate connection between transportable devices and access points connected to a wired network. Research firm In-Stat has forecast that global shipments of consumer electronic (CE) devices with embedded WiFi chips will reach almost one billion by 2012, up from 294 million in 2007.⁷⁴ Reasons for this growth include the use of Wi-Fi in lap-tops, netbooks, mobile phones, digital TVs and home networks.

WiFi advertising firm JiWire estimates that there are 2,561 WiFi hotspots in Australia (free and charged services), or around one hotspot for every 8,400 Australians. The USA has the most WiFi hotspots of any country, at around one for every 4,500 Americans.⁷⁵

Radiofrequency spectrum

SPECTRUM SHARING

The management of spectrum is undergoing major changes with the increasing sophistication and proliferation of radio technologies. As spectrum becomes increasingly congested and contested by various services, strategies for these services (including cognitive radio) to coexist and share spectrum will become increasingly important.⁷⁶

In October 2008, the USA Federal Communications Commission’s (FCC) Office of Engineering and Technology announced the results of its second phase of spectrum sensing and transmitting capability measurement studies of prototype ‘TV white-space’ devices.⁷⁷ The tests used spectrum-sensing technologies (such as cognitive radio) in combination with geo-location and incumbent services database access techniques.

The FCC reported that using spectrum for broadband data can theoretically be done without interfering with television and other authorised services operating in the white-space bands. The report established that white-space devices ‘... will be allowed into TV spectrum simultaneous with the completion of the transition from analog to digital television broadcast on 17 February 2009 [the USA digital switch over]’.⁷⁸ On 4 November 2008, the FCC announced the adoption of rules for unlicensed use of television white spaces.⁷⁹

In June 2008, as part of its digital dividend consultation process, the UK regulator Ofcom proposed the release of white space in a phased process between 2008 and 2011. Under the proposal, users would be able to decide what technology to use and what services to offer.⁸⁰

⁷⁴ <http://www.instat.com/press.asp?ID=2392&sku=IN0803980WS>

⁷⁵ www.jiwire.com

⁷⁶ ACMA, *Five-year Spectrum Outlook 200 –2014*, April 2008

⁷⁷ The devices tested were developed to demonstrate capabilities that might be used in low-power radio transmitting devices that would operate on frequencies in the digital broadcast television bands that are unused in each local area. www.fcc.gov

⁷⁸ *Evaluation of the Performance of Prototype TV-Band White Space Devices Phase II*, Technical Research Branch Laboratory Division, Office of Engineering and Technology, FCC, October 15, 2008

⁷⁹ http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-286566A1.pdf

⁸⁰ Ofcom, *Digital dividend – new opportunities for local services*, June 2008
http://www.ofcom.org.uk/media/news/2008/06/nr_20080612

INTELLIGENT TRANSPORT SYSTEMS

Intelligent transport systems (ITS) aim to improve transportation safety, mobility and efficiency through the integration of advanced communications technologies into the transportation infrastructure and in vehicles. ITS encompass a broad range of wireless and wireline communications-based information and electronics technologies.

The European Commission (EC) has decided to designate the frequency band 5875–5905 MHz for intelligent transport systems (ITS).⁸¹ It is envisaged that European radiocommunications equipment operating in this band will ‘... include cooperative systems based on vehicle-to-vehicle, vehicle-to-infrastructure and infrastructure-to-vehicle communications for the real-time transfer of information’. Anticipated benefits from ITS include traffic congestion avoidance, event warning (for example, adverse road conditions) and vehicle or driver monitoring. This has important implications for ACMA as the Australian radiofrequency manager because the automobile manufacturing market is global in coverage and Australian drivers will reasonably expect to be able to have the vehicle features available to overseas drivers. The availability of the features in Australia could be jeopardised or delayed if the equipment had to be able to operate on frequencies specific to Australia.

Following the EC Direction, the European Telecommunications Standards Institute (ETSI) has published a harmonised standard to enable the market placement for smart vehicle communications systems—the so-called ‘co-operative’ systems.⁸² The use of designated frequency band for ITS in Europe will be on a non-exclusive basis.

ITS arrangements are being developed in the USA based on use of the frequency band 5850–5925 MHz.

Allocation of 5.9 GHz radiofrequency spectrum for ITS purposes is under consideration in Australia. Requirements for ITS, including system design and services to be supported, are being considered by relevant Australian transport agencies in consultation with ACMA. The amount of 5.9 GHz spectrum required to support ITS has not been decided but ACMA has put in place arrangements that preserve the availability of the frequency band 5850–5925 MHz for ITS while planning is underway.⁸³

MANAGED SPECTRUM PARK

Under the ‘public park’ radiofrequency planning concept, devices as diverse as microwave ovens, garage door openers and WiFi links can operate under a class licence regime in a shared band of defined frequencies. Such sharing usually requires the power of these devices to be kept well down. This approach avoids the need for ongoing individual frequency co-ordinations and the registering of technical details and locations of equipment for each new user. Access to the band by all potential users is then relatively unconstrained.

⁸¹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:220:0024:01:EN:HTML>

⁸² http://www.etsi.org/WebSite/NewsandEvents/2008_09_Harmonizedstandards_ITS.aspx

⁸³ http://www.acma.gov.au/webwr/radcomm/frequency_planning/spectrum_embargoes/emb48.pdf

The Managed Spectrum Park (MSP) initiative is intended to ‘integrate the desirable features of the management right, public park and administrative licensing regimes’⁸⁴ and could lead to even better economic outcomes.

Following the outcomes of consultation the New Zealand Government announced in September 2008 that there was support for the formation of a managed spectrum park (MSP)⁸⁵ in the 2.5 GHz radiofrequency spectrum band. The concept of an MSP allows for ‘... local and regional broadband services, such as WiMAX. It encourages a flexible, cooperative, low-cost and self-managed approach to the allocation and use of radio spectrum ...’⁸⁶ Initial licences are planned to be released in October 2009.

ACMA is to review planning, licensing and pricing arrangements to determine how the 2.5 GHz band can be planned and allocated to maximise the overall benefit derived from the spectrum, taking into account electronic news gathering requirements and the potential uses of the band for wireless access services.⁸⁷

⁸⁴ Brian Miller, Manager Radio Spectrum Policy and Planning, Ministry of Economic Development, New Zealand to the ITU at <http://www.itu.int/ITU-D/treg/Events/Seminars/Virtual-events/SpectrumManagement29Sept2005/New%20Zealand.pdf>

⁸⁵ According to the NZ Minister of Economic Development, MSPs ‘...are intended to allow access to a number of users in a common band of spectrum on a shared and, as far as possible, self-managed basis. Ideally, they encourage efficient use of spectrum, innovation and flexibility and provide for low-cost compliance and administration over time’.

<http://www.rsm.govt.nz/cms/pdf-library/policy-and-planning/radio-spectrum/managed-spectrum-parks/msp-discussion-paper-kb-pdf>

⁸⁶ <http://www.beehive.govt.nz/release/positive+outcome+spectrum+park+consultation>

⁸⁷ http://www.acma.gov.au/webwr/assets/main/lib310081/spp08_08_spp08_08_strategies_for_was_consultation_outcomes.pdf

Applications

Web Applications

CONTINUING EVOLUTION OF THE WEB

The first generation of the web was characterised as the Information Age. With the emergence of the second generation (Web 2.0) over the early part of this decade, the story of the web has largely been about interaction. It became known as the social web. Currently in the early stages of development, the semantic web (or Web 3.0) is expected to anticipate information of interest to users, providing a more personalised web experience.

Originally conceived by Tim Berners-Lee as a way to form a consistent logical set of data,⁸⁸ the semantic web is expected to provide useful information through being context aware⁸⁹ and through intelligent search and retrieval functions. The aim is to provide the right information to the right person at the right time about a place, person, music or video of relevance to a user or community of users.

