.sg

Singapore

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Overview

Indicators

Singapore's key economic sectors continue to be in manufacturing, construction, utilities, wholesale and retail trade, hotels and restaurants, transport and communications, financial services, and business services. Its GDP was S$159.1 billion in 2003, with a per-capita GDP of S$38,023 (US$1 = S$1.70).[1]
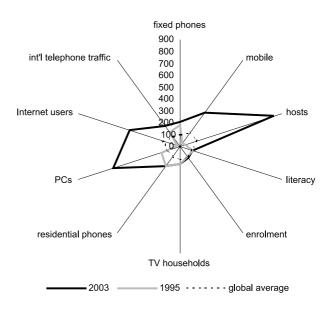
In Singapore's ICT sector, computer ownership in households grew from 63.9 percent in 2001 to 73.7 percent in 2003. Computers are increasingly seen as a necessity in the home, rather than luxury items, especially for families with school-going children. In 2003, 64.4 percent of homes had Internet access (dial-up and broadband connections). Broadband penetration of households was 39.6 percent compared to 17.7 percent in 2001 and 24.2 percent in 2002. There were 2.6 million (62.6 percent) computer users in 2003, compared to 1.9 million (46.0 percent) in 2001. There was a corresponding increase in the total number of Internet users from 1.6 million (38.7 percent) to 2.1 million (51.0 percent). About two-thirds of individuals aged 15 years and above owned a mobile phone.[2]

Development

The government, through the Infocomm Development Authority of Singapore (IDA), has continued to push forward initiatives and programmes to develop and enhance the ICT industry in Singapore. The results are reflected in the improvement in the key ICT indicators cited above.

Progress in such efforts has been made notwithstanding the downturn of the economy during the 2002–2003 period, the difficult market conditions and the regional competition facing the industry. A greater focus has been placed both by the government and the industry on cutting costs and reducing wastage in an effort to bring about maximum returns in a period of uncertainty.

For the industry, the economic downturn has led to some consolidation among market players. Major players and national icons, such as Singapore Airlines, have not been immune to the onslaught of problems, particularly since the SARS outbreak in early 2003, which brought to the surface underlying threats. Many ICT companies have found the need to expand beyond the shores of Singapore to countries such as China and Indonesia. Government agencies, for example IDA and International Enterprise Singapore, are aggressively helping companies to enter new markets in China and other countries in the region. Companies competing primarily for business domestically have found meeting their bottom line a difficult challenge during a period of cost reduction across the board. There are signs that the economy is recovering and that companies are transitioning out of the difficult period. Nonetheless, the need to look beyond the limited size of the Singapore market and grow internationally will remain a key thrust for local companies in the years ahead.

To better understand the underlying factors supporting and driving these developments and other successes in Singapore, we will consider the importance of instituting a suitable infrastructure and a pro-investment environment, nurturing competition, and implementing effective regulation. With successes, there are also failures that are useful to review. We will thus briefly look at some of the lessons learnt along the way leading to where Singapore is presently.

Infrastructure and investment

The achievements that Singapore has made over the years in the advancement of ICT may be attributed to the vision and drive of early pioneers from back in the 1980s in recognising the importance of technology to the development of the economy. As early as 1979, the government had recognised the need for computerisation, and a Committee for National Computerisation was formed, chaired by the Senior Minister of State for Education. In 1981, the government established a separate statutory board (the National Computer Board, the precursor of IDA) to

implement the first National Computerisation Plan with a focus on computerising the civil service, developing an indigenous IT industry and growing a pool of local IT manpower. Through the years, various plans and initiatives were put in place in step with Singapore's economic growth: the National IT Plan in 1986, IT2000 in 1992, and Infocomm 21 at the turn of the century. Each of these plans contained elements that addressed different segments of society: business, government and the people. The combination of the vision, a core group of dedicated IT professionals working towards that vision, and a forward-looking government that was cognisant of the importance of technology brought together the right mix of factors for the sector to grow.

On the investment front, in 2002 the total foreign equity investment in Singapore was S$228.6 billion and total foreign direct investment was S$238.6 billion, of which S$9.4 billion was from the sector of transport, storage and communications. The highest investments were in the sectors of manufacturing (36.3 percent), financial and insurance services (35.2 percent) and commerce (15.9 percent). The top investors in 2002 were the USA (14.5 percent), Japan (13.9 percent) and the UK (13.8 percent), followed by the Netherlands, Switzerland, British Virgin Islands, Cayman Islands, Bahamas, Germany and Bermuda. The key indicators from 1998 to 2002 show a steady growth in foreign investment. At the time of writing, more up-to-date data were not yet available to suggest whether foreign investment in Singapore has been affected by the trend of business operations relocating from Singapore to other regional countries where costs are lower. The strengths that have attracted foreign investment to Singapore appear to have remained thus far – good infrastructure, skilled workforce, conducive environment for business, a low crime rate and a stable government.

Singapore's investment overseas in 2002 amounted to a total of S$273.1 billion compared to S$274.5 billion in 2001. The largest investment destination was the British Virgin Islands (13 percent), China (12 percent), Bermuda (9.2 percent), Malaysia (8.2 percent) and Hong Kong (8.1 percent). Each of these destinations had a higher level of investment in 2002 compared to 2001.[3]

On the international front, significant strides have been made by the government in negotiating and concluding a number of bilateral trade agreements with key trading partners, most notably with the USA. Such initiatives form part of the broader efforts to help the local industry become more internationally and externally oriented. The agreements negotiated by the government provide a stepping stone to help local players open doors in foreign markets.

