Nets, Webs and the Information Infrastructure

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e-ASEAN Task Force

UNDP-APDIP

PREFACE

One the many challenges facing the countries in the Asia-Pacific today is preparing their societies and governments for globalization and the information and communication revolution. Policy-makers, business executives, NGO activists, academics, and ordinary citizens are increasingly concerned with the need to make their societies competitive in the emergent information economy.

The e-ASEAN Task Force and the UNDP Asia Pacific Development Information Programme (UNDP-APDIP) share the belief that with enabling information and communication technologies (ICTs), countries can face the challenge of the information age. With ICTs they can leap forth to higher levels of social, economic and political development. We hope that in making this leap, policy and decision-makers, planners, researchers, development practitioners, opinion-makers, and others will find this series of e-primers on the information economy, society, and polity useful.

The e-primers aim to provide readers with a clear understanding of the various terminologies, definitions, trends, and issues associated with the information age. The primers are written in simple, easy-to-understand language. They provide examples, case studies, lessons learned, and best practices that will help planners and decision makers in addressing pertinent issues and crafting policies and strategies appropriate for the information economy.

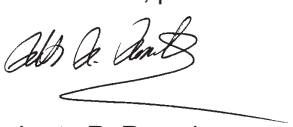
The present series of e-primers includes the following titles:

- The Information Age
- Nets, Webs and the Information Infrastructure
- e-Commerce and e-Business
- Legal and Regulatory Issues for the Information Economy
- e-Government;
- ICT and Education
- Genes, Technology and Policy: An Introduction to Biotechnology

These e-primers are also available online at www.eprimers.org. and www.apdip.net.

The primers are brought to you by UNDP- APDIP, which seeks to create an ICT enabling environment through advocacy and policy reform in the Asia-Pacific region, and the e-ASEAN Task Force, an ICT for development initiative of the 10-member Association of Southeast Asian Nations. We welcome your views on new topics and issues on which the e-primers may be useful.

Finally, we thank all who have been involved with this series of e-primers-writers, researchers, peer reviewers and the production team.



Roberto R. Romulo
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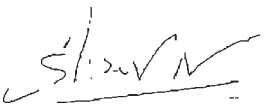

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CONTENTS

INTRODUCTION

This primer attempts to capture the essence of current information and communications technologies that are relevant to policy makers in developing countries. The technologies, case studies and examples focus on the Internet (the "Net"), the World Wide Web (the "Web"), and the information infrastructure also known as the information highway.

In the first section, "Enter the Net," current technologies are explained to give the policy maker an idea of the real world infrastructure crucial to building a country's information infrastructure. Web sites and other references are provided for further reading.

The second section, "Viruses, Privacy and Security," discusses the oft-spoken dangers of the Internet. Examples of actual regional and legislative initiatives addressing privacy and security issues on the Internet are given in boxes.

Section three, "Net 4 Us," lays out the issues where government action is important. Topics in this section include the digital divide, open source, the language barrier, local content, broadband deployment, universal service, and universal access.

I. ENTER THE NET

What is information and communications technology?

From the Merriam-Webster OnLine Dictionary (www.webster.com), we have the following definitions:

> Information - the reception of knowledge or intelligence
> Communication - an act or instance of transmitting; a process by which information is exchanged between individuals through a common system of symbols, signs, or behavior
> Technology - a manner of accomplishing a task especially using technical processes, methods, or knowledge

Information and communications technology (ICT) refers to a broad field encompassing software, hardware, computers and networks. It includes communication infrastructure and technologies such as regular telephony, cellular networks, satellite communication, broadcasting media, and other forms of communication.

What is the Internet?

The Internet is by far the fastest growing information and communications medium. There has been a phenomenal growth in the number of users, extent of infrastructure, and amount of information in the Internet over the past few years. The Interna-

Box 1. *Your Computer to the Internet.* There are various ways for a person to connect to the Internet. This diagram is a distilled summary and does not represent all possible ways of connecting to the Internet.

User's PC

*The **Personal Computer (PC)** is the traditional window to the Internet. A user may access a computer from his/her home, office or a public place such as an Internet café. For a computer to be effectively used for the Internet, the minimum input and output devices required are a keyboard, a pointing device such as a mouse, and a monitor connected to the Central Processing Unit (CPU). Other devices that enhance a user's experience include speakers, a microphone, a Web or digital camera, a scanner, and other hardware.*

speaker/ headset

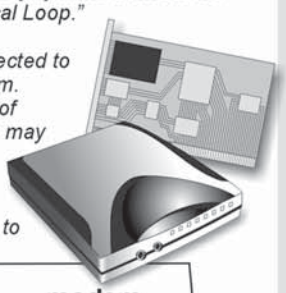
video

microphone

User's Communication Equipment

***User Communication Equipment** connect the users' PC(s) to the "Local Loop."*

The home user is connected to the Internet via a modem. Depending on the type of connection, the modem may be connected to a telephone line or to a coaxial cable (just like the cable that connects to a cable television).

