

.th

Thailand

Thaweesak Koanantakool, Kalaya Udomvitid,
and Chadamas Thuvasethakul

Total population	63.04 million (December 2006) ^a
Literacy rate	98.1% (December 2005) ^a (male = 98.2%; female = 97.9%)
GDP per capita (PPP)	USD 9,331 (2007) ^b
Computers per 100 inhabitants	26.8 (2007) ^c
Fixed-line telephones per 100 inhabitants	11.7 ^d
Mobile phone subscribers per 100 inhabitants	78.86 (June 2007) ^e
Internet users per 100 inhabitants	20.85 (June 2007) ^f
Domain names registered under .th	35,082 (March 2008) ^g
Broadband subscribers per 100 inhabitants	2.59 ^d
Internet domestic bandwidth	162.93 Gbps (April 2008) ^d
Internet international bandwidth	26.33 Gbps (April 2008) ^d

(Sources: ^aNational Statistic Office 2005; ^bWorld Bank 2008; ^cThailand National Statistical Office 2007; ^dNECTEC 2007, 2008; ^eOffice of the National Economic and Social Development Board 2007; ^fKoanantakool 2007)

INTRODUCTION

Thailand's main industries are electronics, automobile manufacturing, and agro-industry. Thailand is also the world's largest producer and exporter of rice. The Thai government recognizes that information and communication technology (ICT) has an important role to play in the enhancement of economic productivity, as well as in the transformation of Thai society into a knowledge-based society. Thus, ICT, telecommunications, broadcasting, and innovation issues are well addressed in the Constitution of Thailand (2007). Furthermore, the Computer-Related Crime Act was enacted in 2007 to make the Internet safer and more secure for every citizen. In addition, Thailand's second ICT Master Plan (for 2009–2013) is currently being drafted.

However, there are a number of challenges with respect to ICT development in Thailand, namely, the establishment of a fair and competent regulatory body for telecommunications and broadcasting, bridging the digital divide, and building confidence in e-commerce.

TECHNOLOGY INFRASTRUCTURE

Rapid developments in broadband services and mobile phone usage are driving the development of technology infrastructure in Thailand. More specifically, progress is being made in Internet Protocol version 6 (IPv6), grid computing, broadband wireless, computer security, and Web 2.0 and Web services, while trials are being conducted for the shift to third generation (3G) mobile services, Worldwide Interoperability for Microwave Access (WiMAX), and digital broadcasting.

The Ministry of Information and Communication Technology (MICT) announced in 2007 the Thailand IPv6 Development Plan (www.thailandipv6.net), which aims to make the next-generation Internet Protocol (IP) available in Thailand by 2010. IPv6, which extends IP addresses from 32 bits to 128 bits, is expected to solve the shortage of Internet address space currently associated with the 20-year-old Internet Protocol version 4 (IPv4). Although the transition from IPv4 to IPv6 is planned to take place within the next two years, Internet users in Thailand can now join the experimental IPv6 network test bed (www.ipv6.nectec.or.th/testbed.php) started in 2003 by the National Electronics and Computer Technology Center (NECTEC), Communication Authority of Thailand (CAT), and Telephone Organisation of Thailand (TOT). By September 2007, five domestic peering nodes and 35 international peers had joined the test bed project. Moreover, to introduce IPv6 to the public, NECTEC has developed the IPv6 Tunnel Broker that allows Internet users to experience IPv6 on their existing IPv4 networks.

Thai telecommunication operators are also planning the introduction of broadband wireless services such as 3G, WiMAX, and High Speed Packet Access (HSPA). As of January 2008, the National Telecommunication Commission (NTC) had granted licences to 12 operators¹ to conduct commercial, six-month trials of broadband wireless access services. Operators will run WiMAX trials on two frequency bands of 2.3 GHz and 2.5 GHz. In April 2008, all mobile phone operators and the MICT jointly declared their readiness to cooperate in testing HSPA and other 3G services.