Competition

IDA's efforts to manage the ICT industry since the full liberalisation of the telecommunications market have been instrumental in creating a more competitive telecommuni-cations industry and lowering basic telecommunications charges for businesses and consumers.

It is useful to contrast the development of the cellular mobile phone and broadband markets in Singapore in relation to the underlying competitive landscape. The mobile phone market took off in the late 1990s with intense competition between the incumbent telecommunications provider and a new mobile provider, with a third mobile operator introduced a few years after. Today, the incumbent is no longer dominant in this segment of the market. Notwithstanding that Singapore introduced mobile phones into the market later than some other countries, the penetration of mobile phones has rapidly reached 89.9 percent, more than double that of fixed lines (44.6 percent).

By comparison, the broadband market had fairly limited competition when the technology was first introduced, and there was also no competition within each mode of access. There were two providers, with the incumbent telecommunications operator offering an ADSL solution and a cable television company offering a cable modem solution. The government's earlier efforts in the late 1990s to improve broadband penetration through incentives and other funding schemes had met with limited success. However, after that initial slow start, a significant increase in competition between broadband providers (within different modes of access) and lower underlying cost structures (due to market liberalisation) had significantly boosted broadband subscription. The 2003–2004 surge in broadband subscription attests to the effectiveness of competition in bringing about greater demand and market maturity, and thus higher penetration.

Continuous effective competition is essential to sustaining the industry's growth. As with mobile phone subscription, it is expected that broadband subscription will eventually surpass traditional dial-up Internet subscription as the use of the Internet becomes more pervasive and the more technologically savvy younger generation enters the workforce. Effective competition will allow new services that are being planned for the future to catch on at a much faster rate.

Regulation

IDA's primary focus has been on developing suitable policies and regulating the telecommunications sector. While developmental efforts and initiatives for the broader IT sector are being further expanded, IDA and the Attorney-General's Chambers conducted several rounds of consultation in 2004 relating to the amendments of Singapore's cyber laws to help IT and e-commerce development.

It is expected that more innovative application-level services will be provided over the telecommunications and data network infrastructure. Regulation will continue to be important, with a gradual shift of focus and emphasis from the telecommunications infrastructure to higher-level policy issues such as facilitating new services to provide high-

quality voice and video services over data networks (which are potentially independent of traditional telecommunications companies) as well as addressing emerging problems and issues at the application level, such as spamming and cyber security. As the solutions for such new problems may no longer be satisfactorily resolved at the domestic level, international cooperation between countries and greater participation by Singapore in international forums and discussions may be essential to enable Singapore to adapt to the rapidly evolving ICT environment and to meet new challenges. Looking further ahead, broader civil society issues such as the impact of ICT on lifestyle, on citizen–government interaction and on the concept of democracy may need to be addressed.

Some lessons

Amid the progress made by Singapore in its ICT development, there are also some lessons that can be learnt. One of the underlying drivers of ICT adoption is the cost of telecommunications infrastructure and the extent of Singapore's connectivity to the region. Singapore's telecommunications market was fully liberalised (down to basic telephony services and lifting the cap on foreign ownership of telecommunications companies in Singapore) only in 2000, although certain telecommunications services (e.g. mobile phone services, Internet access provision) had been opened up several years earlier. This phased approach had given regional competing economies an edge in attracting internationally competitive telecommunications players into their markets and to lay submarine cables to establish a network of connectivity to the region. Prior to liberalisation, infrastructure cost had been one of the factors that led companies to consider establishing their regional headquarters in countries other than Singapore. After four years of liberalisation, the telecommunications market in Singapore is now highly competitive (with IDD call charges to popular destinations falling by more than 60 percent, for instance), and this has led to greater innovation and availability of services in the market.

Early adoption of technology comes with its inherent risks. Singapore's bold moves in earlier years have resulted in a large number of systems being deployed, some more successful than others. In the late 1990s, an initiative to deploy interactive multimedia kiosks in areas of high pedestrian traffic did not result in a viable business model that could be sustained. However, after the turn of the century, a new generation of kiosks providing bill payment and other ancillary services has found a niche area to thrive in. Another example of the risk-taking nature of innovation was the National Library Board's decision to use radio frequency identification (RFID) to electronically tag library books. Although RFID was a relatively untested technology at that time, the library's highly computerised and automated borrowing and return system has turned out to be a success. Library members are able to borrow and return books, and

even pay fines for overdue books, through an entirely automated system.

The speed of technology evolution is another factor to consider as an early technology adopter. While systems such as LawNet and TradeNet have been hailed as significant successes and milestones when they were first deployed, there is now a greater cost and resistance to the deployment of newer technologies to replace or upgrade such systems because of considerations of maintaining continuity and securing returns on the original investment. With legacy systems in place and operating, it may sometimes be more difficult to switch to leading-edge technology.

Since the 1980s, the path taken by Singapore has been a challenging one. Looking ahead, with greater competition from other countries in the region, and with the emergence of economic giants such as China, there is a need for Singapore to look at the path taken, learn from the lessons and move ahead with the benefit of hindsight.

Local online content

The following websites remain important sources of indigenous content on Singapore: AsiaOne (*http://www.asia1. com.sg*), Channel News Asia (*http://www.channelnewsasia. com*), DBS Bank (*http://www.dbs.com.sg*), eCitizen (*http:// www.ecitizen.gov.sg*), Internet Yellow Pages (*http://www. yellowpages.com.sg*), Singapore government portal (*http:// www.gov.sg*), Singapore infomap (*http://www.sg*), Singapore infomap for kids (*http://www.sg/kids*), Singapore maps (*http:// www.streetdirectory.com*), SPRInter: Singapore government Press Releases on the Internet (*http://www.sprinter.gov.sg*), Yahoo! Singapore (*http://www.yahoo.com.sg*).