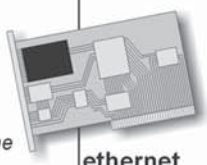


modem

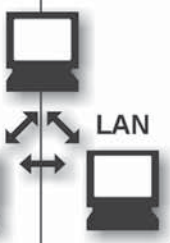
home

corporation

The office user is often connected to a local area network (LAN). The LAN is a network of computers within the same office or building. The network includes computers that have specialized functions in the network. These computers are referred to as servers.



ethernet



LAN

user services
DNS, email, etc.

*Servers are similar to office staff who are tasked to help others in specific ways. The **email server** is like a delivery boy dedicated to sending and receiving email. The **Domain Name Server** (DNS) is like a phone operator that routes requests for information to the correct machine. The DNS connects to the Internet via a modem.*

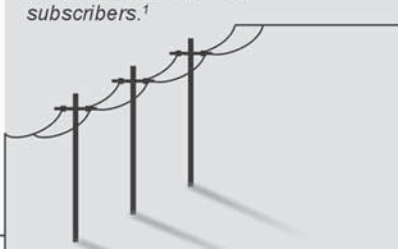
security

For added security, a LAN or a WAN (Wide Area Network) may use a firewall before connecting to the Internet. The firewall limits access to the LAN from the outside world. The firewall is like a security guard who protects an office from intruders, in this case harmful data and information.

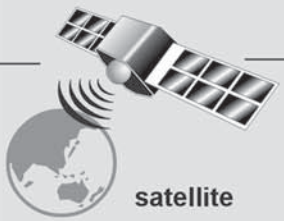
Local Loop Data Carrier

*The **Local Loop Data Carrier** connects the user location to the ISP's Point of Presence (PoP).*

The local loop data carrier refers to the medium through which data is transported from the user's modem to the ISP. Examples of more common data carriers are local phone lines, co-axial cable TV lines, and satellite and wireless technologies. They differ in their speed and method of data transfer. Data carriers will be discussed in more detail later in this section. All these transport media connect the user's computer to the ISP's PoP, a place where communications services are available to subscribers.[1]



PSTN/DSL/ISDN



satellite

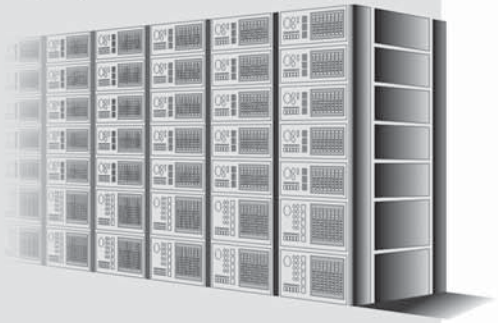
cable

fixed wireless

ISP's Point of Presence

*An **ISP's PoP** is where connections from the user are accepted and authenticated.*

An ISP issues a username and password that a user needs to present to be given access to the information highway. The ISP's PoP is like a tollgate that determines whether or not to allow a user to use the highway—the information highway.

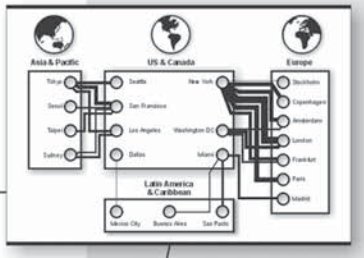


ISP's PoP

User Services and Online Content

The main service of an ISP is to provide access to the Internet. Aside from this, the ISP usually offers email addresses and Web site hosting services.

user services
DNS, email, etc.



Online Content
hosting platform
(web, audio, video, online services)

***Online Content** refers to host sites that the users interact with.*

Online content resides in computers around the world. These computers, known as hosts or servers, are dedicated to storing information and providing this information to users when the information is requested.

Online content is created by companies or individuals. The common form of content is the Web site. Web sites may be as plain as text documents. They can also display images. Web sites that make good use of the Internet and the technologies it can run are dynamic. They contain images, music, videos and other dynamic elements. However, Web sites like these are fully appreciated only by users who have fast computers and a broadband connection.

ISP backbone

*The **ISP Backbone** interconnects the ISP's PoPs, and interconnects the ISP to other ISPs and online content.*

tional Telecommunication Union (ITU) estimates that the Internet has grown from about 4.4 million users in 1991 to 655 million in 2002.[1] Internet user population for 2004 is projected at 709.1 million (eMarketer) and 945 million (Computer Industry Almanac).