The foundations for semantic web development has been enabled by standards approved by the W3C such as [microformats](#) and [Resource Description Framework \(RDF\)](#)⁹⁰ that allow data to be reused (as HTML allows content to be reused). semantic web tools include [Open ID](#) that provides users with a single identity to log in to their favourite sites; and Friend of a Friend ([FOAF](#)) and Semantically-Interlinked Online Communities ([SIOC](#)) that enable data sharing between services and online community integration. An Australian company, Faraday Media, has developed attention profile mark-up language ([apml](#)) which is an open standard for attention profile encapsulation.

Enabled by data portability—where media and content providers and social networks open up their data—a web user’s online identity, media, contacts and content would follow wherever they go.⁹¹

A possible trajectory for web developments was created by Radar Networks (see Figure 2) which envisages moving from the social web at present through to the semantic web era (2010–2020) and on to the intelligent web (2020–2030).⁹²

⁸⁸ <http://www.w3.org/DesignIssues/Semantic.html>

⁸⁹ Where the data is relevant to the user, with relevance depending on the user’s task or circumstances.

⁹⁰ RDF is a language for representing information about resources in the World Wide Web. RDF specifications are built on URI and XML technologies. <http://www.w3.org/TR/rdf-primer/>

⁹¹ <http://www.vimeo.com/610179>

⁹² The intelligent web refers to smart applications and smart services enabled by metadata that describes the meaning of data and the logical relationships between data and concepts
<http://www.memebox.com/futureblogger/show/824>

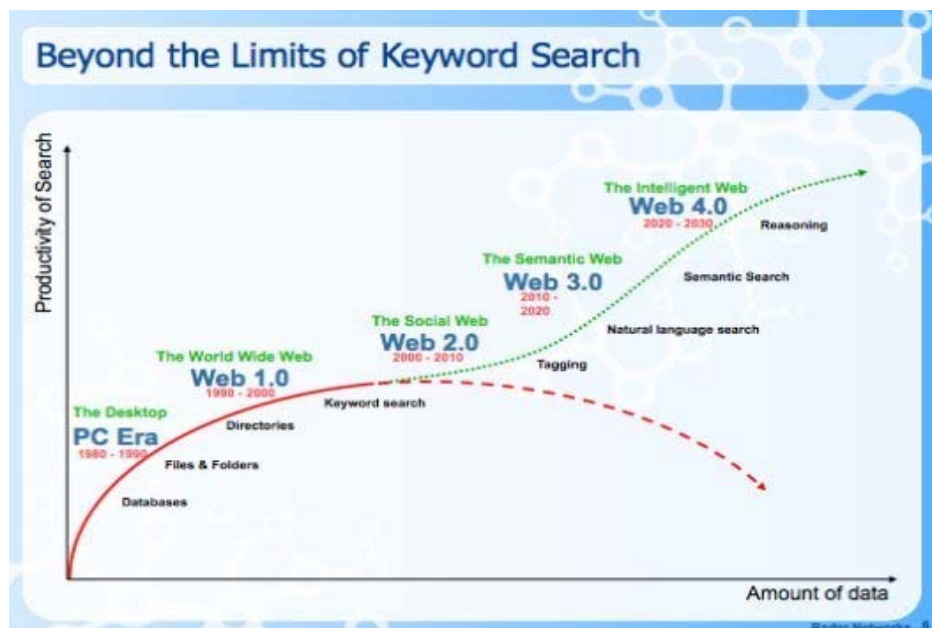


Figure 2: Beyond the limits of keyword search—a possible trajectory of web developments (Source: Radar Networks)

While the full potential of the semantic web is unlikely to be realised for some years yet, some early applications that use semantic technologies are already available, such as:

- [Twine](#) which helps users organise, share and discover information according to user interests, with a network of like-minded people.
- [Quintura](#) which is a semantic search engine and advertising technology company.
- [SemanticProxy.com](#)⁹³ which is currently in beta and provides an early sample of what may lie ahead. SemanticProxy.com has the capacity to translate the content of any URL on the web to its semantic representation in RDF, HTML or microformats. Their vision is that ‘...every web site will expose its content in a way that’s readable by machines’.⁹³
- The [Yahoo! Search Open Systems](#) which supports a number of semantic web standards, claims to ‘... present users with more compelling and useful search results’.⁹⁴

WEB BROWSING ALTERNATIVES

Web browser competition has ramped up over recent months with upgrades either in beta or launched by Firefox, Microsoft and Apple. Google released a new service called Chrome, positioned as a web application platform hoping to challenge the dominance of Microsoft.

Web browser quality of performance comparisons are shaping up to be of interest to users in terms of website loading times, user interface features and browser security.

⁹³ <http://www.semanticproxy.com/about.html>

⁹⁴ <http://www.ysearchblog.com/archives/000527.html>

Content and network management applications

DEEP PACKET INSPECTION

Deep packet inspection (DPI) technology provides ISPs with the capacity to monitor user web traffic in real time.

DPI lies behind the next stage in the development of behavioural-targeting software that may be used to build up profiles of user interests to target advertisements more accurately. ISPs face commercial pressures to upgrade their infrastructure in response to their customers' increasing use of bandwidth intensive applications. Incentives to monetise user information are coming from advertisers and holders of copyright.

As *The Economist* reported in June 2008, critics of behavioural targeting are concerned with third parties monitoring what people are doing online.⁹⁵ According to Colorado Law School Professor, Paul Ohm, ISPs now have the capacity to monitor large volumes of traffic. While noting that ISPs have a track record for respecting user privacy, Professor Ohm points to commercial incentives and the removal of technological barriers giving rise to potentially new threats to privacy.⁹⁶ Professor Ohm proposes a new theory of communications privacy policy '... to help policy makers strike the proper balance between user privacy and ISP need'. Important elements of the proposed approach appear to include contextual integrity (taking into account pre-existing norms of privacy and scrutiny) and an evidenced-based approach to evaluating ISP needs.

Developments in web technologies may also provide solutions that allow users to have control over personal information online. Formed in March 2008 by a consortium from the ICT sector and universities, [PrimeLife](#) is a European-funded project to develop technologies to bring privacy to the web and its applications.⁹⁷

The need to reconsider privacy issues for the information age was recognised by the Australian Law Reform Commission's report, *For Your Information: Australian Privacy Law and Practice*, launched in August 2008.⁹⁸

The March 2008 *Top Six Trends in Communications and Technology* noted that DPI could be used by service providers to control or 'shape' traffic data flows to cope with congestion or prioritise traffic. The Canadian Radio Television and Telecommunications Commission has announced it will make enquires into the current and potential traffic management practices of ISPs operating in Canada, including the impact of such practices on end-users.⁹⁹ The inquiry will include a public hearing in July 2009. Bell Canada has been reported to have used DPI to throttle (restricting the flow of) P2P traffic on its network since late 2007.¹⁰⁰

⁹⁵ 'Watching while you surf', *The Economist*, 5 June, 2008

⁹⁶ Ohm, Paul, *The Rise and Fall of Invasive ISP Surveillance* (August 30, 2008). U of Colorado Law Legal Studies Research Paper No. 08-22. Available at SSRN: <http://ssrn.com/abstract=1261344>
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1261344

⁹⁷ <http://www.primelife.eu/>

⁹⁸ <http://www.alrc.gov.au/media/2008/mr1108.html>

⁹⁹ <http://www.crtc.gc.ca/eng/NEWS/RELEASES/2008/r081120.htm?Print=True>

¹⁰⁰ <http://arstechnica.com/news.ars/post/20081120-canadian-regulators-allow-p2p-throttling.html>

INTERNET CALL BLOCKING

Another form of internet traffic management is internet call blocking. European regulators are investigating mobile network operators who block customers from making VoIP calls. Because it is concerned about the possible infringements of competition rules, the EC is reported to have sent questionnaires to phone companies asking what ‘tools’ they use to ‘control, manage, block or slow down or otherwise restrict or filter’ internet-based voice calls.¹⁰¹ The outcome of this inquiry may shed more light on ISP content management practices in Europe and possibly elsewhere, including Australia.