In addition, the following websites also offer useful information on Singapore. Big Trumpet (*http://www. bigtrumpet.com.sg*) is an initiative of NTUC Income, the insurance subsidiary of the national cooperative, the National Trades Union Congress. The website is built on Microsoft's .NET technology through a project called .NETMySingapore to develop XML web services in Singapore. The technology enables community web services to be connected together. This website features key components such as "MyCareer" (job enhancement and matching activities), "MyClub" (special-interest clubs), "MyFolder" (financial, educational, medical and personal information), "MyHome" (home services: tutors, contractors, online shopping), "MyMoney" (insurance and financial planning services) and "MyWorkplace" (interaction with colleagues and the workplace). The portal links different information systems together and allows users to access their personal information on any device, at any time and at a high level of security.

The portal Can.com.sg (*http://www.can.com.sg*) offers a variety of local map and transportation information, coupled with other local highlights and features. It provides a valuable source of information relating to getting around and how to find things in Singapore. Given a location, the portal allows the user to find amenities and other services in

the immediate vicinity of the location. It also hosts an event calendar as well as a discussion forum on selected issues.

Singapore Airlines provides flight information and booking services at its portal *http://www.singaporeair.com*. It allows travellers to determine airfares, check flight schedules, purchase plane tickets, carry out check-in for flights (from Singapore and other selected countries served by the airline) and select seats, make choice of cuisine for business-class travellers, preview on-board entertainment, and redeem frequent-flyer miles.

The portal Cut Waste (*http://www.cutwaste.gov.sg*) was launched in conjunction with the government's setting up of the Cut Waste Panel. It allows members of the public to offer suggestions on how the government can cut its spending in various areas. The suggestions and the responses are posted on the website. Some of the responses to suggestions offer a good insight into the government's rationale behind certain policies.

Online services

E-government

The government launched its second e-Government Action Plan (eGAP II) in July 2003. The plan was valued at S$1.3 billion and aims to meet the primary objectives of delighting customers and connecting citizens through a networked government. This new three-year plan is a follow-up to eGAP I launched in 2000.

IDA, the architect of eGAP II, has stated that the focus of this plan is to transform the public service into a networked government that delivers accessible, integrated and value-added e-services and helps to bring citizens closer together. The investment of S$1.3 billion is for upgrading infrastructure, developing capabilities and further improving electronic public services. Some visible tangible benefits from productivity improvement will be the reduction of fees for government services and licences and faster processing time.

More than 1,600 e-services have been implemented, representing 90 percent of all the key government services suitable for electronic delivery. The targets ahead for 2006 are to implement 12 more cross-agency integrated services, have 90 percent of the customers of public services use e-services at least once a year, and achieve an 80 percent level of satisfaction with the overall quality of the e-services. Where possible, mobile technologies will be deployed to provide personalised, location-specific and time-sensitive e-services.

In relation to connecting citizens, new ways will be sought to encourage active citizenry and community bonding. Technology will be used to explain public policies and their rationale online and provide another channel for public feedback on policy formulation and review. Technology will also be used to reach out to citizens in Singapore and overseas and allow them to participate in the policy-making process. Internet technologies will be used to form new online communities or to support existing ones.

With the ability for technology to bring a greater range of inputs and perspectives to policy makers, the goal is also to bring about a change in mindset among civil servants – one that will look at issues with an open mind and not be fixated on preserving the status quo.

In striving to be a networked government, the objective is to create an environment for government agencies to collaborate, share information and leverage on collective knowledge to serve the public seamlessly and effectively. A government-wide policy on data protection is already in place and coordinated with the TrustSg effort. In addition, a coordinated, proactive and preventive approach will be undertaken to enhance the government's overall ICT security preparedness for any contingency.

One of the important national initiatives supporting e-government is SingPass, an infrastructure that enables a single password to be used for all e-government services, regardless of which government agency is providing the service. It is intended to simplify the authentication process for citizens using online government services, without the need to separately register with each service and to remember a different user identifier and password for each service.

E-lifestyle

An annual e-Celebrations campaign is held to promote an e-lifestyle. Initiatives such as the National IT Literacy Programme equip Singaporeans with basic ICT literacy skills. The NEU PC Programme (an expansion of the PC Reuse Scheme) appears to contribute to the growth in home computer ownership as it continues to make available new and used PCs to needy families. There are also other initiatives aimed at promoting the use of broadband (during the Broadband Month) and also consumer confidence (through the TrustSg nationwide trust mark). Other fairs with specific themes, such as e-Festival@Great Singapore Sale and e-Festival@Homemakers, are aimed at promoting ICT to different segments of the population.

Internet access terminals and numerous WiFi hotspots are emerging in the market, in particular at popular fast-food and other food and beverages outlets. The demand for such access points in public places points to people's increasing comfort with the use of technology and the greater need to remain connected even while on the move.

E-commerce and e-business

A number of initiatives have been launched with the objective of encouraging greater business adoption of ICT and e-commerce. These include the development of a centre of competency by NEC in Singapore to facilitate automatic global e-procurement for NEC's international procurement offices. Another initiative is the Ri3K reinsurance exchange for the Asian insurance market. This platform provides straight-through processing to allow end-users to integrate their own systems with the central exchange. Such a solution

brings about savings through reduced leakage cost and increased operational productivity.