The Internet has become a powerful tool and enabler in various fields, including communication, hobbies, learning, commerce, governance, research, entertainment, agriculture, and the arts. It is the most pervasive medium worldwide, commanding the attention of anyone who wants to keep abreast of world developments.

What is the difference between the Net and the Web?

The Internet (or Net) is a network of networks. It is made up of computers, cables, and other networking hardware. Different individuals and institutions have helped develop tools and protocols that use the Internet as a medium for information or data exchange.

The Internet encompasses data exchange facilities (computers, servers, hubs, switches, backbones, etc.) and protocols (HTTP, FTP, TCP/IP, WAP, etc.) and other applications (email, telnet, chat, instant messaging, streaming video, usenet, etc.).

The World Wide Web (or Web), on the other hand, is the most popular of all Internet applications. The Web provides users with the ability to access information and services while connected to the Internet. Web users may also publish information and offer services that can be accessed by anybody else in the Internet. The Web's primary protocol, HyperText Transfer Protocol (HTTP), allows users to jump from one link to another. This is similar to reading many references and skipping from one topic to another instead of reading in a fixed sequence (for example, from page 1 to 100).

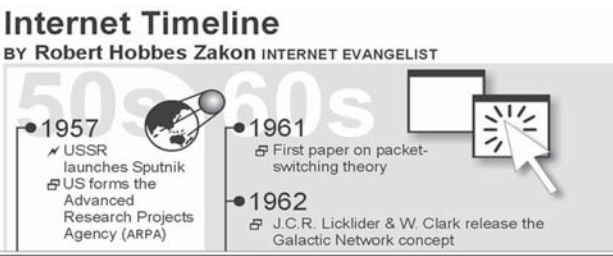
What is the most common way of connecting to the Internet?

Dialing from a computer via a modem and phone line is still the most common way of connecting to the Internet.

Different areas and telephone companies have different telephone facilities. The telephone equipment in a user's vicinity and the equipment of the telephone company will determine the type of service that will be available to a user.

Public Switched Telephone Network (PSTN) refers to the telephone system based on copper wires carrying analog voice data. PSTN requires the user to have a modem to dial up to the ISP. It is also commonly known as Plain Old Telephone Service or POTS.

PSTN uses a circuit switched network to transmit continuous real-time data (e.g., voice). Live video is also transmitted better via a circuit switched network. Packet switched



networks are used for data that do no need to be sent immediately or in real-time. Thus, email, the Web, chat and other Internet applications use packet switching.

Packet switching technology is continuously being improved. Eventually, packet switching networks will be able to transmit voice and video as efficiently as circuit switching networks.

Table 1. Comparison of Circuit Switched and Packet Switched Networks

	Description	Advantages
Circuit Switched	Allocates a dedicated line for data transfer between two telephones or two computers	Ideal when data must be transmitted quickly, must arrive in sequenced order, or must arrive at a constant rate; used when transmitting real time data, such as audio and video
Packet Switched	Does not have a dedicated line for data transfer; instead, data is chopped into packets and sent out to the recipient with no specified route	More efficient and robust for data that is sporadic in nature and can withstand delays in transmission, such as email messages, and Web pages Recent developments are making possible packet switching for audio. Voice Over Internet Protocol (VOIP) or Voice Over DSL (VODSL) are examples of "real time" data being transmitted using packet switching.

What is DSL?

DSL (Digital Subscriber Line) is a form of high-speed Internet access over standard telephone lines. Unlike regular dial-up connection, which requires a modem, DSL provides a dedicated connection to the Internet and the PC is always connected to the ISP. Furthermore, DSL can handle a telephone call and Internet access at the same time.

There are three types of DSL, namely, Asymmetric DSL (ADSL), Symmetric DSL (SDSL) and ISDN DSL (IDSL). These types differ in the speeds of receiving and sending data.

DSL in general is more expensive than ordinary dial-up access. The advantage, of course, is a faster Internet connection.

What is ISDN?

Integrated Services Digital Network or ISDN is an international communications standard for sending voice, video and data over digital telephone lines. ISDN lines may be used to make regular calls to PSTN or DSL phone lines.