MANUFACTURER CONTROL

In other developments that contrast with open source trends, manufacturers may deliver devices locked to specific services or suppliers. Device firmware can be updated over the network and features can be added, updated or removed without the user being aware of what changes are being made. This is similar to the way software updates for operating systems and applications are being delivered over the internet now.

Mobiles

The mobile sector is an area of continued growth in users and in applications development.

In September 2008 the ITU announced there were likely to be over four billion mobile users in the world by the end of 2008, representing a global penetration rate of over 60 per cent.¹⁰² The largest recent growth rates have been in Brazil, Russia, India and China. Mobile phones are expected to play a leading role in connecting the world to the benefits of ICT, contributing to the United Nations Millennium Declaration targets by 2015.

To mark the ten years since its founding, Google asked ten of their top experts to offer their views on what is going to happen in the next ten years. For the mobile sector, their expectations are that mobiles will:

- Become even more powerful (in computer processing terms), always connected and sensor-rich.
- Enable a more personalised web experience through being context and location aware, anticipating and delivering information to meet the particular needs of users. Information of relevance might be traffic conditions, and details of something a user might be interested in purchasing or visiting.
- Enable users to be in control of privacy settings through trust and verification software.¹⁰³

Sensor-rich mobiles refers to the use of sensors paired with software in mobile phones to detect, measure and interpret information about the users everyday environment.

APPLICATIONS DEVELOPMENT AND DISTRIBUTION

In mobiles, Apple and Google represent two different business models for applications development. Since July 2008, users of Apple’s 3G iPhone have had access to Apple’s [App](#)

¹⁰¹ <http://www.iht.com/articles/2008/11/11/business/mobile.php>

¹⁰² http://www.itu.int/newsroom/press_releases/2008/29.html

¹⁰³ <http://googleblog.blogspot.com/2008/09/future-of-mobile.html>

[Store](#) on iTunes to browse, buy and download applications to their mobile phone. Applications submitted to the store are hosted under rules determined by Apple.

Google's [Android Market](#) website (launched in the US in [October 2008](#)) is a site where users can download applications to their Android-powered devices. Operating as an open market, applications are developed by the applications developer community. Applications are developed using standard open source development tools through an agreed software development kit and mobile OS road map.

Incentives for the applications developer community range from seeking commercial opportunities to building reputation and demonstrating technical skills and capabilities.

LOCATION-BASED SOCIAL NETWORKING

Location-based services (LBS) use details about the physical location of a user or device to provide tailored or targeted information. A user's location can be determined using the Global Positioning System (GPS) or cellular tower location. Location-based services reveal whether friends are in close proximity (and options to communicate with them or not) or provide information about locations of possible interest to the user (for example, restaurant listings and prices, movie reviews, and map directions). According to *eMarketer*, LBS are evolving into a component of the mobile marketing mix enabled by the increasing penetration of GPS capabilities in mobile phones. *eMarketer* estimated there might be 63 million users of location-based services worldwide by the end of 2008, and 486 million by 2012. See Figure 3 below.¹⁰⁴

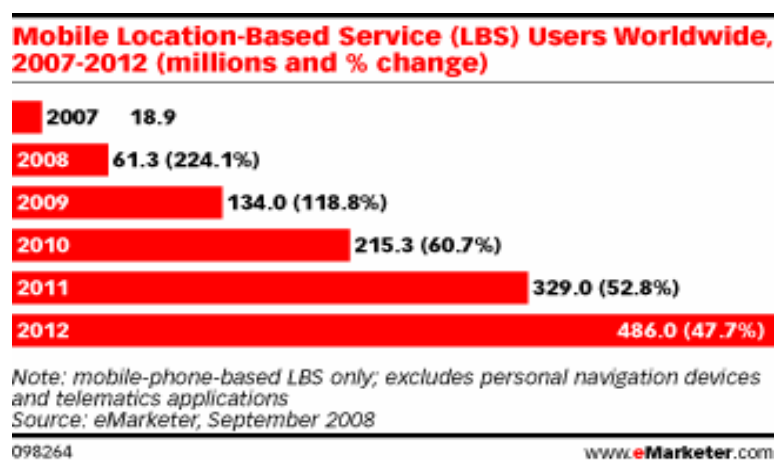


Figure 3: Mobile location-based service (LBS) users worldwide

According to TechCrunch, by the end of September 2008 there were six major location-based social networks available for the iPhone, all but one of them working anywhere in the US.¹⁰⁵ A range of factors likely to hinder mainstream usage were identified, mostly around ease of use of the UI, and battery life. Wider take-up is anticipated should the major social networking sites (MySpace and Facebook) add location-aware services. Comments in response to the TechCrunch posting raised concerns about potential risks such as virtual stalking and personal surveillance.

¹⁰⁴ http://www.emarketer.com/Reports/All/Emarketer_2000510.aspx?src=report1_home

¹⁰⁵ <http://www.techcrunch.com/2008/09/28/the-state-of-location-based-social-networking-on-the-iphone/>

Japan and South Korea are expected to lead the growth of LBS in the Asia-Pacific region. Deployment of large-scale LBS services in other areas of the region, including Australia, has been constrained by a range of factors, including interoperability issues, the comparative lack of GPS-enabled handsets and concerns regarding privacy infringement and high roaming charges. Recent factors likely to drive growth in LBS services in Australia include the more widespread availability of mobile broadband access services and service providers seeking to offer value-added services.¹⁰⁶

Managing subscriber profile data, including presence and location information, will enable service providers to track user behaviour on different screens in an integrated manner. Service providers may rely on advertising and develop tools that have the ability to quickly select advertisements, manage advertising space, analyse consumer profile information, capture and manage opt-in, opt-out data, flexibly manage campaigns and target specific audiences in a highly focused manner.¹⁰⁷

The Cellular Telephone Industries Association ([CTIA](#), an international body based in Washington DC, US, and representing sectors of the wireless communications industry) published best-practice guidelines for location-based services, including user notice and consent provisions.¹⁰⁸

Nokia and travel information company Lonely Planet have teamed up to distribute Lonely Planet content via Nokia Maps.¹⁰⁹ Ericsson's Me-On-TV enables interactive TV shows and new user-generated content services by allowing citizen reporters equipped only with a video-enabled phone to contribute to multimedia productions. The hosted location-based services provide a portfolio of location-enabled applications for operators to target consumers and enterprise segments.¹¹⁰

MOBILE PAYMENTS AND MONEY TRANSFER

Mobile payments and money transfer services are likely to become more widely available as Australia follows trends that are well established in many countries, particularly in Eastern Asia,¹¹¹. The infrastructure section of this report covers successful trials of NFC technology for mobile payment services, including in Australia, allowing customers to pay for goods and services with a wave of their mobile phone.¹¹² Other m-payment solutions include mobile banking, m-wallets (that store credit or debit information on a SIP chip) and text messaging (premium short message services).

Mobile payment systems offer advantages to small business operators on the go, enabling payments to be made wherever they may be.¹¹³

¹⁰⁶ <http://www.directionsmag.com/press.releases/index.php?duty=Show&id=26647&trv=1>

¹⁰⁷ http://www.alcatel-lucent.com/enrich/v2i32008/issueDownload/ECv2i3_magazine_NavigatingTheTransformation_en.pdf

¹⁰⁸ http://www.ctia.org/business_resources/wic/index.cfm/AID/11300

¹⁰⁹ 'Nokia to distribute Lonely Planet content', *NewsWire*, 20 August 2008.