A number of cross-industry participation programmes have also been put in place. The National E-Supply Chain Task Force aims to prepare manufacturers and logistics providers for e-supply chain management. An eSupply Chain Management Council has been launched to encourage the adoption of e-supply chain management among local enterprises. In addition, efforts to boost security in e-commerce included the formation of a Singapore PKI Technology Centre, supported by PKI Forum Singapore, CrimsonLogic and IDA. The centre provides a basic public key (PKI) infrastructure for interoperability testing and showcasing of new technologies and applications.[4]

Mobile commerce

In 2001, in an effort to make mobile commerce a viable reality in Singapore, IDA gathered local mobile and wireless operators to collaborate with industry partners to develop a nationwide mobile payment platform. This collaborative effort came to a conclusion some two years later in 2003, when IDA announced that four out of the five trial systems are to be commercialised. The infrastructure is expected to connect key parties such as financial institutions, telecommunications operators, merchants and other service providers to create an environment for consumers to easily and conveniently make payments through portable devices such as their mobile phones.

The four trial systems that are going ahead commercially are Blink, Go Virtual, TeleMoney and YW8. Two of the systems, Go Virtual and YW8, will be provided by a consortium of local banks through the Network for Electronic Transfers (NETS). The other two systems will be commercialised by the Systems@Work as well as Mobile Solutions and Payment Services. Technical trial is ongoing for the fifth system, Gemini.

The success of this collaborative approach towards solution building demonstrates that bringing multiple players in the market together can expedite development and deployment of key infrastructures compared to individual companies launching their own proprietary and closed solutions, and it creates an infrastructure that is not tied to a specific operator.[5]

Industries

In 2003, the Singapore ICT industry grew by 2.0 percent to S$32.83 billion in total revenue, up from S$32.17 billion in 2002.[6] Of the total revenue, the hardware retail sector accounted for 46.1 percent, telecommunications services 20.2 percent, software 15.5 percent, IT services 9.9 percent, and content-related activities 8.3 percent.

The export market accounted for 54.1 percent of the ICT industry revenue for 2003, compared to 45.9 percent from the domestic market. Within the domestic market,

telecommunications services comprised 41.1 percent of the revenue. The significant areas of growth in the domestic market were hardware retail (up 40.1 percent), content-related activities (up 2.5 percent), and telecommunications services (up 2.0 percent). However, there was a decline in IT services (down 29.1 percent) and software (down 21.5 percent). In contrast, revenue from the export market was dominated by hardware retail (63.6 percent) and software (24.2 percent).

In the liberalised telecommunications sector, as of January 2004, there were 32 facilities-based operator licensees and 692 services-based operator licensees.[7]

Key national initiatives

Connected Singapore

Since the Infocomm 21 strategy was articulated in 2001, Singapore has made significant strides in moving its ICT industry forward. The full liberalisation of the telecommunications sector was an important foundation and catalyst upon which industry growth was further built. Despite the downturn in the economy both globally and within Singapore since then, it is expected that ICT will continue to be an engine of growth for the nation and an enabler for other sectors. Hence, in 2003, IDA articulated an updated and fine-tuned vision entitled Connected Singapore,[8] comprising four key strategies:

- *Infocomm for connectivity, creativity and collaboration:* This strategy aims to bring ICT products and services to the masses with a view to enriching lives, to drive the development of an infrastructure to enable the production of these products and services, to promote useful applications and encourage their use, and to promote greater literacy in ICT. Infrastructure and applications are both important in the drive towards greater infusion of ICT into society. The programmes are targeted at different levels and segments of society, including schools and the masses.
- *Digital exchange:* This strategy aims to make Singapore the hub for global distribution and trading of digital content, products and services as a new source of economic growth. It builds on the existing infrastructure and business environment to encourage digital exchanges to be cultivated and to grow. A wide spectrum of media, including interactive media and entertainment, digital publications and software, is to be explored (see *Digital cinema* below).
- *Engine of growth:* This strategy targets economic activities and jobs in ICT to create new opportunities. Capabilities will be developed, and assistance will be rendered to help companies grow beyond Singapore's borders. Specific target growth areas to be nurtured are wireless technology development, multimedia content management, web portal development, and security

services. Industry collaboration is expected to be an important element of the strategy.

• *Agent for change:* This strategy aims to help both businesses and the government use ICT more effectively and serve their customers better. Clusters of businesses will be examined to identify ways through which ICT can be leveraged to their advantage. The government, through its e-government initiatives, aims to enhance the experience of citizens through the appropriate use of ICT solutions.

Underlying these four broad strategies are three foundation areas that IDA will also address:

• *Capability development:* There is a need for greater and more specialised expertise in the ICT sector, as the needs of businesses and industry grow. Various programmes are already in place to facilitate the development of the manpower and skills needed.

• *Technology planning:* Given the pace of technology evolution, clarity of the direction of technology development is an important element in guiding Singapore's path. IDA plays a key role in charting the vision, trends and development of the technology landscape for Singapore, as well as in facilitating trials on next-generation technologies. Suitable technology standards also need to be established to enable interoperability between different solution providers.

• *Conducive business environment:* The final component of the underlying foundation is the creation of a business and regulatory environment that is pro-business. Here, IDA, as a policy maker and regulator for the ICT sector, will play an important role in facilitating fair competition between industry players and in creating an environment that businesses will thrive in.

Digital cinema

IDA and the Media Development Authority (MDA) launched an initiative to develop the digital cinema industry in Singapore. The initiative forms part of IDA's Digital Exchange strategy under the Connected Singapore vision and part of MDA's Media 21 strategy.[9] It brings together the focuses of both agencies – IDA on building capabilities and capacity to process, manage and distribute digital content, and MDA on developing content.