Timeline graphics by Ma. Corazon M. Cruz

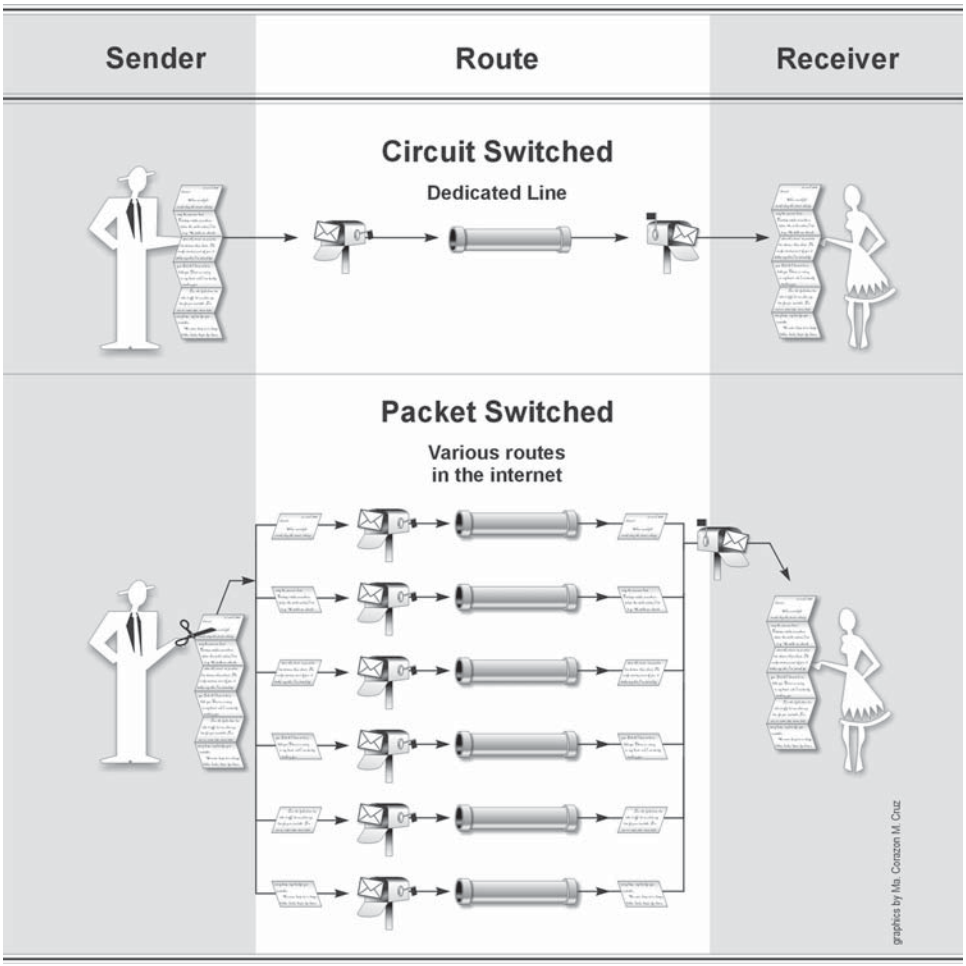
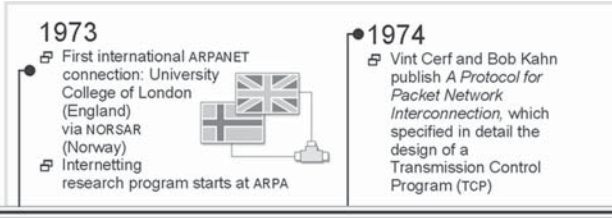


Figure 1. Circuit Switch and Packet Switched Networks

ISDN has two kinds of channels, which are like different lanes on a single highway. The B-channel can be used for Internet connections or voice calls. The D-channel is a signaling channel used by the ISDN network equipment.[3]

In addition, ISDN has two pre-defined configurations: Basic Rate Interface (BRI) and Primary Rate Interface (PRI). BRI uses two multimedia channels and one signaling channel within a single line. BRI is used primarily by small offices and home users to connect to the Internet. A PRI connection supports 23 (sometimes 30) multimedia channels and one signaling channel. It is used primarily by corporations and organizations with large communication requirements.

ISDN modems and lines are more expensive than standard dial-up, cable modems and DSL lines.



Can I get an Internet connection through my cable TV?

Cable television providers have started to deliver Internet access. In some cases, a single cable from the cable company can connect to both the television and the computer through a cable modem. The modem takes care of separating data for the TV and data for the computer. Whereas dial-up and DSL connections make a one-to-one connection to the Internet provider, cable modem users must share bandwidth with everyone else on the network. The more people online using the same pipeline at any moment, the slower the data transfer rate will be.

What is broadband?

Broadband, formed from the words broad and bandwidth, pertains to data carriers that have significantly wider bandwidth than the ordinary dial-up access of home-users. A wider bandwidth translates to a faster Internet connection. DSL, ISDN and Cable Internet are considered broadband connections to the Internet.