¹¹⁰ 'Ericsson launches three new hosting services', *NewsWire*, 12 February 2008.

¹¹¹ <http://www.kpmg.com.au/Portals/0/KPMG%20-%20Mobile%20Payments.pdf>

¹¹² <http://www.telstraenterprise.com/productsservices/paymentstransactions/payments/Pages/TelstraContactlessPayments.aspx>

¹¹³ 'Mobile payments: rake in cash', *The Australian*, 25 July 2008, <http://www.theaustralian.news.com.au/story/0,,24076200-5010941,00.html>

Visa is reported to have more than a dozen pilot and commercial programs enabled by the Visa mobile platform.¹¹⁴ Mobile payments are likely to be for relatively low-value purchases such as refreshments, tickets or food.

It is envisaged that subscribers may also be able to discover new services by holding their NFC phones next to smart posters and advertisements.

E-security developments and outlook

E-security threats for 2009 and beyond were identified at a summit of leading security experts hosted by the [Georgia Tech Information Security Center](#) (GTISC) in October 2008. On top of e-security risks through email, specific threats and countermeasures driven by the increasing use of data in fixed computing and mobile applications are expected to include:

E-Security risk trends

Emerging and potential problem areas

Malware

Malicious software designed to intrude or damage a computer system without a user's informed consent

Poorly designed and maintained websites, social networking sites and false domains

Botnets

Groups of computers infected with malware and controlled by a malicious bot master

Botnets gaining in sophistication and better obfuscation techniques.

Cyber warfare

The use of cyber attacks by antagonist nations

Direct denial-of-service attacks against media outlets and government sites. Systems that support infrastructure are possible cyber attack targets.

Threats to VoIP and mobile devices

Voice spam and voice phishing, data theft, possible denial of service threats or attacks and mobile payments fraud

The evolving cybercrime economy

International conglomerates of professionally trained malware developers motivated by high profit

¹¹⁴ <http://www.nfcnews.com/2008/09/04/visa-launches-new-mobile-payment-services>

At the conclusion of the summit the GTISC released the [*Emerging Cyber Threats Report*](#) for 2009 outlining the role that internet security education, technology standardisation and regulation may play in preventing the spread of cybercrime.

E-security service provider McAfee (a seller of protection software) stated that the number of malware attacks observed in 2008 was larger than the total number of attacks in 2006 and 2007 combined.¹¹⁵

In other developments, malware developers have been reported to be moving away from well-protected sites to social networking sites. Using spear-phishing techniques, emails are sent using details harvested from social networking sites. These emails appear to be authentic but are actually fake.¹¹⁶

There have been reports of personal details being harvested from users' profiles and the use of software bugs that reveal confidential information.¹¹⁷ In one high-profile case, an antivirus researcher was impersonated on Facebook resulting in threats being made against him and his spouse.¹¹⁸

E-Security trends have shown a big increase in non-hidden malware such as Antivirus XP 2008 which skirts the line between malware and spyware.¹¹⁹ In one particular example, a number of ISPs disconnected hosting a server because it continued to allow malware to be distributed.¹²⁰ There have been instances of e-security scams in the US where '... scam artists who use fake security alerts to frighten consumers into paying for worthless computer security software.'¹²¹

The Australian Government is seeking to address the growth in the risks and threats from the growth in computing and mobile device applications through the development of an e-security framework.¹²²

Human computer interaction

Human computer interaction (HCI) refers to the design and implementation of computer systems that people interact with. HCI aims to improve interactions between users and computers by making computers more usable and responsive to user needs. HCI involves the intersection of computer science, behavioural science, design and several other fields of study.

Research developments in new interaction technologies are expected to move into the mainstream over the next decade. Applications are likely to include speech-recognition,

¹¹⁵ <http://arstechnica.com/news/ars/post/20080909-mcafee-moving-to-the-cloud-for-antivirus-protection.html>

¹¹⁶ <http://www.computerweekly.com/Articles/2008/06/13/231056/malware-threats-double-in-2008-mcafeefinds.htm>

¹¹⁷ http://www.theregister.co.uk/2008/03/25/facebook_exposes_private_pics/

¹¹⁸ <http://www.sophos.com/blogs/gc/g/2008/04/28/facebook-trolls-and-death-threats/>

¹¹⁹ http://www.informationweek.com/blog/main/archives/2008/09/xp_security_sca.html

¹²⁰ http://www.theregister.co.uk/2008/09/26/intercage_knocked_offline_again/

¹²¹ http://voices.washingtonpost.com/securityfix/2008/09/microsoft_washington_state_tar.html

¹²² [http://www.ag.gov.au/www/agd/rwpattach.nsf/VAP/\(3A6790B96C927794AF1031D9395C5C20\)~DRAFT+E-Security+Review+2008+-+Public+industry+Discussion+Paper.pdf/\\$file/DRAFT+E-Security+Review+2008+-+Public+industry+Discussion+Paper.pdf](http://www.ag.gov.au/www/agd/rwpattach.nsf/VAP/(3A6790B96C927794AF1031D9395C5C20)~DRAFT+E-Security+Review+2008+-+Public+industry+Discussion+Paper.pdf/$file/DRAFT+E-Security+Review+2008+-+Public+industry+Discussion+Paper.pdf)

touch panels, pen capabilities and smart cameras.¹²³ An application is now available that enables users to do a Google search just by using their voice.¹²⁴

A recent development has seen commercially available brainwave-controlled headset which ‘reads’ and interprets different mental states associated with the headset user and transmits that information wirelessly to a variety of platforms. Further developments in robotics and pervasive and embedded computing are expected to change ways of interacting with computers.¹²⁵

Emerging forms of telecommunication

TELEPRESENCE

Telepresence¹²⁶ aims to provide a video-based immersive system which attempts to imitate a face-to-face meeting using high-resolution 3D vision and audio. The simulation of remote participants ‘sitting across a table’ is enabled by the transmission of life-size images, careful positioning of cameras, the ability to have eye contact (or ‘as close to eye contact as possible’), the provision of multiple microphones and personal controls for each participant, and the right codecs employed on a managed network.

Telepresence applications range from corporate conferencing to remote surgery. Meetings can be also scheduled from within calendar applications.

According to *The Australian* Cisco sold six telepresence videoconferencing systems in Australia by June 2008.¹²⁷ Current obstacles for the more widespread adoption of telepresence systems are the high costs of the systems installation at each end, extensive bandwidth usage, and the lack of interoperability with existing videoconferencing systems and other business applications.

Advantages are similar for existing videoconferencing systems, namely reduced travel costs and time savings resulting in higher productivity.

Tele-immersive systems combine aspects of virtual reality with videoconferencing and aim to allow people separated by great distances to interact naturally, as though they were in the same room. It combines the display and interaction techniques of virtual reality with new vision technologies that transcend the traditional limitations of a camera. Rather than merely observing people and their immediate environment from one vantage point, tele-immersion stations convey them as ‘moving sculptures’, without favouring a single point of view. The result is that all the participants, however distant, can share and explore a life-size space.