KEY INSTITUTIONS AND ORGANIZATIONS DEALING WITH ICT

There are several key organizations dealing with ICTs in Thailand. The MICT coordinates all ICT development according to the ICT Master Plan and the IT 2010 Policy Framework. The Software Industry Promotion Agency (SIPA) is an arm of MICT. The NTC is the telecommunications regulator. The National Electronics and Computer Technology Center (NECTEC) is a research institution for ICT development.

The SIPA (www.sipa.org) is a public organization that promotes the Thai software industry by rapid skills enhancement for software developers, expanding employment opportunities in the industry, and stimulating growth of the domestic and international markets. The SIPA's development guidelines (2005–2009) aim to sharpen Thailand's competitive edge in software outsourcing, particularly for enterprise software, animation and multimedia, mobile applications, and embedded software. The organization's main focus is building a pool of experts and qualified companies to drive the development of the industry. The SIPA also supports key activities to promote the industry, namely: the annual ICT market survey, ICT awards, and open source software development and usage. Recently, the SIPA proposed a tax incentive scheme to promote software businesses to the government. The scheme is under review by the Board of Investment (BOI).

As an independent regulator, the NTC (www.ntc.go.th) is a special body that reports directly to the upper house of the Parliament. It sets categories of telecommunication services, manages the use of the spectrum for telecommunication services, and grants licences to telecommunication operators. In 2006 the NTC established three new institutes: the Telecommunications Research and Industrial Development Institute (TRIDI), the Telecommunication Consumer Protection Institute (TCPI), and the Interconnection Institute (ICI). TRIDI's mission is to promote the development of the telecommunication industry, including local hardware, software, applications, and content. TRIDI collaborates with universities around the country to promote them to become research and development (R&D) centres in telecommunications. R&D centres are given research funds for students who are doing their master and doctoral degrees and for faculty and project leaders conducting R&D related to telecom technology. The TCPI focuses on consumer protection enforcement. It collaborates with independent consumer organizations to create a consumer protection network and to revise existing regulations to better serve telecom consumers. The ICI's main role is to coordinate with the regulator's Interconnection Settlement Panel to handle disputes between and among telecom operators.

NECTEC (www.nectec.or.th) is a statutory government organization under the National Science and Technology Development Agency (NSTDA), Ministry of Science and Technology. Its main responsibilities are to undertake, support, and promote the development of software, microchip, and electronics clusters through R&D activities. NECTEC has taken a leading role in exploring new opportunities in ICT and it has provided ICT infrastructure to the country since the beginning of the 1990s. NECTEC's work includes SchoolNet Thailand, the Government Information Network, the Thai Computer Emergency Response Team (ThaiCERT), the Software Park, IPv6, Open Source Software, RFID, and IT laws (in cooperation with MICT). More recently, NECTEC has worked on the Annual ICT Market Survey (in cooperation with SIPA and Software Park Thailand), online real-time traffic report system, experiments using Wireless Fidelity (WiFi) and WiMAX for rural broadband services (in cooperation with NTC and TOT), development of a high-capacity e-learning system, and coordination with many other ministries with respect to data warehouses, training, and IT standardization (in cooperation with the Thai Industrial Standards Institute or TISI).

ICT AND ICT-RELATED INDUSTRIES

In 2007 the total value of the Thai ICT industry was about THB 538 billion (about USD 15.96 million³), representing a 9 percent growth from 2006. The rapid growth of the ICT industry has contributed to enhanced productivity in both business and government sectors. The ICT-related industry (electronics and parts), in particular the hard disc drive sector, is also a big contributor to the Gross Domestic Product (GDP).

The ICT market in 2007 was dominated by communication equipment and services (THB 391,218 million, or 72.7 percent). ICT spending on computer hardware, computer software, and computer services amounted to THB 68,719 (12.8 percent of the total ICT market), THB 57,178 (10.6 percent) and THB 20,703 million (3.8 percent), respectively. The ICT market in 2008 is expected to grow 13.1 percent from the previous year (Pornwasin 2008) and predicted to reach THB 608.5 billion. The largest growth is expected in computer services at 26.9 percent, followed by computer software at 17.6 percent. The hardware market is projected to grow 6.8 percent and communication services 12.9 percent. Enterprises spent more than twice what government did on ICT in 2007.