Digital cinema represents a transformation from the traditional film-based system to a digital-based system that started from the introduction of digital sound some years ago. Newer technologies such as encryption can provide greater security for film distribution and deter piracy. It is expected that a significant number of new job opportunities will be created in the areas of post-production and infrastructure for digital cinema.

This initiative was undertaken at the same time as one of the local cinema chains, Eng Wah Organisation, converted 20 of its screens to digital cinema. An outdoor digital screen was planned too. This involved S$9 million of industry spending.

Enabling policies

Singapore continues to push for the establishment of free trade agreements (FTAs) with a number of countries around the world. As of December 2004, FTAs have been concluded and signed with New Zealand, Japan, the European Free Trade Association, Australia, the USA, and the Hashemite Kingdom of Jordan. Negotiations are still underway for FTAs with ASEAN and China, Bahrain, Canada, Egypt, India, Republic of Korea, Mexico, Pacific Three (New Zealand, Chile and Singapore), Panama, Peru, and Sri Lanka.

Among the FTAs already concluded, the US–Singapore FTA[10] represents one of the most significant achievements. Together with the e-commerce chapter of that FTA, the two countries also signed a joint statement on e-commerce aimed at strengthening the environment for e-commerce.[11] There are also important provisions covering new aspects relating to intellectual property rights (IPR).

E-commerce commitments

The two governments stated in the joint statement on e-commerce[12] that they recognise the importance of e-commerce as an engine of growth and commit themselves to taking steps domestically to realise the full potential of e-commerce (see sidebar). E-commerce is expected to enhance the standard of living of citizens and create new jobs and opportunities. Small and medium enterprises will also benefit from having access to a worldwide market.

In the chapter on e-commerce within the FTA, the two governments commit that they will not apply customs duties or other duties, fees or charges in relation to the import or export of digital goods by electronic transmission. Where a digital product is imported by some other physical medium, the customs value shall be determined based on the carrier medium, without regard to the value of the digital product. The same treatment shall be given to all digital products irrespective of where the products were created or who the owners of the products are. Scheduled programming content is not included within the scope of digital products.

Intellectual property rights provisions

Of the wide-ranging issues covered in the US–Singapore FTA, one of them is the protection of IPR. The main features of the IPR provisions are outlined in the sidebar. Both countries are expected to give effect to the various IPR obligations under the FTA within time periods ranging from six months to one year from the entry into force of the FTA on 1 January 2004.

Abstract of the US–Singapore Joint Statement on E-Commerce

The two governments endorsed the following principles and policies that will guide the development of e-commerce:

- The private sector should lead in the development of e-commerce and in establishing business practices.
- Both governments should avoid imposing unnecessary regulations or restrictions on e-commerce.
- Governments should encourage effective self-regulation through private sector codes of conduct, model contracts, guidelines and enforcement mechanisms.
- Cooperation among all countries will assist in creating a seamless environment for e-commerce.

The statement also noted that governments should work towards a global approach that supports the recognition and enforcement of electronic transactions and electronic authentication methods (including electronic signatures). It endorses an approach that:

- removes paper-based obstacles to electronic transactions by adopting relevant provisions from the UNCITRAL Model Law on Electronic Commerce
- permits parties to a transaction to determine the appropriate authentication technologies and implementation models for their transactions, with the assurance that those technologies and implementation models will be recognised and enforced
- permits parties to a transaction to have the opportunity to prove in court that their authentication technique and their transaction are valid and
- takes a non-discriminatory approach to electronic signatures and authentication methods from other countries

On e-commerce value chain, the statement noted that the sectors of telecommunications, transportation, customs, electronic payments, delivery and distribution services, and marketing and advertising are essential to e-commerce. The following principles are supported by the two governments:

- Telecommunications reforms ensure the development of more efficient telecommunications services needed to lower the cost of getting online and doing business online.
- Open skies agreements and other liberalised transportation regimes are necessary to make it easier and cheaper to ship goods ordered electronically from one country to another.
- Efficient and effective customs administration facilitates efficient product delivery.
- Overly burdensome marketing and advertising restrictions that place onerous costs on merchants should be avoided.
- Swift, secure, reliable, cost-effective and internationally interoperable electronic payment systems are essential.
- Efficient, liberalised delivery and distribution service regimes are essential.

The statement also covers a number of other wide-ranging areas including the following:

- The two governments will cooperate in the promotion of the APEC Principles on International Charging Arrangements for Internet Services (ICAIS), which endorse commercially negotiated charging arrangements.
- The two governments encourage international cooperation among regulators and law enforcement authorities to deal with illegal activities, including criminal and terrorist activities on the Internet.
- The two governments recognise that e-commerce falls within the scope of WTO rules and commitments. Trade barriers to the free flow of content do not exist today and should not be created in the future. Any taxation of e-commerce transactions for the supply of goods and services should be clear, consistent, neutral and non-discriminatory.
- On electronic payments, private sector leadership should be recognised, and a competitive market for electronic payment should be encouraged.
- On consumer protection, consumers should receive effective protection in the online environment, promoted through the enforcement of consumer protection laws and regulations. There should be industry-supported mechanisms to empower the consumers and resolve consumer complaints and concerns.

Provisions on IPR in the US–Singapore Free Trade Agreement

The two countries commit to entering into and complying with a number of international treaties including the Convention relating to the Distribution of Programme-carrying Signals Transmitted by Satellite (1974), the WIPO Copyright Treaty (1996) and the WIPO Performances and Phonograms Treaty (1996). There are specific commitments governing trademarks (including geographical indications), patents, and copyright and related rights, as well as commitments relating to enforcement issues and limitation of liability of service providers.