The tele-immersive portal could be characterised as a telephone of the future—an interactive user interface which could be employed in a number of applications that use high bandwidth networks as a platform. Typical applications for tele-immersion include tele-meetings, medical applications such as pre-operative planning, tele-assisted surgery,

¹²³ <http://www.microsoft.com/presspass/exec/billg/speeches/2008/06-03teched.mspx>

¹²⁴ <http://googlemobile.blogspot.com/2008/11/google-mobile-app-for-iphone-now-with.html>

¹²⁵ <http://www.microsoft.com/presspass/exec/billg/speeches/2008/06-03teched.mspx>

¹²⁶ http://www.cisco.com/en/US/prod/collateral/ps7060/ps8329/ps8330/ps7073/prod_video_data_sheet_telepresence_1.html <http://www.go-telepresence.com/articles/article-2.html>

¹²⁷ <http://www.australianit.news.com.au/story/0,24897,23910994-15306,00.html>

advanced surgical training and tele-diagnostics, tele-collaborative design, computer-supported training and education, three-dimensional interactive video.¹²⁸

¹²⁸ http://www.cs.unc.edu/Research/stc/publications/Sadagic_Presence01.pdf
http://www.cs.unc.edu/Research/stc/inthenews/pdf/sciam_2001_0401.pdf
<http://www.advanced.org/teleimmersion2.html>

Social and economic trends and implications

Consumer Web experience

WHAT CONSTITUTES A FULL WEB EXPERIENCE?

Ovum reported that the United Kingdom Advertising Standards Authority labelled a TV advertisement for Apple's iPhone misleading for claiming the device supported 'access to the full internet'.¹²⁹ The case is interesting as it highlights differing expectations about a 'full web experience' and whether a generalised web experience may exist or not.

Consumer web experiences vary depending on:

- ISP performance (such as actual internet download and upload speeds, and traffic management practices)
- broadband home, access, core and international back-haul network capacity
- web-server performance (website loading time, user interface and security)
- web-service location (local or overseas)
- e-security software (including patch updating)
- the use of legacy software
- the capacity of a device or desktop computer to support technologies such as Flash that underpin internet video and TV
- application software and
- website design.

A Pew Internet study reported that networked workers in the US found that increased connectivity was a mixed blessing. The benefits of increased connectivity and flexibility were offset through added stress and demands on their lives.¹³⁰

Actual experiences of web users will vary depending on the practices of website developers and owners and their ISPs, their choice of computing hardware and software use, and their own levels of stress and digital literacy. Understanding or monitoring user web experiences is becoming more complex and fast changing.

¹²⁹ Ovum, *Straight Talk*, 28 August 2008

¹³⁰ http://www.pewinternet.org/PPF/r/264/report_display.asp

Web usability

DATA PORTABILITY

In general terms, data portability refers to the use of data on different computer systems, or to move data from one database to another. With the development of the social web, there is now more interest in data portability concerning the use of personal data.

The March 2008 *Top Six Trends in Communications and Media Technologies, Applications and Services – Possible Implications* report noted that those who used the internet for social networking had some concerns about the rights of users to control personal data and how the data is used by service providers.¹³¹ Users may wish to update, transfer or remove data from more than one social network. Data may include personal profiles, details of friends on social network sites as well as other content loaded to such sites, or perhaps comments that people make on others' blogs. Problems are more likely to arise for those people who use multiple social networks. Changing an email address or other contact details currently involves working through each service to make required changes.

During the course of 2008 there have been some developments in this area. Several leading social networking sites and vendors have demonstrated some support for data portability. They include Facebook Connect, Google's Friend Connect and MySpace's Data Availability that allows users to port data to third-party social network sites. Formed by a group of like-minded people, the [Data Portability](#) project seeks to promote the use of existing open standards and open-source solutions that enable data portability and identify new standards that may be required. The project is open to individuals, companies or organisations to contribute and to collectively influence industry developments. Defining data portability as 'the option to use your personal data between trusted applications and vendors', the group's mission is '... to promote the idea that individuals have control over their data by determining how they can use it and who can use it.'¹³²

One immediate benefit of data portability would be from the ability to update contact details in one location with updates to other sites following automatically.¹³³

Social web

The social web is a term used to describe the social nature of the internet, where people interact and socialise online using social media and social networking applications. More recently the social web has extended to business and integration with mainstream media.

SOCIAL MEDIA

Social media provides a low-cost medium for individuals and organisations to produce and distribute content in ways that were previously only available through traditional media (TV, radio and publications). This section focuses on the growth of blogging and micro-blogging and its emergence as an important part of the media landscape.

Although there are no precise global figures on the number of blogs and blog use, several reports over recent months indicate a significant increase in the number of blogs and

¹³¹ ACMA, *Top Six Trends in Communications and Media Technologies, Applications and Services – Possible Implications*, March 2008 http://www.acma.gov.au/WEB/STANDARD/pc=PC_311145

¹³² <http://www.dataportability.org/>

¹³³ <http://scobleizer.com/2008/03/26/the-real-roadblocks-to-data-portability-on-social-networks/>

blogging activity. Technorati released its latest *State of the Blogosphere* report in September 2008. ACMA has been tracking Technorati reports on the global state of blogosphere¹³⁴ since the *Telecommunications Performance Report 2004–05*. Figure 4 below is a graph prepared by ACMA that shows the trend since 2004.

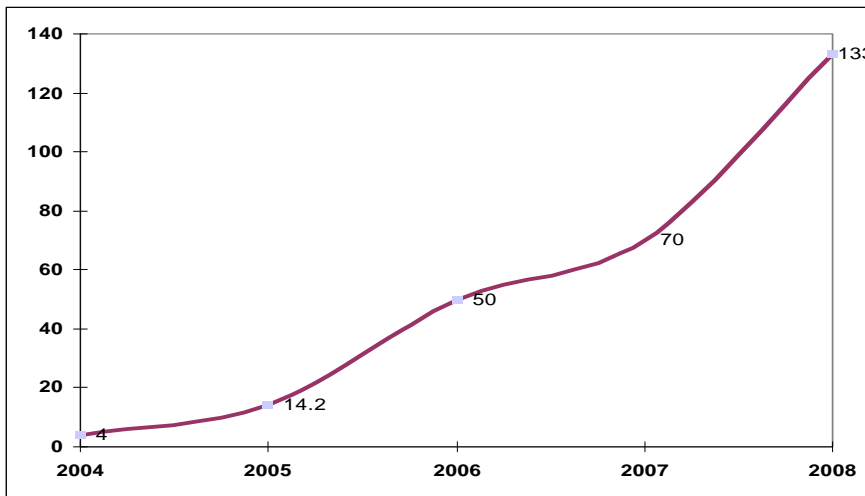


Figure 4: Blog records indexed by Technorati, 2004–2008

(Developed by ACMA from data sourced from Technorati)

The number of blog records indexed by Technorati increased from four million in 2004 to 133 million by September 2008. There was a 1.9 times increase in the number of blog records indexed from April 2007 to September 2008.

Other highlights shown in Figure 5 below were:

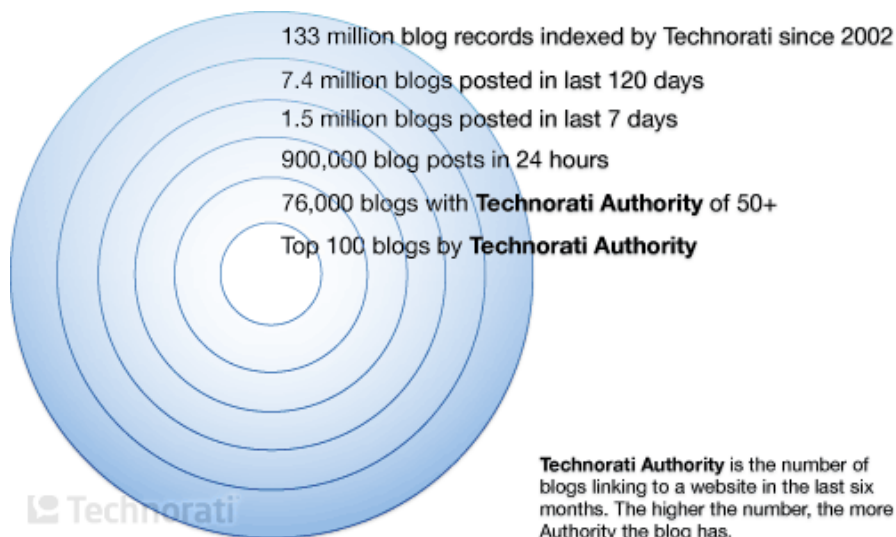


Figure 5: Highlights in the blogosphere from April 2007–September 2008

¹³⁴ Technorati define the blogosphere ‘...as the collective community of all blogs. As all blogs are on the Internet by definition, they may be seen as interconnected and socially networked’.