In 2007, growth in the computer services sector was 17 percent, higher than the 9.8 percent and 14.2 percent growth of the hardware and software sectors, respectively. Market growth in 2008 is expected to be driven more by government spending on continued investments in infrastructure development projects.

In the communication industry, the mobile handset market in 2008 is still growing (by value), but at a slower rate than in previous years. Low-cost mobile handsets will be the main driver of mobile handset growth (9.8 percent) and service growth (12.4 percent). The data communication service sector is anticipated to be the highest growth area for 2008 at about 20.9 percent.

Thailand has been the world’s largest exporter of hard disc drive (HDD) and supplied parts since 2005, with more than 40 percent share of the world market. The HDD export value was THB 532,955 million in 2006, a 35.25 percent increase from 2005. In 2003, the Thai government, through the BOI, launched an investment promotion policy called the STI (skill, technology, and innovation) program. STI gives longer tax breaks to investors who invest in or support R&D or skilled-worker training in high-technology industries located in Thailand. The policy became much more aggressive in 2004 when the NSTDA established the Hard Disc Drive Institute (HDDI) to support human resource development for the industry (Brimble 2003; Sutharoj 2008).

With support from the HDDI/NSTDA, the top brands in the HDD industry are expanding their production facilities and adopting more advanced manufacturing processes. This trend will become stronger as more engineers complete their training in the government-funded capacity-building program (details in the section on ‘Capacity-building’).

The Thai animation and games industry had an average annual growth rate of 50 percent in 2004–2006, with a value of THB 10.2 billion in 2006 (SIPA 2007). Of this, 4.5 billion came from the animation industry and the remaining 5.7 billion came from the game industry. However, although its market value is high, the Thai game industry accounts for only 0.6 percent of the world’s game market. The SIPA survey also found that more than 90 percent of the value of the industry came from imported game software.

Recognizing its potential, the SIPA has identified digital content as one of the key industries to develop and promote. The SIPA is targeting revenues of THB 30 billion from digital content by 2010. Since 2004 SIPA has been organizing an annual event called Thailand Animation and Multimedia (TAM), to serve as an arena for industry players to exchange knowledge, to learn new knowledge and technologies, to establish connections, and to explore business and partnership opportunities. It is also an event for young amateurs, professional animators, and graphic designers to showcase their latest work. In 2007, the SIPA opened the Bangkok Digital Content Centre as a facility where animation and game developers can use development tools, such as motion capture, to develop their products (Sambandaraksa 2007; Solomon 2008).

As the Thai government has positioned the country to be a ‘Healthcare-Hub’,³ many hospitals have improved their services by using ICT to support their operations. Through its IT subsidiary company, Global Care Solutions (GCS), Bumrungrad Hospital has become a leading user of ICT in medical services. In October 2007 Microsoft acquired the GCS system, which is now being used by seven hospitals in Asia Pacific (Microsoft 2007). The acquisition expands Microsoft’s portfolio in the healthcare industry while giving the privately owned Thai IT provider access to worldwide markets.

KEY ICT POLICIES, THRUSTS, AND PROGRAMS

Although many ICT indicators, such as number of Internet users and international Internet bandwidth, point to a considerable increase in the utilization of ICT in Thailand, the digital divide between the Bangkok metropolitan areas and the rest of the country remains significant, as suggested by household computer ownership data and Internet user profile statistics. To bridge the digital divide and enable the shift to a knowledge-based economy, Thailand’s national ICT policy focuses on infrastructure and knowledge building (Koanantakool 2006; National Information Technology Committee 2002; Thuvasethakul and Koanantakool 2002).

Since 2002 ICT development in Thailand has been guided by the first ICT Master Plan (2002–2006) that is part of the policy framework called IT 2010. This framework emphasizes five flagship applications: e-industry, e-commerce, e-government, e-education, and e-society. NECTEC and the MICT have been assigned to complete the second ICT Master Plan for the period 2009–2013, and to prepare ICT 2020, the national ICT policy framework for the next decade.