In the area of Internet domain names, the two countries commit that their governments will continue to participate in the Government Advisory Committee of ICANN to address government concerns relating to domain names and the country code top-level domain (ccTLD). They also commit to implementing dispute resolution procedures modelled after the ICANN Uniform Domain Name Dispute Resolution Policy (UDRP) within their respective ccTLD to resolve cases of bad-faith registration that violates trademarks.

For copyright, the FTA specifies the mutual obligations that need to be provided with respect to areas such as reproduction right, temporary reproduction, communication to the public, works made available to the public, term of protection, prohibition of the circumvention of effective technological measures, criminalisation of offences, protection of rights management information, and the use of only authorised software by government agencies. Limitations and exceptions may be made for free over-the-air broadcasting and other non-interactive transmissions. There are circumstances under which circumvention of effective technological measures is allowed, such as in non-infringing reverse engineering activities, non-infringing research activities to identify and analyse flaws and vulnerabilities, prevention of access of minors, and non-infringing activities to correct the security of a system.

The FTA includes an article that deals with the protection of encrypted programme-carrying satellite signals and stipulates civil and criminal offences for certain types of activities related to the decoding of such encrypted signals as well as the reception and further distribution of such decoded signals.

The FTA sets down general obligations for the enforcement of IPR in both the civil and criminal jurisdictions. In addition, there are special requirements in relation to border measures relating to the enforcement of IPR.

The FTA provides for limitations on the liabilities of service providers. The two countries are obliged to implement legal incentives for service providers to cooperate with IPR owners to deter the unauthorised storage and transmission of copyrighted materials, as well as to implement limitations in the law on the remedies for service providers in copyright infringement that they do not control occurring over their systems and networks. These limitations are confined to situations such as transmission of content without modification, automatic caching, storage directed by users, and hyperlinks. Service providers will have obligations including implementing a policy to terminate infringers' accounts and accommodating technical measures for copyright protection, as well as adopting a notice and take-down process with respect to infringement. Where a service provider removes or disables materials in good faith, the countries are obliged to provide exemption of liability in their respective laws for any resulting claims.

Regulatory environment

Computer misuse

The Computer Misuse Act[13] was first enacted in 1993, modelled after the UK's Computer Misuse Act 1990. In 1998, it was amended to address new types of attacks (e.g. denial of service) that had evolved with the spread of the Internet. The amended act recognises that some computer systems are critical to the nation (e.g. those for banking and finance, emergency services and public services) and thus harsher punishment will be meted out to offenders who secure unauthorised access to such systems. It also allows for orders for compensation to be made to victims of computer crime. The amendments aim to deter computer criminals with harsher penalties for repeat offenders and to provide police with wider investigative powers, including the power to access encrypted data where authorisation has been obtained from both the Commissioner of Police and the Public Prosecutor.

In 2003, the act was amended again to make provisions in two specific areas. The first is for the Minister of Home Affairs to be able to authorise a person or an organisation to take steps necessary to prevent or to counter a threat to national security, essential services, defence, or foreign relations of Singapore, where there are reasonable grounds to believe that such a threat exists, before the offence is committed. The provision also grants added protection for the informants of such threats. The second area is for certain offences under the act to be compounded, thus allowing the police greater flexibility in taking action in incidents of minor offences.

The act, since its enactment in 1993, has been extra-territorial in nature – that is, it applies to any person, regardless of nationality or citizenship, both outside and within Singapore. In particular, it will apply if the computer, program or data relating to an offence is in Singapore. The act does not require every computer crime to be reported. However, the Monetary Authority of Singapore has required that all incidents involving financial institutions to be reported to it.

Domain name registration

The Singapore Network Information Centre (SGNIC, *http://www.nic.net.sg*) implemented a Registry–Registrar (SgR2R) System with effect from January 2003. The system allows multiple registrars that are accredited by SGNIC to register domain names under the country domain ".sg". SGNIC continues to maintain the ".sg" database and sets the broad policies for domain name registration. However, it stopped performing its registrar function from January 2003, and five accredited registrars took over that role. SGNIC does not limit the number of accredited registrars. The first five accredited registrars are Adicio Pte Ltd, Pacific Internet, WebVisions Pte Ltd, IP Mirror Pte Ltd and SingNet Pte Ltd. With more competition in domain name registration, SGNIC expects a wider range of services in support of registration to become available over time. An applicant for accreditation as a registrar needs to demonstrate its business, technical and organisational capabilities, as well as furnish a performance bond. The accredited registrars are free to levy their own fees to end-users for registering and maintaining domain names under ".sg".

Accredited registrars are expected to follow a code of practice, including operating in good faith, promoting the confidence of registrants and other users, maintaining fair and open competition, advancing the reputation of the domain name industry, and upholding the integrity and image of the national registry. The registrars are not to register domain names on their own behalf for the purpose of preventing legitimate domain name registration. They are also to register or renew a domain name only at the request of a domain name registrant, and not in advance of such a request for the purpose of preventing a competitor from registering the name or for the purpose of offering the name to the registrant at a later time. Registrations are submitted through an online application, and domain names are registered on a first-come first-served basis. Even if a registrar has approved a registration, SGNIC reserves the right to reject or refuse a selected name if it is the full or abbreviated name of government agencies or if it gives rise to a misconception about racial and religious harmony or other social issues. Disputes over domain names may be dealt with through the Singapore Domain Name Dispute Resolution Policy (SDRP).