Having broadband is just like having a wider pipe to supply water to a household. Broadband allows Internet users to view Web pages more quickly, including multimedia files. Ordinarily, it takes several minutes for large images to be downloaded from the Internet using an ordinary dial-up. With broadband, a user will be able to download movies, audio and image archives. Users will be able to maximize video conferencing. They will also be able to make national and international phone calls using the Internet.

What are wireless technologies?

Wireless technologies refer to methods or devices that achieve data transfer without the use of wires connecting two devices. Essentially, wireless technologies are based on radio frequency waves just like a music radio or a two-way radio.

There are mobile wireless and fixed wireless configurations. The difference between them has to do with whether the devices are movable. Examples of mobile wireless devices are the mobile phone, personal digital assistant (PDA), laptop computer, digital camera, and audio player. A powerful quality of the mobile device is that the user can take it anywhere.

Fixed wireless, on the other hand, refers to wireless devices or systems that are situated in fixed locations such as an office or home. A wireless LAN (WLAN) using desktop computers is an example of a fixed wireless device. (See discussion on Wi-Fi.)

Satellite Internet access is also high-speed. Unlike the analog dial-up and the DSL, satellite access is available practically anywhere, even in remote areas without phone lines. Aside from the Internet, television channels and radio stations can be transmitted to a user's satellite dish. For countries that do not have good telecommunications infrastructure, satellite technology is an option for Internet connectivity. However, considerable electric power is needed for wireless data transmissions using a satellite connection.

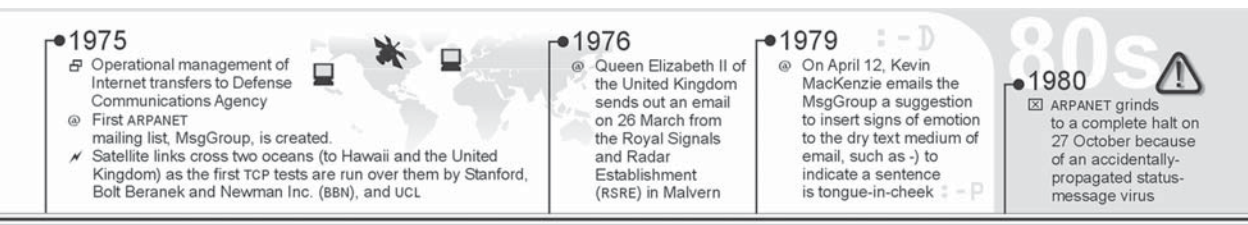
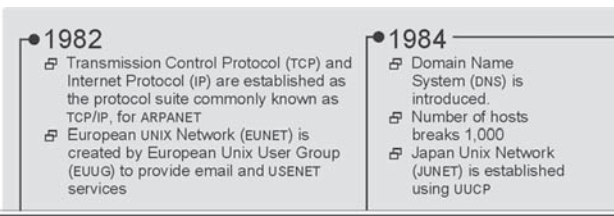


Table 2. Comparison of Local Loop Data Carriers

	Distribution Method	Speed (compared to 56Kbps modem)	Drawback
Dial-up (PSTN)	ISPs use household telephone lines to transmit data from the Internet. A modem converts the data and the PC displays the information.		Limited speed. Old phone cables tend to be less reliable.
DSL	DSL turns digital signals of computers into sound waves and zaps them through the phone network.	More than 10 times faster	Residents farther than 4.25 kilometers from a central phone office probably can't get service.
ISDN	Phone line has multiple channels. It can accommodate a combination of 3 to 31 voice calls and/or Internet connections depending on the configuration[4].	2 to more than 20 times faster	Phone line will not work during power interruptions. It has two bills-one for the phone and another for the Internet connection. An ISDN modem is expensive.
Cable Modems	Data from the Net flows over the same coaxial cable that carries TV signals. A modem splits the Internet data from TV data and directs the data to the PC and the TV correspondingly.	10 to 20 times faster	An expert is needed to set up the system. Subscribers using the Internet at the same time and using the same feeder line have to split the bandwidth amongst themselves.
Satellite	Satellites that beam TV signals also transmit Internet data. The Internet signals are collected on dishes, split off from TV signals, and routed to the PC.	4 to 8 times faster	Most satellite services are only one way. Many customers need a complex setup to send data back to the Net over their regular phone line. Two-way services are slower.
Fixed Wireless	The same airwaves used to beam wireless phone calls can be used to transmit Internet data. The signals are delivered from wireless towers, collected on dishes attached to the home, and routed to the PC.	2 to 10 times faster	Requires a clear and direct line of sight between the tower and a customer's home.

Adapted from: "A Broadband Primer," *BusinessWeek online* (October 8, 2001); available from http://www.businessweek.com/magazine/content/01_41/b3752049.htm; accessed 3 September 2002.