As a member of the World Trade Organization (WTO), Thailand committed to free and open competition in the telecommunications sector by 2006. In this connection, the government has formulated the Telecommunications Business Master Plan (for 2005–2007) that provides guidelines for (Tilleke and Gibbins n.d.):

- Regulating and supervising the telecoms market to increase competition through liberalization;
- Management of telecommunications resources;
- Impartial expansion of telecommunications services nationwide;
- Supporting and developing the telecommunications industry, including the use of telecommunications to support education, religion, culture and security among others; and

- Preparing the use of telecommunications during emergencies/ crises.

The first Telecommunication Master Plan was extended to March 2008, after which the second master plan took over. Compared with the first plan, the new Master Plan is less restrictive in approach, emphasizes the public interest more, and more clearly spells out the development time frame. For example, the licensing framework for 3G is to be completed in 2008 and the frequency allocation framework in 2009.

LEGAL AND REGULATORY ENVIRONMENT FOR ICT DEVELOPMENT

Two major laws were enacted in Thailand in 2007 — the Constitution of the Kingdom of Thailand, which has a section addressing the regulatory regime for the telecommunication and broadcasting business, and the Computer-Related Crime Act, which intends to make the Internet safer and more secure for every citizen. In early 2008 the revised version (second edition) of the Electronic Transactions Act of 2001 was also enacted. With these laws in place, the volume of electronic transactions, with a market value of approximately THB 305,159 million in 2006, is expected to increase.

The new Constitution of Thailand, B.E. 2550 (A.D. 2007) addresses technology convergence by mandating the merger of two regulatory bodies into one organization with the power to regulate both telecommunication and broadcasting. Specifically, the new Constitution requires the newly elected members of Parliament to establish a new agency in charge of radio frequency spectrum management and supervision over the operation of broadcasting and telecommunications businesses within 180 days from the time the Constitution took effect.

The Computer-Related Crime Act has been in effect since July 2007. This long-awaited law was drafted in 2004 and has gone through a series of revisions. It is expected to create a safe environment for Internet users in Thailand through the definition of computer offenses, empowerment of law enforcement officers to deal with computer crimes and crimes committed via a computer or the Internet, and definition of duties of service providers. The law lists the following as offences: unlawful access to computers or network resources, unauthorized interception of email or data transmission, sniffing, spamming, hacking, and disseminating false or pornographic content. There are additional penalties for offenses that may cause damage to national security, the economy, and society at large.

Law enforcement agencies are expected to be more effective in dealing with cybercrimes as competent officers now have

authority to search for and seize electronic evidence, under supervision of the courts. They are also empowered to stop service providers from disseminating offensive content. The minister of ICT is responsible for the enforcement of this law, as well as issuing orders and appointing competent officers. To preserve evidence, the law requires service providers (e.g. Internet Service Providers — ISPs — or telecom companies) to keep a record of traffic data for at least 90 days.⁴

The e-Transaction Act of 2001 encouraged businesses and government agencies to adopt electronic transactions to improve efficiency. But increasing demands for use of electronic documents called attention to gaps in existing laws, such as the need to define the electronic equivalent of the duty stamps required under business laws. In 2006, the office of the prime minister and NECTEC conducted a study that resulted in recommendations to revise the e-Transaction Act to fill in the gaps. The revised law, enacted in February 2008, allows for the use of electronic documents and print-outs as court evidence. It also changed the secretariat of the e-Transaction Commission from NECTEC to a unit under the MICT.

The e-Transaction Act also requires the issuance of several Royal Decrees. The Royal Decree on e-government transactions has been in effect since January 2007. It specifies that government agencies must have a security policy and a privacy policy before they operate e-services. Two additional Royal Decrees relating to the supervision and governance of Certification Authorities (CAs) and e-payment service providers have been endorsed by the Cabinet and are now under review by the Council of State. Once these decrees are enacted and with appropriate enforcement mechanisms in place, trust and confidence in the use of e-transactions will be enhanced considerably.

DIGITAL CONTENT

Local language websites and other forms of media (e.g. Compact Disc-Read Only Memory — CD-ROM — or e-books) are being developed to give Thai people more access to all kinds of practical information, such as information about jobs, the traffic situation, weather forecasts, news, shopping, language training, e-learning, and social networking. In addition, local language platforms facilitate knowledge-sharing and participation in e-society.