Consumer protection

A new Consumer Protection (Fair Trading) Act came into force on 1 March 2004. This act, in general, does not apply to transactions between businesses but focuses on transactions between businesses and consumers (i.e. individuals procuring for personal use). It covers all goods and services that are provided to consumers, whether they are paid for or are supplied under a gift, lease, contest or other arrangement. However, there are specific transactions that are excluded from the application of the act: the sale and purchase of real estate, employment contracts, and transactions regulated by acts under the purview of the Monetary Authority of Singapore (e.g. Banking Act, Commodities Trading Act). The act defines the principles of what constitutes an unfair practice and specifically names certain activities as being unfair practices, including some promotional tactics.

Unfair trading, however, does not constitute a criminal act. Instead, consumers who have been the subject of such practices may pursue a legal action in court for monetary or other forms of compensation or relief. There is no enforcement body established under the act, although the Consumer Association of Singapore and the Singapore Tourism Board have charge over the act. Consumers must bring their own legal action to seek remedies. A S$20,000 financial limit and a one-year time limit are imposed by the act.

There is a special provision for a direct sales contract that arises from an unsolicited visit by a supplier to a consumer to make a sale. For such contracts, the consumer has the right to cancel the contract within three days after the day of the transaction. However, the supplier has no duty to inform the consumer of his or her right of cancellation, although there are incentives for the supplier to do so.

Open source movement

Industry

In November 2003, the second Asia Open Source Software Symposium was held in Singapore.[14] It was hosted by the Singapore Linux User Group together with Japan's Center of the International Cooperation for Computerization, with the objectives of building a cooperative community and promoting collaborative developmental activities among participating economies. The symposium was first held in March 2003 in Phuket, Thailand, in recognition of the fact that there was a need for direction to be set in relation to the open source movement, which was not well coordinated thus far.

The meeting in Singapore attracted speakers and attendees from numerous countries in the region. The speakers each covered open source development in their respective countries. Participants came from government organisations and IT policy-making bodies, officially funded

R&D groups, businesses and industry players using open source, academia, and institutions involved in human resource development and supporting community groups. There were two sessions for discussing open source legal issues and e-learning.

Government

IDA, as the agency responsible for monitoring the development of open source, has provided within its government bulk procurement system alternatives of both open source and commercial software for back-end systems. Purchase decisions are made by the individual agencies according to their specific needs and requirements. The agencies will consider and compare the overall system cost of the various alternatives and pick the system that offers the best value for money. Other factors such as maintenance costs, support costs, in-house capability, and interoperability with existing systems and applications are also taken into consideration. Government servers are presently using a mixture of open source and commercial software solutions.

For desktop systems, IDA has assessed the suitability of using open source solutions for office productivity suites and desktop operating systems. It is presently not ready to recommend open source for office productivity suites, as the savings in licence fees need to be balanced against other cost factors, including support costs, interoperability and retraining. The issue of interoperability is of particular concern, as documents have to be exchanged both within the government and with organisations outside the government. The government also presently benefits from lower licence fees on bulk licensing arrangements with commercial software vendors.

In relation to open source solutions for desktop operating systems, views and sentiments on their use are still divided. Indications so far are that open source solutions are more readily used and accepted by sophisticated IT users. With time, usability and support concerns for open source are expected to be resolved. IDA will continue to monitor the ongoing development and will review the stand, if necessary, in future based on the principle of getting value for money for the government as a whole.[15]

Research and development

In 2003, 20.0 percent of ICT companies invested in R&D. Software products commanded the largest share of R&D expenditure (65.8 percent), followed by hardware products (32.8 percent). The other products and services commanded less than 2 percent of R&D expenditure.[16]

Some notable developments in R&D include the opening of a S$30 million R&D laboratory in Singapore by Hewlett-Packard (HP).[17] HP's existing plant in Singapore is its global manufacturing centre for a range of networking products. The new facility will bring its R&D capabilities in networking hardware, such as high-speed digital and analogue circuits, to Singapore. The intention is for greater knowledge transfer with the production site and to improve the design process and manufacturing efficiency.

Another significant development is the launch of the National Grid Pilot Platform (NGPP). The purpose of the NGPP is to create a national infrastructure to link up computing resources in Singapore so that they can be shared through a secure, reliable and efficient network for a variety of purposes, including education, commerce, entertainment and R&D.

The NGPP is co-funded by the Agency for Science, Technology and Research, the Defence Science and Technology Agency, the Economic Development Board, the National University of Singapore, Nanyang Technological University, the Singapore–MIT Alliance, and IDA. The participating research institutes have committed to sharing their computing resources on the NGPP.

The NGPP has also received strong support from ICT vendors, such as Cisco, StarHub, Singapore Computer Systems, Dell, IBM, HP, and Sun Microsystems, who have each contributed equipment and services to the initiative.

Trends

IDA has identified key technological trends and developments in conjunction with the local industry, which were presented in its fourth Infocomm Technology Roadmap and unveiled at a public seminar in November 2002.[18] The key trends identified are as follows:

- *The "new" megabit broadband for better two-way communication:* It is expected that broadband via ADSL and cable modem will replace dial-up as the dominant means of Internet access by 2007. It is also expected that the Internet upload speed will match the download speed.
- *The connected home for a connected lifestyle:* The convergence of technologies involving information, communications and entertainment will see appliances and devices around the house being brought together, connected and operated over an integrated IP-based network. A variety of digitised information will be available on PCs, home entertainment systems, media servers and game consoles.
- *Mobile wireless going broadband to offer new ubiquitous services:* By 2007, 3G networks will be in place with the computing capabilities of mobile devices improved significantly. The concept of "anytime, anywhere, any device" will become a reality by then. Mobile services will evolve into rich multi-party multimedia and instant communications, and corporations will bring mobile solutions to their workforce. Multimedia broadcasts and multicasts will feature in e-learning, seminars, and corporate marketing and advertising.