What is Bluetooth?

Bluetooth is a global standard for a short-range wireless connectivity that can establish links between mobile phones, PCs, laptops, PDAs, and digital cameras, among other devices. It enables a user to connect with a single or several devices at once. Because it is a global standard accepted by major telecommunication, software and networking companies, it is expected to become a widespread technology within a few years. This will allow "universal" and seamless data communication of various devices across different platforms and different hardware.

Bluetooth eliminates short data cables. For example, Bluetooth can replace the cable that connects a music player or mobile phone to a headset. It can also be used to replace the data cable used to synchronize PDAs with computers. Bluetooth focuses on applications where there is low power requirement and where data transfer rates are moderate.

What is Wi-Fi?

Wi-Fi, short for wireless fidelity, is a broadband wireless technology with a data transfer rate of more than 10 times that of Bluetooth. It is based on the IEEE 802.11b industry standard. Products certified as Wi-Fi by Wireless Ethernet Compatibility Alliance (WECA) are interoperable with each other even if they are from different manufacturers. A user with a Wi-Fi product can use any brand of access point with any other brand of client hardware that is built using the Wi-Fi standard.

Wi-Fi offers a 100-meter range and an 11-Mbps transmission rate. This makes it ideal for quick Internet access. Wi-Fi's foremost use is to augment existing local area networks (LAN). Although Wi-Fi is not necessarily going to replace wired LANs, it makes a network more versatile in terms of expansion and can also increase users' mobility.

What is the difference between Bluetooth and Wi-Fi?

Although Bluetooth and Wi-Fi operate in the same frequency of 2.4GHz, the two technologies have three main differences: range, data speed, and power consumption.

It must be noted that Bluetooth and Wi-Fi operate in a portion of the ISM band commonly allocated to the industrial, scientific and medical fields. Worldwide, the ISM band is generally used free of charge and without license for non-commercial purposes.

Common appliances such as cordless phones and microwave ovens, as well as magnetic resonance instruments (MRIs) and medical equipment may interfere with devices using Bluetooth and Wi-Fi.[5] Technology is being improved so that interference between devices can be avoided.

The regulatory policies in the deployment of Bluetooth and Wi-Fi should also be carefully reviewed.

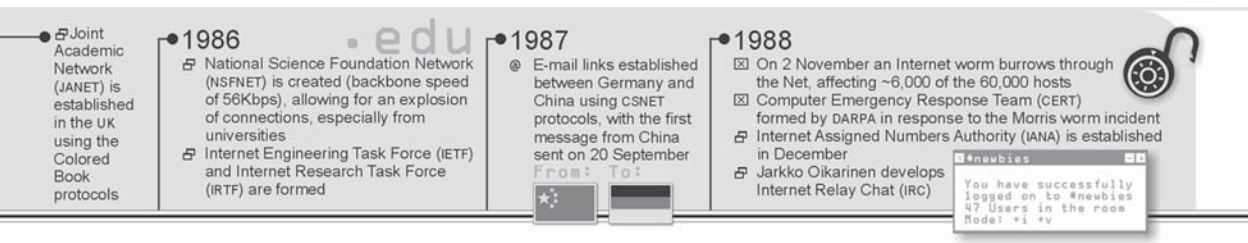


Table 3. Comparison of Bluetooth and Wi-Fi

Characteristic	Bluetooth	Wi-Fi
Frequency	2.4 GHz	2.4 GHz
Range	10 meters	100 meters
Data transfer rate	800 Kbps	11 Mbps
Power consumption	Low	Medium
Primary devices	Mobile phones, PDAs, consumer electronics, office and industrial automation devices	Notebook computers, desktop computers, servers
Primary users	Travelers, office and industrial workers, electronics consumers	Corporate offices, campuses, business or conference venues

Adapted from Michael Man, *Bluetooth and Wi-Fi* (Socket Communications, March 2002); available from http://www.socketcom.com/pdf/TechBriefWireless.pdf; accessed 3 September 2002.

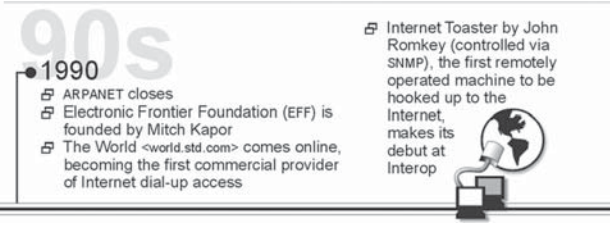
How do mobile wireless devices access the Internet?

There are a couple of ways to connect to the Internet via wireless devices.