Information and knowledge exchange channels like e-groups, blogs, wikis, and YouTube are now widely used. Weblogs or blogs have grown more popular over the past few years, with Thai users now numbering in the thousands. The top blog sites are exteen.com, BlogGang by pantip.com, storythai, GotoKnow.org, and oknation.net by the Nation Multimedia Group.

Wikipedia in Thai (th.wikipedia.org) started in December 2003. As of April 2008 there were 35,150 Thai Wikipedia articles, 42,717 registered users, 18 editors, and about 150,000 visitors per day. Truehits.net ranks Thai Wikipedia as the 31st most popular website in Thailand.

In 2007 the Ministry of Science and Technology launched an online ‘smart’ traffic report that allows drivers to determine road-traffic conditions from coloured scalable maps on mobile phones equipped with General Packet Radio Service (GPRS) and Java. The program for mobile phones can be downloaded for free from <http://traffic.thai.net>. Users can also get information on the traffic condition of any road in Bangkok by SMS or instant messaging (e.g. MSN). The project is part of the NECTEC’s Intelligent Transport System (ITS) program in collaboration with the Office of Transport and Traffic Policy and Planning and the Bangkok Metropolitan Authority.

The Digital Accessible Information System (DAISY) is a World Wide Web Consortium (W3C) data format standard for talking books. More specifically, the DAISY format is a mark-up language that allows users to get information from mp3 compact discs (CDs) by direct access to chapters, pages, paragraphs, and lines. Talking books in the DAISY format give visually challenged people better access to books than does Braille printing. The project, which is supported by Princess Maha Chakri Sirindhorn, has produced more than 100 book titles and distributed these to libraries/schools for the blind in various parts of Thailand. A recent addition by NECTEC is the audio version of the Thai Junior Encyclopedia initiated by His Majesty the King in 1963.

ONLINE SERVICES

A breakthrough in the e-payment system in Thailand is the launch of the Interbank Transaction Management and Exchange (ITMX) service. The Revenue Department has also successfully introduced a tax filing service via the Internet, or e-Revenue. However, not all government e-services have been as successful because many government websites are still underutilized.

As part of the Bank of Thailand’s (BOT’s) Payment 2004 Policy, a national funds transfer hub was established in 2005 to serve electronic funds transfer across commercial banks (Thai Law Forum 2005; *The Nation* 2005). Now money transfers between accounts can be made across banks using the Internet and mobile phones.⁵ The ITMX service was initiated by the BOT (www.bot.or.th) and is operated by the Banking Association of Thailand. The BOT is drafting a law to facilitate use of the ITMX service.

The Revenue Department launched income tax return filing through the Internet in 2001. Both corporate and personal taxpayers found the system convenient. Payments are made

through e-banking. Recently, the Revenue Department added tax payment services through mobile phones. For example, short message service (SMS) is used to inform taxpayers who submit tax returns online about tax refund details and individual tax information. As an incentive, online taxpayers are able to access tax refunds within three days (Sirisaengtaksin 2007).

Since June 2007, the Revenue Department has made its website (www.rd.go.th) accessible to everyone, including persons with disabilities, by following Web Content Accessibility Guideline 1.0 of the Web Accessibility Initiative (WAI) of the W3C. The initiative has been implemented on the Thai language version of Web pages on ‘Tax Knowledge’, ‘The Revenue Code’, and general information ‘About the Revenue Department’. The Department aims to make all such information accessible to everyone in the near future (see ‘Thailand’s Ranking in the 2008 UN e-Government Survey’).

ICT-RELATED EDUCATION AND CAPACITY-BUILDING PROGRAMS

In Thailand, using ICT in education and capacity-building programs on a large scale has been plagued by many problems, particularly the lack of focus on students. Most procurement projects are marred by delays and conflicts of interest, and poor content and learning strategies. However, there are attempts to overcome these problems, such as the One Laptop per Child (OLPC) and the e-learning via Distance Learning Television (e-DLTV) projects.