A number of studies are cited in the report to support the claim that blogging has hit the mainstream internationally and is now a significant part of the media landscape.¹³⁵ Universal McCann reported that 77 per cent of internet users globally read blogs.¹³⁶ According to MarketTools, blogs, online communities and social networks have become a mainstream source of information for most Americans.¹³⁷ In China (which now has the world's largest internet population of 253 million users) the number of regular blog users rose to 107 million in 2008, up 116 per cent over 2007.¹³⁸ Blogging activity levels in China indicate that Technorati's figures may understate blog use worldwide by a significant margin.

In response to Technorati's report, ReadWriteWeb suggested that it was blog readership that is now mainstream rather than blog authorship.¹³⁹

There is evidence to show that Australian blog readership is following international trends. A Nielsen online survey of consumer-generated media reported that 48 per cent of Australian internet users had read blog content, with nearly 20 per cent reading blogs on a daily basis.¹⁴⁰ The Universal McCann report cited above reported that 62 per cent of active Australian internet users read blogs. One estimate dating from February 2008 put the size of the Australian bloggers at around 2.3 million, with a total of 7.07 million Australians having read a blog.¹⁴¹ According to Alexa, a web traffic tracking company, as of November 2008 two blogging sites were in the top 21 websites in Australia.¹⁴² Research into the Australian political blogosphere is underway at the Queensland University of Technology.¹⁴³

Blogging continues to evolve with microblogging platforms such as Twitter¹⁴⁴ gaining in popularity. Microblogging allows users to express themselves in short messages and provide links to websites, and distribute their messages to friends or followers.

A number of important social factors lie behind the growth of social media, including the opportunity for people to express themselves, to be creative, to build or maintain connections with others, and communicate with like-minded communities of interest. The medium is participative and interactive or, as has been said following the US presidential election, 'The advantages of web technology ... are to do with intimacy, connection, and immediacy'.¹⁴⁵

¹³⁵ comScore Media Metrix (August 2008), eMarketer (May 2008), Universal McCann (March 2008)

¹³⁶ http://www.universalmccann.com/Assets/wave_3_20080403093750.pdf

¹³⁷ <http://www.socialmediatoday.com/SMC/49276>

¹³⁸ <http://www.cwrblog.net/1224/chinese-iwom-landscape-by-cic-data.html> Data was sourced from the Chinese Internet Information Center: <http://www.cnnic.cn/en/index/index.htm>

¹³⁹ http://www.readwriteweb.com/archives/state_of_the_blogosphere_2008.php

¹⁴⁰ Nielsen Online, January 2008, *Consumer Generated Media - Separating Hype from Reality*, p.89

http://www.nielsen-online.com/pr/pr_080226_AU.pdf

¹⁴¹ <http://blogs.com.au/thelocal/2008/02/27/23-million-australians-have-created-a-blog/>

¹⁴² http://www.alexa.com/site/ds/top_sites?cc=AU&ts_mode=country&lang=none The two sites were blogger.com (ranked no. 11) and Wordpress.com (ranked no. 21)

¹⁴³ <http://snurb.info/node/864>

¹⁴⁴ A significant increase in Twitter usage in Australia for the year to August 2008 has been reported, http://wotnews.com.au/like/australia_twitter_statistics/2503022/

¹⁴⁵ 'Barak Obama: Victory is Sweet', *TimesOnline*, 7 November, 2008

http://technology.timesonline.co.uk/tol/news/tech_and_web/the_web/article5109087.ece

As an expanding part of the media landscape blogging is shaping up in Australia to be one of the means through which social, economic and political issues are discussed, alongside traditional media platforms (TV, radio and print).

SOCIAL NETWORKING

The functionality and use of social networking sites is expanding rapidly, for personal use and in enterprise. Social networking has become a tool for coordinating social action.

The March 2008 *Top Six Trends in Communications and Media Technologies, Applications and Services – Possible Implications* report noted that ‘social networking sites may evolve over the next five years to become integrated hubs for individuals, organisations and their extended networks to connect, communicate, access and share tailored news, information and entertainment’.¹⁴⁶ For increasing numbers of people, that is already the case. ComScore reported a 25 per cent increase in social networking activity worldwide in the year to June 2008. The total worldwide audience for social networkers aged 15 or more was 580 million¹⁴⁷ — about 40 per cent of the estimated 1.46 billion internet users globally¹⁴⁸.

[Facebook](#) grew by 153 per cent to become the top global social networking site with 132 million unique visitors in June 2008. Facebook reported it had 3.36 million Australian users (18 per cent of the population) by the end of July 2008. This is an increase of 43 per cent over the preceding six months, making Australia the fifth fastest-growing Facebook country.¹⁴⁹ According to Alexa, the social networking sites Facebook, MySpace and Bebo were in the top 15 web sites in Australia in November 2008 by traffic ranking.¹⁵⁰

The functionality of social network sites has expanded in the first half of 2008 with the introduction of some data sharing between sites and entertainment services. [MySpace](#) launched a new site, MySpace Music, for its US users in September 2008. An Australian version is expected to be launched within a year. The new service lets users stream music for free, or purchase songs to download. In a strategic shift toward personalised advertising, MySpace has segmented users in the US into target groups according to their personal interests.¹⁵¹

Social network providers are adding mobile interfaces to their services which may enable specialist, mobile-centric social networks to emerge. Many operators have witnessed the spread of social networking to the mobile market, including Vodafone UK, which listed Bebo, Facebook, MySpace and YouTube among the ten most-visited sites for its mobile internet customers. Due to the difficulty in subscribing to new services on mobile devices compared to desktop computers, because of smaller form factors (physical size and shape) and less-advanced searching capabilities, several major online social networking service providers have found it advantageous to form partnerships with mobile network operators to facilitate access to their sites from mobile devices.¹⁵²

¹⁴⁶ ACMA *Top Six Trends in Communications and Media Technologies, Applications and Services – Possible Implications*, March 2008, p.15 http://www.acma.gov.au/WEB/STANDARD/pc=PC_311145

¹⁴⁷ <http://www.comscore.com/press/release.asp?press=2396>

¹⁴⁸ <http://www.internetworldstats.com/stats.htm>

¹⁴⁹ <http://www.insidefacebook.com/2008/07/29/tracking-facebooks-2008-international-growth-by-country/>

¹⁵⁰ Facebook ranked no. 5, MySpace no. 9 and Bebo was 15th.

¹⁵¹ ‘MyTunes versus iTunes as News takes on digital rivals’, *The Age*, 26 September, 2008

¹⁵² Analysys Mason; ‘Mobile operators will be first to gain from mobile social networking, says Analysys Mason’, 08 October 2008, *Telecommunications Business*, 296. Retrieved 6 October, 2008 from ProQuest Telecommunications Database. (Document ID: 1565706171).

Social networking is being deployed within enterprises as well. A recent European survey found that ‘the use of social networking tools as part of everyday life has led to an increase in efficiency’.¹⁵³ IBM has developed its own platforms that provide blogging, podcasting, file sharing, wikis and social networking for its 380,000 staff.¹⁵⁴ Research into the relationship between social networking and formal organisational structures was published in October 2008 by Demos and Orange Business Services. Their report [Network Citizens](#), found that ‘the dynamics of the workplace are being reshaped ... [and that] the turbo charging of networks by certain forms of technological advance – in particular the rise of online ‘social networking’ – is also clear’.¹⁵⁵ The research looked into the upsides and downsides of networking.