- *Security technologies that facilitate e-commerce:* With greater demand for security solutions, more standards-based end-to-end security frameworks will emerge to meet business and consumer needs in dealing and transacting in the networked environment.

During the IX2003 Conference in September 2003, the Minister for Information, Communications and the Arts noted that the Asian economy, while fast growing at one stage, had undergone a very difficult period of crisis after crisis that affected the ICT sector adversely. Notwithstanding this setback, the prospects ahead appear positive. History has indicated how key strategic initiatives in IT over the years have helped to put in place the foundation for the present conducive business environment. Even in relation to the SARS outbreak, technology demonstrated its power and utility in the management of a public crisis by enabling the mass scanning of the body temperatures of arriving and departing passengers at the airport.

The minister also encouraged companies to exploit ICT to build their relationships with suppliers and customers to bring about greater efficiency all round. IDA is expected to play the important role of identifying business problems that can be addressed via technological solutions and finding ways for ICT to be used in enhancing the country's competitiveness and economic growth.

During the World Summit on the Information Society in December 2003, the minister further noted that Singapore still faced challenges ahead, although it had made progress towards the vision of an information society. There continues to be a need to deal with the enhancement of access to multilingual content, to address digital divide issues to ensure the young and the elderly have meaningful access to ICT, to enable broadband access for more people, to sharpen the IT skills of the workforce, to keep workers updated with technological developments, and to effectively manage competition in the ICT industry. ICT will bring greater benefits to society as citizens become more active participants.

With the challenges ahead, it is the author's belief that the role of IDA will be critical to Singapore's ability to realise the above objectives. IDA will need to critically assess and examine its role and its capability. For instance, with respect to policy development, IDA needs to look beyond the regulation of the telecommunications industry at the greater policy needs of the ICT market operating on top of the telecommunications infrastructure.

At the same time, the Singapore ICT industry needs to play a greater leadership role in industry and technology development, complemented by the policies instituted by IDA to cultivate this mindset. The industry needs to emerge from under the "wing" of the government and be prepared and willing to take on its own risks in development and trials, with or without government support. A vibrant and creative ICT industry, together with a world-class e-government and an increasingly ICT-sophisticated citizenry, will contribute significantly towards the sustained growth of the Singapore economy.

Notes

1. Statistics Singapore (2004), Key Stats – Annual Statistics, *http://www.singstat.gov.sg/keystats/annual/indicators.html*.
2. IDA (2004), Annual Survey on Infocomm Usage in Households and by Individuals for 2003, *http://www.ida.gov.sg/idaweb/doc/download/I2908/Annual_Survey_on_Infocomm_Usage_in_Households_and_by_Individuals_for_2003.pdf*.
3. The investment data given in this section came from *http://www.singstat.gov.sg/keystats/surveys/fei.pdf* and *http://www.singstat.gov.sg/keystats/surveys/investment.pdf*.
4. IDA (2003), Annual Report 2002/2003, *http://www.ida.gov.sg/idaweb/doc/download/I222/IDA_AR2003.pdf*.
5. IDA (2003), Wireless page, *http://www.ida.gov.sg/idaweb/wireless/index.jsp*.
6. IDA (2004), Annual Survey on Infocomm Industry for 2003, *http://www.ida.gov.sg/idaweb/doc/download/I3073/InfocommIndustry2003Summaryv2.doc* and *http://www.ida.gov.sg/idaweb/doc/download/I3073/Key_findings_from_Infocomm_Industry_Survey_2003.pdf*.
7. IDA (2004), List of IDA Licensees, *http://www2.ida.gov.sg/license/licensees.nsf/licenseview?openview*.
8. IDA (2003), Connected Singapore, *http://www.ida.gov.sg/idaweb/marketing/infopage.jsp?infopagecategory=&infopageid=I2227&versionid=1*.
9. MDA (2003), Media 21: Transforming Singapore into a Global Media City, *http://www.mda.gov.sg/MDA/documents/media21.pdf*.
10. The full text of the FTA can be found at *http://www.mti.gov.sg/public/PDF/CMT/FTA_USSFTA_Agreement_Final.pdf*.
11. IDA (2003), US and Singapore Sign Joint Statement on Electronic Commerce, *http://www.ida.gov.sg/idaweb/media/infopage.jsp?infopagecategory=ebusiness.mr:media&versionid=7&infopageid=I2257*.
12. The full text of the joint statement can be found at *http://www.ida.gov.sg/idaweb/doc/download/I2257/US_E-Commerce_Joint_Statement_(Website_Version).pdf*.
13. The full text of Singapore's statutes can be found at *http://statutes.agc.gov.sg*.
14. *http://www.asia-oss.org/nov2003*.
15. Cut Waste Suggestions and Replies website (2003), Saving Cost in Software Licensing, *http://app.mof.gov.sg/cutwaste/suggestionview.asp?id=124*.
16. See note 6.
17. Internetnews.com (2003), HP Opens $30M R&D Lab in Singapore, *http://www.internetnews.com/infra/article.php/2243111*.
18. IDA (2002), ITR-4 page, *http://www.ida.gov.sg/idaweb/marketing/infopage.jsp?infopagecategory=factsheet:marketing&versionid=1&infopageid=I1926*.