The Thai OLPC team includes NECTEC, Suksapattana Foundation, teachers from Darun Sikhalai School, volunteers from the Prince Royal School, and the Department of Informal Education. A group of engineers and educators participated in the development of Thai language interface on the XO machine⁶ in September 2006. OLPC field trials took place at Bansamkha village school in Lampang in May 2007. Two more schools in Nakhonnayok joined the trial programs in October. With the support of the Ministry of Education and NECTEC, about 170 XO laptops have been deployed in experiments in two provinces.

Having a personal laptop allows the children involved in the trials to access the Internet through the wireless network. Their teachers are encouraged to assign self-learning tasks to the children while their parents are learning with them through music, writing, drawing, and taking photographs.

In the e-DLTV project, schools in the rural areas of Thailand are being equipped with satellite TV receivers to utilize 14 simultaneous live broadcasts from the classrooms of Klai Kangwon School in Hua Hin. The project addresses the lack of teachers in remote areas (see ‘e-Learning for Distance Learning TV Library for Every School in Thailand’).

Thailand's Ranking in the 2008 UN e-Government Survey

Thailand ranked 64th out of 182 countries in the 2008 e-Government Readiness Index of the UN. In 2005, Thailand ranked higher at 46th.

Focusing on 'connected e-Governance', the UN Survey combined 'government' and 'governance' in the use of IT for public sector transformation. Thus the scores account not only for back-office and front-office processes, but also for the whole-of-government value of services that come from connected government. The e-Government Readiness Index is calculated from four sub-indices — the Web Measure Index, Telecommunication Infrastructure Index, Human Capital Index, and e-Participation Index. The Web Measure Index provides UN Member States with a comparative ranking on their ability to deliver online services to their citizens. There are five stages in the Web Measure Index:

- Stage 1 — Emerging: showing Web pages and links to ministries; most pages are static and no interaction
- Stage 2 — Enhanced: showing more information, well-organized and easy to find
- Stage 3 — Interactive: downloadable forms, providing more convenience to citizens
- Stage 4 — Transactional: two-way interactions between citizens and government, option to pay tax and apply for licences online
- Stage 5 — Connected: government agencies are themselves connected and provide seamless, one-window service

Thailand ranked 50th in the Web Measure Index. The poorest score for Thailand was on the e-Participation index, at rank 62nd, well below Vietnam (18th) and Bhutan (19th). The ranking provides a good opportunity for government CIOs to reflect on how to improve the national performance.

(Source: UN 2008)

To maintain Thailand's position as the number one world exporter of hard disk drives, the Thai government has adopted a Skill, Technology and Innovation incentive package for the industry. Specifically, in August 2004 the NSTDA set up the HDDI, which offers partial financial support for seven HDD-cluster development projects. One of the projects is a training program for engineers and technicians to upgrade the technology capability of Thai-based HDD manufacturers and suppliers, especially in advanced automation engineering. The training program also aims to build the critical mass of engineers in the precision electronics industry and related industries to cope with the big shift to automation. As of the end of 2006, 2,354 engineers had participated in the training program.

A strategic roadmap for the HDD industry, which covers four issues (technology, human resource, supply chain, and policy), has also been developed, and the Cabinet approved in June 2007 a five-year budget of THB 1,360 million for HDDI/NSTDA to implement the strategic roadmap. The budget is expected to expedite and strengthen technological capability in the electrical and electronic industry, particularly the HDD cluster, through R&D and human resource development. HDDI in turn funds collaborative research between universities and industry in four main areas: automation, electrostatic discharge contamination, materials, and HDD applications. The success of this capacity-building project can be gauged from increased foreign investment by HDD assemblers and the increase in the

number of locally based HDD suppliers. BOI statistics indicate that from January 2007 to August 2008, HDD investment in Thailand was approximately THB 60,000 million (USD 1,780 million). The number of HDD and related suppliers (e.g. head gimbal, slider, spindle motor, etc.) had increased from 63 to 70 companies.

OPEN SOURCE/OPEN CONTENT INITIATIVES

The open source movement in Thailand has gone into the mainstream with the regularly held Asia Open Source Software forum and the establishment of the Open Source Software Association. The SIPA and NECTEC support open source developments. Thailand recently launched an open source project, called OpenCARE, aiming to link different information systems for disaster relief coordination. Another important open content initiative is the Thai Telecommunications Encyclopedia.