The Economist reported that professional social networks are being used by web-based business networking and job hunting.¹⁵⁶ According to the report, the two most popular sites, LinkedIn and Xing, are growing rapidly. Users are willing to pay for value-adding services to enhance their employment or business prospects. Business people use social network sites for networking with like-minded individuals or professional interest groups.

A report into US online retailing revealed that social network sites used by retailers include Facebook, MySpace and YouTube. Fifty-nine of the top 100 online retailers maintained a page on Facebook.¹⁵⁷

In contrast to developments internationally, an Australian report into social networking in the enterprise that was published in November 2008 found that ‘The majority of large Australian companies are trialling social networks within their organisations and senior executives believe that, rather than being a waste of employee time, there is substantial value to be harvested from connecting with Web 2.’¹⁵⁸ While most organisational engagement with social networking is currently experimental, there is an expectation that these tools are likely to have a significant impact on the way business is conducted.

Another possible application of social networking is peer-to-peer banking, where individuals use online services to lend to each other as opposed to using banks as third-party intermediaries. The appeal of peer-to-peer banking is in more attractive interest rates, and better social, demographic and ethical matching between lenders and borrowers. Mirroring this interest, established internet banks are starting to experiment with social network style customer interfaces.¹⁵⁹

Academic and consultant, Clay Shirky, has described social networking as a tool for coordinating social action. In a presentation to the UK-based RSA (Royal Society for the encouragement of Arts, Manufactures and Commerce)¹⁶⁰, Shirky said that:

- group action has become easier (through social networking platforms)
- sharing information gains reputational value and

¹⁵³ http://www.corp.att.com/emea/insights/pr/eng/social_111108.html

¹⁵⁴ <http://redcouch.typepad.com/weblog/2008/10/sm-global-repor.html>

¹⁵⁵ Bradwell, P. & Reeves, R. (2008) *Network Citizens*, Demos.
<http://www.orangecoalition.com/discussions/view.php/49>

¹⁵⁶ ‘Facebook for suits’ *The Economist*, 27 September, 2008

¹⁵⁷ <http://www.emarketer.com/Articles/Print.aspx?id=1006674>

¹⁵⁸ http://rossdawsonblog.com/weblog/archives/2008/11/launch_of_the_e.html

¹⁵⁹ <http://www.misaustralia.com/viewer.aspx?EDP://20080903000030265038&gclid=CMfb2ZOqlpYCFRsRagodfBNP6A>

¹⁶⁰ <http://www.thersa.org/events/vision>

- media is moving from a source of information to a source of action.

Social networking sites reduce the difficulty of group action through the comparative ease of maintaining connections between group participants (for example, sending messages to group members on Facebook). Shirky does not consider that social action online will replace institutions, but that the imbalance of power between institutions and distributed groups is being adjusted. Shirky cautioned that while the internet enables social action, the outcome is not entirely good as it also enables action by groups that are inimical to society.

As social networking and social media have become mainstream for many individuals and are being used increasingly for business, issues of public concern that arise include online identity management, personal and commercial data management, and reputation management. As the media landscape is inclusive of social media, new influencers come to bear in informing and shaping public opinion and community standards. ACMA was involved in developing international guidelines for using social network services. The guidelines were launched in April 2008.¹⁶¹

However, there is some uncertainty about the outlook for social networking. In a survey of 17 markets across the world, carried out in June 2008, research firm Synovate was surprised to learn that more than a third of social networkers surveyed said they are losing interest. According to Synovate, over half the survey population (58 per cent) do not know what social networking is.¹⁶²

The global economic slowdown is also placing pressure on social media and social networking start-ups to show that they are profitable, especially those that have focused on building up a loyal audience and then monetising with advertising.¹⁶³

CONSUMER PARTICIPATION IN CONTENT CREATION AND DISTRIBUTION

Participative web developments have led to a new dimension in the economy being identified: the ‘value chain 2.0’. This approach recognises that consumers are no longer passive but are now active in producing and distributing content and in the value creation process.¹⁶⁴ Otherwise known as the ‘direct economy’ examples of consumer empowerment include ways that ‘people book their own flight tickets ([EasyJet](#)), assemble furniture ([Ikea](#)), customise the computer they want to buy ([Dell](#)), trade shares online ([Swissquote](#)), submit product ideas ([P&G](#), [Muji](#) and [Nespresso](#)), write articles ([OhMyNews](#) and [Wikipedia](#)) or book reviews ([Amazon](#)), track their own packages ([Fedex](#)), and market, negotiate, sell, ship ([eBay](#)), and so on. These are different degrees of interactivity and participation.’¹⁶⁵

The Value Chain 2.0 paper provides an overview of the challenges of value-chain adaptation to the ‘networked realities’ of the participative economy.

¹⁶¹ http://www.acma.gov.au/WEB/STANDARD/pc=PC_311043

¹⁶² <http://www.synovate.com/news/article/2008/09/global-survey-shows-58-of-people-don-t-know-what-social-networking-is-plus-over-one-third-of-social-networkers-are-losing-interest.html> (Australia was not included in the survey)

¹⁶³ http://www.mediapost.com/publications/?fa=Articles.showArticleHomePage&art_aid=94770

¹⁶⁴ <http://www.thinkstudio.com/text/chain20.pdf>

¹⁶⁵ http://giussani.typepad.com/loip/2006/08/direct_economy.html

Cloud computing

Cloud computing refers to the use of web-based computing systems, applications and services that are accessed independently from the underlying infrastructure. This enables computing services to be available where and when needed.

Although the term cloud computing is relatively new, storing data within the internet has been practised for some years. Pew Internet reported that some 69 per cent of Americans use webmail services, store data online, or use software applications whose functionality is located on the web.¹⁶⁶ Macquarie University uses Google's Gmail service for students and recent graduates.¹⁶⁷

Economic factors behind the anticipated growth of cloud computing include the falling cost of storage and businesses seeking IT cost efficiencies. They also see the potential for business agility and resilience through not being tied to legacy computing systems. Users are attracted to cloud computing because of its convenience and ease of use.

The Economist stated that 'It [cloud-computing] will undoubtedly transform the information technology (IT) industry, but it will also profoundly change the way people work and companies operate. It will allow digital technology to penetrate every nook and cranny of the economy and of society, creating some tricky political problems along the way'.¹⁶⁸ Instead of separate IT operating systems, firms might outsource their IT requirements to specialist operating systems.

Conversely, concerns about the safety of personal data and security, ownership and control over copyright material or the loss of direct control over applications, may impede consumer and corporate take-up of cloud computing. A possible response to such concerns would be to offer virtual private cloud computing with service-level undertakings.

The internationalised nature of cloud computing raises issues of jurisdiction over access to and protection of personal data. According to *The Economist*, most privacy laws assume that data resides in one place. For national rules to be enforceable, '... at some point, cloud providers may find themselves compelled to build data centres in every country they do business ...' potentially eroding the cost advantages offered by cloud computing. Therefore, a looming challenge is to strike a balance between sovereignty and efficiency.¹⁶⁹

Conclusion

This report provides further evidence of ongoing and significant change in the communications and media landscape over the last few months, and over the horizon.

Some of the changes continue established trends, most notably convergence of networks and services based on IP platforms. Issues to keep track of include demand for

¹⁶⁶ Pew Internet & American Life Project, Use of Cloud Computing Applications and Services, September 2008. http://www.pewinternet.org/PPF/r/262/report_display.asp

¹⁶⁷ <http://www.australianit.news.com.au/story/0,24897,24561076-15306,00.html>

¹⁶⁸ 'Let it rise: a special report on corporate IT', *The Economist*, 25 October, 2008, p3

¹⁶⁹ 'Computing is about to face a trade-off between sovereignty and efficiency', *The Economist*, 25 October, 2008

radiofrequency spectrum and potential network bottlenecks, including those arising from network and traffic management practices. Increasing use of data networks and services, and the growth in the social web raise new challenges on the horizon around the use and control of personal data online, and in responding effectively to cybersecurity threats. The sophistication of web services and user interfaces increase the complexity and challenges in promoting digital literacy.