WAP (Wireless Application Protocol) is a protocol that enables some mobile phones and PDAs to transfer data from the Internet.[6] To gain access to the Internet, a subscriber needs to connect to the cellular phone company's gateway. The gateway connects to WAP servers that provide content. Content is written in wireless markup language (WML), a programming language designed for displaying information accessed via WAP. A WAP-enabled mobile phone has a micro-browser to view sites. Not all Web sites can be accessed using WAP. Content needs to be written in WML so that a WAP-enabled mobile phone can access the content. WML may also be embedded in Web sites so that portions of the Web site may be accessed using WAP.

General Packet Radio Service or GPRS is a technology that speeds up the data transmissions of WAP.[7] GPRS gives access to the Internet at speeds of 56 to 114kbps using packet switching. Its key feature is that a user is charged only for the packets of data that are transferred regardless of how much time it takes to transfer these data. Without GPRS, a user will most likely be charged on a per-minute basis regardless of the amount of data transmitted.

3G refers to the 3rd Generation Phone, which gives a user access to regular voice calls, short message service (SMS), email, Internet access and video. Some 3G phones have built-in video cameras that may be used to take digital photos or videos, which can be sent to other 3G phones. 3G boasts of transmission speeds reaching from 128kbps up to 2Mbps depending on whether the phone is at standstill or in a moving vehicle.



A mobile phone can also be used to connect a PDA or laptop computer to the Internet. The PDA or laptop is attached to the mobile phone and is the user's primary visual interface to the Internet instead of the small screen of the mobile phone.

Box 2. Applications of High-Speed Wireless Solutions for Developing Countries: Lessons Learned in Latvia and Moldova

Because of poor-quality telephone infrastructure, developing countries face the difficult task of connecting locations (located in the same area/city) with dedicated high-bandwidth needs (from 256 kbps to 4 Mbps). The Eastern European countries of Latvia and Moldova are examples of countries where poor telephone infrastructure has been overcome by providing high-speed wireless Internet links to universities, schools, and government agencies.

In Latvia in 1993, LATNET, the Latvian academic network, began experimenting with low-cost 2 Mbps wireless local area network (LAN) personal computer adapters for use in a citywide university network. Currently the LATNET wireless system in Riga is the most important part of the educational network, connecting more than 200 sites, including university departments, institutes, high schools, and government agencies.

The country of Moldova received its first dedicated Internet connection in 1996, when the capital Kishinev was connected to the Internet by a 256 K VSAT (very small aperture terminal) link to Norway. Virtually overnight, the city government-sponsored project was connecting schools, government agencies, and nonprofit, nongovernmental organizations with full-time, high-speed dedicated Internet links. Since then the wireless network in Moldova has expanded considerably through local efforts.

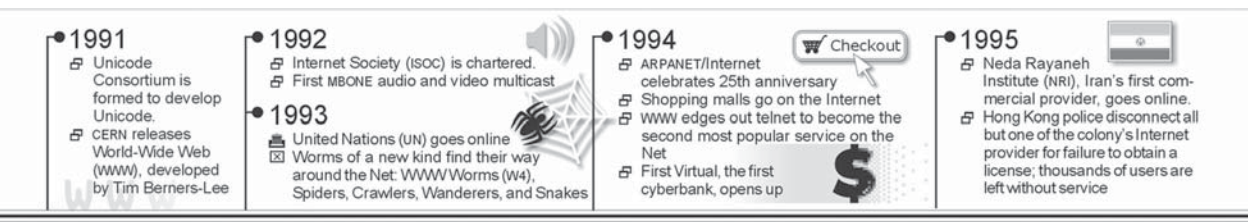
Source: Guntis Barzdins, John Tully and Arnis Riekstins, "Applications of High-Speed Wireless Solutions for Developing Countries: Lessons Learned in Latvia and Moldova," INET 99 [home page online]; available from http://www.isoc.org/isoc/conferences/inet/99/proceedings/4d/4d_2.htm; accessed 3 September 2002.

What is convergence?

Convergence is the coming together of computers, communications networks, and broadcasting/television. More and more data are being stored in digital format and networks are becoming digital. Thus, in the near future there will be no need for separate TV and communications networks. TV shows will reach viewers via the telephone network just as easily as when using a TV broadcasting network. A more formal and comprehensive definition of convergence is "the progressive integration of the value chain of the information and content industries-telecommunications, posts, multimedia, electronic commerce, broadcasting, information technology, and publishing industries-into a single value chain based on the common use and distribution of digital technology."[8]

Convergence can be classified into three types:

1. Convergence of technologies - a common platform to deliver voice, data and video services
2. Convergence of services - delivery of multiple services to end users over the same medium/network



3. Regulatory convergence - establishing a single Regulatory Authority (RA) with the blurring of the regulatory boundaries for telecommunication, information technology and broadcasting

Why and how is convergence essential?