The OpenCARE (<http://opencare.org>) initiative came about from the Thai experience of the Tsunami disaster in December 2004. OpenCARE stands for The Open Exchange for Collaborative Activities in Response to Emergencies. Basically, this open source project is an information exchange platform that facilitates information sharing and coordination among relief organizations. It is based on XML (Extensive Markup Language), which allows information sharing by accepting input

e-Learning for Distance Learning TV Library for Every School in Thailand

In December 1995, in honor of His Majesty the King's Golden Jubilee, the Distance Learning Foundation and the Ministry of Education of Thailand launched an educational television through satellite broadcast program called Distance Learning Television (DLTV). Satellite receivers were donated to 3,000 schools each year to implement the distance learning concept and thereby address Thailand's problem of chronic shortage of teachers in the rural areas. The target: 30,000 schools in 10 years.

In 2000, the broadcasting system was modernized and the feeds increased to 14 channels serving 24 hours a day. The complete curriculum for secondary schools was broadcast daily all over Thailand and even to neighbouring countries. Evenings and weekend time slots were allocated to broadcasts for learners of foreign languages such as English, French, German, Japanese, and Chinese.

In 2003, the Telecommunications Association of Thailand got together with a group of companies to set up video servers to stream all of the 14 DLTV channels live on the Internet. All of the previously broadcast programs are online at www.dlf.ac.th. The Internet channel is becoming popular.

In 2007, NECTEC developed an integrated e-learning system with a high-capacity video streaming service for DLTV. With this technology, it is now possible to digitize all of the programs in eight main subjects or learning areas for secondary school and place these into the server, together with the individual presentation and individual lesson plans, quizzes and teacher's notes for each of the lectures.

The new project, called e-DLTV, aims to give one server to each school to create a super-broadband on-demand learning network in the school LAN. The server is based on the open source Linux operating system, Apache, MySQL, and PHP. The content/lesson management system is called LearnSquare, and it is now the most well-known e-learning platform in Thailand. All of the contents are stored on 1.5 terabyte hard disks, and each server can serve 300 simultaneous video viewing PCs in any school through the gigabit Ethernet port. e-DLTV can be used in a classroom environment as well as on an individual basis at the same time. Any terminal can retrieve any lecture from the selection of over 2,000 videos.

The e-DLTV project is part of Her Royal Highness Princess Maha Chakri Sirindhorn's IT Project. The 'source' of all DLTV programs is Klai Kangwol School in Hua Hin, 200 kilometres south of Bangkok. Eight schools have been in pilot operation since December 2007, and a total of 90 schools are targeted for operation in 2008. When completed, this system will be the largest e-learning system available to Thai students.

The e-DLTV project mitigates Thailand's shortage of teachers by providing each school with pre-recorded quality lectures. New technology overcomes the broadcast nature of the satellite and the lack of bandwidth problems by locating the high-capacity server within each school's local network. Moreover, all software used is open source. Thus, the concept is highly scalable. Using the nationwide broadband Internet connection, it will also be possible to implement online content updates to all servers.

(Sources: Boonruang 2008; *Daily News Online* 2008)

from multiple sources and translating the information into a format that each recipient understands and can use immediately. OpenCARE is designed using open standards such as OASIS's Emergency Data Exchange Language (EDXL) and People Finder Interchange Format (PFIF).

OpenCARE services can operate over the Internet, by instant messaging, as a Web portal, and between amateur radio operations. As of 2008, five relief agencies in Thailand have joined OpenCARE. The project, a contribution of Internet Thailand Public Company Limited, is intended to complement

the Emergency and Educational Communication Vehicle (EECV) reported in the 2007–2008 edition of the *Digital Review of Asia Pacific*. The OpenCARE initiative is now part of the ITU-D and is being considered a part of ISO/TC223.

The Thai Telecommunications Encyclopedia project (<http://www.thaitelcomkm.org>) was initiated by academic members of the ECTI Association of Thailand. It aims to collect knowledge related to various aspects of telecommunication from various experts. The encyclopedia includes the telecommunication development history of Thailand.