ACMA will continue to monitor these developments and consider the implications for regulation.

Glossary

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| 3D | <p>Three dimensional</p> <p>A geometric model in three dimensions (length, width and depth).</p> |
| 3G | <p>third generation mobile telecommunications</p> <p>A broadband mobile telecommunications platform supporting multimedia voice, video and data services. WCDMA and CDMA2000 are the 3G technologies derived from the GSM and CDMA 2G technologies respectively.</p> |
| 3GPP | <p>The Third Generation Partnership Project (3GPP) is a collaborative project for the maintenance and development of GSM technical standards and reports.</p> |
| beta | <p>When used in reference to software, is the release of an initial or upgraded program or system for testing by the public. Users may experience bugs with beta software.</p> |
| Blogosphere | <p>A collective term encompassing all blogs and their interconnections. As all blogs are on the internet by definition, they are perceived as existing together as a connected community (or as a collection of connected communities) or as a social network.</p> |
| Botnets | <p>Groups of computers infected with malware and controlled by a malicious bot master.</p> |
| Cloud computing | <p>Refers to the use of web-based computing systems, applications and services that are accessed independently from the underlying infrastructure or geophysical location.</p> |
| CPU | <p>Central processing unit</p> <p>A machine that can execute computer programs.</p> |
| DPI | <p>Deep packet inspection</p> <p>Provides ISPs with the capacity to monitor user web traffic in real time.</p> |
| DSL | <p>Digital subscriber line</p> <p>Transmission technique that dramatically increases the digital capacity of telephone lines into the home or office.</p> |
| DSLAM | <p>digital subscriber line access multiplexer</p> <p>A telecommunications network device that connects multiple customer DSL lines to a high-speed internet backbone using multiplexing techniques.</p> |

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| eHSPA | evolved high-speed packet access The 3GPP release 7 specifications including high-speed HSDPA and HSUPA. |
| Ethernet | Refers to the IEEE 802.3 standard used in computer networking technologies for local area networks. |
| ETSI | European Telecommunications Standardisation Institute Produces globally applicable standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, converged, broadcast and internet technologies. Officially recognized by the European Commission as a European Standards Organization. |
| GB | Gigabytes A billion bytes. |
| GHz | Gigahertz One billion Hertz, where one Hertz is the measurement of frequency equal to one cycle per second. |
| GPS | Global Positioning System A US space-based radionavigation system that provides reliable positioning, navigation, and timing services to civilian users on a continuous worldwide basis. Freely available to all. |
| GSM | Global system for mobile communication The widely used European digital cellular network standard. |
| GSMA | GSM Association A global trade association representing the interests of GSM mobile phone operators and vendors. |
| HCI | Human computer interaction Refers to the design and implementation of computer systems that people interact with. |
| HD | High definition A digital video system with higher resolution. |
| HFC Cable | Hybrid fibre coaxial cable Network element consisting of optical fibre on main routes, supplemented with coaxial cable closer to a customer's premises. |
| HSDPA HSUPA | High-speed downlink packet access protocol High-speed uplink packet access protocol |

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| | 3G (third generation) mobile telephony communications protocols in the High-Speed Packet Access (HSPA) family, which allows networks based on Universal Telecommunications System (UMTS) to have higher data transfer speeds and capacity. |
| IEEE | <p>A non-profit organization, IEEE is a leading professional association for the advancement of technology.</p> <p>The IEEE name was originally an acronym for the Institute of Electrical and Electronics Engineers, Inc. Today, the organization's scope of interest has expanded into so many related fields that it is simply referred to by the letters I-E-E-E (pronounced Eye-triple-E).</p> |
| IMS | <p>IP Multimedia Subsystem</p> <p>An open systems architecture that supports a wide range of IP-based multimedia services over packet and circuit-switched networks.</p> |
| IMT-2000 | <p>International Mobile Telecommunications 2000</p> <p>The global standard for third generation wireless communications, defined by a set of interdependent ITU Recommendations.</p> |
| IP | <p>Internet Protocol</p> <p>The key member of the suite of internet protocols at the logical layer, specifying packet addressing and routing data through the internet.</p> |
| ISP | <p>internet service provider</p> <p>Carriage Service Provider offering internet access to the public or another service provider.</p> |
| ITS | <p>Intelligent Transport Systems</p> <p>Aims to improve transportation safety and mobility and enhance productivity through the integration of advanced communications technologies into the transportation infrastructure and in vehicles. ITS encompass a broad range of wireless and wire line communications-based information and electronics technologies.</p> |
| ITU | <p>International Telecommunication Union</p> <p>The leading United Nations agency for information and communications technologies, including radiocommunications, standardisation and development.</p> |
| Kbps | <p>Kilobits per second</p> <p>Data transfer rate of 1,000 bits per second.</p> |

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| LBS | Location-based services Refers to services based on the physical location of the user and/or device (such as targeted advertising or information tailored to a specific location). |
| LCD | Liquid crystal display An electro-optical amplitude modulator that forms a thin, flat display in digital devices. |
| LTE Advanced | Long-term evolution advanced 3GPP proposed mobile systems that go beyond those of IMT-2000. |
| Malware | Malicious software designed to intrude or damage a computer system without the user's informed consent. |
| Mbits/s | Megabits per second Data transfer rate of one million bits per second. |
| MHz | Megahertz One million Hertz. |
| Naked DSL | A digital subscriber line service without a PSTN service. |
| NFC | near field communications A short-range wireless technology that evolved from a combination of existing contactless identification and interconnection technologies, also known as ISO 18902. |
| OLED | Organic light emitting diodes Very thin display technology. Thin films of organic materials that emits a bright light onto a screen with the application of electricity. |
| P2P applications | Peer-to-peer applications Applications where data is exchanged directly between users. |
| PSTN | Public switched telecommunications network operated by a carrier to provide services to the public. |
| Semantic Web | Currently in the early stages of development. The potential of the semantic web is expected to be in personalised web experiences by linking data of interest to users located in different pages. Semantic technology is expected to provide context relevancy/awareness, intelligent search and retrieval functions. |
| SIP-I Protocol | An ITU defined extension for interworking between PSTN & IP |

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| | Networks (IMS). |
| Social Web | A term used to describe the social nature of the internet, where people interact and socialise using social media and social networking applications. |
| Spyware | Software installed on a computer that may occur without the user's knowledge and which transmits knowledge about the user's web activities over the internet. |
| TB | Terabytes One thousand gigabytes |
| Telepresence | Aims to provide a video-based immersive system which attempts to imitate a face-to-face meeting using high-resolution 3D vision and audio. |
| Thin client | A computer with a thin client software reliant on a server in place of applications stored on a hard disk drive to perform data processing. |
| Virtualisation | Enables one computer (server) to do the job of many computers. |
| VoIP | Voice over Internet Protocol A protocol for transmitting voice over packet-switched data networks. |
| W3C | World Wide Web Consortium According to the consortium website, W3C develops interoperable technologies (specifications, guidelines, software, and tools) to lead the web to its full potential. |
| WiFi | wireless fidelity Used generally to refer to wireless local area network (IEEE 802.11) technology providing short-range, high data rate connections between mobile data devices and access points connected to a wired network. |
| WiMAX | Worldwide Interoperability for Microwave Access Industry group organised to advance the IEEE 802.16 standards for broadband wireless access networks for multimedia applications with a wireless connection. |