ICT RESEARCH AND DEVELOPMENT

As the agency tasked with current and emerging technology R&D, NECTEC has initiated 10 strategic programs. Six of these are on technologies, namely, RFID, HDD, Embedded, Wireless, Sensors, and Security. Two are on engineering: Biomedical and Intelligent/Knowledge. The remaining two programs are on applications: Information and Mobile, and Intelligent Transport System.

Niche areas for each program are shown in the following examples:

- Embedded technology: agricultural applications, consumer electronics, and automotive industries
- RFID technology: reader, antenna, and software development
- Sensors technology: electronics-sensor and bio-sensor

TRIDI, the new telecommunication research institute under NTC, also supports R&D and industry development, particularly in technologies for wireline and wireless broadband access, short-range communications, optical communication such as fiber-to-the-home, and next-generation networking.

CHALLENGES AND OPPORTUNITIES

Thailand is moderately successful in expanding effective use of ICT for development, enhancing competitiveness and productivity, and stimulating the growth of the ICT industry. The big drive for value creation through a ‘cluster’ approach by integrating research into a high-value industry, such as hard-disk drive production and animation, is noteworthy.

However, three main challenges need to be addressed for Thailand’s use of ICT for development to succeed: the establishment of a fair and competent regulatory body for telecommunications and broadcasting, bridging the digital divide, and developing trust in e-commerce.

First, the regulatory body for telecommunications and broadcasting has been reformed through the new Constitution of 2007. Instead of two regulatory bodies (one for telecommunications and another for broadcasting), the new Constitution requires the Parliament to pass a law that will set up the National Broadcasting and Telecommunication Commission (NBTC) as the single regulator for both telecommunications and broadcasting. The new Telecommunication and Broadcasting Bill to establish the NBTC has been drafted and is ready for parliamentary deliberations. The law requires the appointment of NBTC members within 180 days. This is a challenging task

because in the past, it took Thailand more than four years to appoint members to just one (of the two) regulatory body.

Second, although Thailand is a leader in supplying low-cost PCs to its citizens, localization of software, putting more Thai language content on the Web, expanding broadband coverage, and lowering broadband prices, broadband penetration in Thailand remains very limited (only 2 percent of the population). While online translation services have been extended from the Web to the short message platform and text-image translation is under development, Truehits.Net statistics show that educational content in Thai is being retrieved by only 2.5 percent of Web visitors. Obviously, the broadband divide and the knowledge divide are big challenges for the move toward a knowledge-based society.

Third, with respect to building a trusted environment for e-commerce, Thailand has achieved three milestones: the enactment of the Computer-Related Crime Law, the establishment of the National Root Certification Authority, and the adoption of central government email services. The latter is an offshoot of the recent ban on excessive use of free email services such as Hotmail, YahooMail, or Gmail, for government data messaging as these violate the official document handling procedure. All three milestones seek to build trust and confidence in electronic document systems, email storage, and the use of electronic certificates to let government officers sign documents electronically. However, the wider use of Public Key Infrastructure that will result in more secure websites with SSL (secured socket layer), and legislation of the Data Protection Act, remain a challenge.

It is hoped that the second ICT Master Plan (2009–2013) currently being drafted will address these challenges.

NOTES

1. The operators granted the testing licences are AIS, United Information Highway, Loxley, TT&T, CAT Telecom, TOT, TrueMove, CS Loxinfo, Trans Pacific Broadband, Samart Telecom, True Universal and Triple T Broadband.
2. USD 1.0 = THB 33.7 (December 2007)
3. The service sector had an economic value of approximately 49 percent of total GDP in 2007 and it is expected to grow further.
4. Although the requirement is perceived to be a financial burden to business, most providers are cooperating with the government and they actually recommended the 90-day period (the draft provided for only 30 days) to gain more trust from user communities.
5. ITMX currently allows for money transfers of up to THB 2 million per transaction, and a cash transfer of up to THB 30,000 per transaction.
6. The XO machine, previously known as the ‘USD 100 Laptop’ or ‘Children’s Machine’, is an inexpensive laptop computer designed to be distributed to children in rural areas.

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