Convergence revolutionizes two things: the communications infrastructure and the way in which people communicate with one another. Communication in this new technological milieu will be more efficient and more economical as the need to set up separate networks for telephone services, television broadcast, cable television, and Internet access will be eliminated. From the standpoint of a consumer, having only one information provider will mean cheaper communication costs.

Moreover, the principle of universal access can be made more achievable with convergence. The present scenario shows that the high costs of installing landlines in sparsely populated rural areas prevent telecommunications companies from installing telephones in these areas. The private sector can be motivated to install landlines in rural areas if revenues from these landlines will not be limited to local and long distance telephone charges, but will also include cable TV and Internet charges.

II. VIRUSES, PRIVACY AND SECURITY

What is a virus?

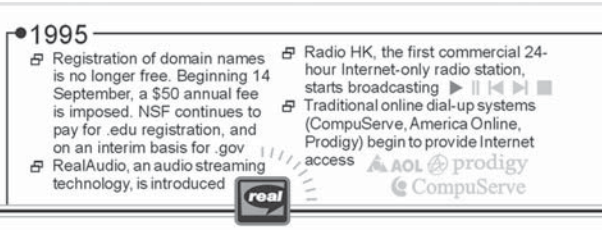
PCWebopedia (www.webopedia.com) defines a computer virus as “a program or piece of code that is loaded onto your computer without your knowledge and runs against your wishes. Viruses can also replicate themselves.”

The term virus has become a catch-all name for all malicious computer programs. Strictly speaking, a virus is a type of electronic infection. The most common forms of infection are the email virus, worm and trojan program.

An email virus moves around in email messages, and usually replicates by automatically mailing itself to the addresses in the victim’s email address book.

A worm infiltrates existing computer networks through security holes. It uses the network to scan for other computers where the worm can reside and replicate itself.

A trojan program is a computer program that claims to do one thing (e.g., it claims to be a game) while taking other actions that the user is not aware of (e.g., copying and sending files to another computer). Trojan programs usually do not replicate automatically. Their activities may range from erasing or modifying files, sending email, or sending private information through the Internet.



Why do virus outbreaks cost companies money?

The following are some of the ways that virus outbreaks increase company expenditures:

Computer breakdowns. Viruses are capable of crippling a computer by erasing or changing important files. They can clog networks, resulting in delays in legitimate computing tasks. This reduces productivity.

Virus cleanup required. When a computer is infected by a virus, the expertise of IT personnel is required to get rid of the virus. Some companies call in IT experts to remove viruses. Other companies choose to employ full time personnel to troubleshoot and guard their system against virus outbreaks.

Lost data / Data recovery. There are instances when data is lost due to a virus outbreak. This data will need to be rebuilt or gathered again.

Security measures. Companies devote a portion of their IT budgets to prevent virus contamination of their networks. This means investments in anti-virus and other security software or hardware.

How can technology prevent virus outbreaks?

Virus infections can be prevented through a combination of good anti-virus software and good user habits.

Virus scanning - Scanning refers to the inspection of computer data to check whether there are viruses. Some scanning software inspect data as they are being introduced to a computer.

Common sense - The most effective defense against viruses are a person's habits in using the computer. For example, users shouldn't download email attachments without scanning them for viruses.

Virus fix - A virus fix is run on an infected computer to repair any damage caused by a virus. Virus fixes are the result of studying the effects of a virus on a computer. Thus, by its very nature, a virus fix becomes available only after a new virus is reported.

What are cookies?

In the Internet realm, a cookie is a message stored by a Web site in a user's computer. It contains information that a Web site can retrieve when the user re-visits the Web site. During the user's subsequent visits, the appearance of the Web site is adjusted based on the information that is "remembered" by the cookie. (Strictly speaking, because the cookie is stored in the computer, the Web site "remembers" the computer and not the user.)

Cookies work like a doctor entering data into a patient's card. When the patient returns to the doctor, information about the patient's previous visits helps the doctor provide better service to the patient.

What information is stored in cookies?

Cookies can store login information so that users do not need to type in this information every time they return to a site. Cookies can also determine the interests of a particular user by the sequence of sites that the user visits, by the information the user submits, or by the topics that the user chooses to view. Cookies can also store data about an ongoing transaction in order to continue the transaction at a later time.

For example, an online shopper, Almira, goes to an online bookstore (like Amazon.com) to buy a book about Elvis Presley. Almira will have a virtual shopping cart where she can store books related to Elvis. Cookies are used to store data for the shopping cart. Using cookies, the Web site may also recommend a compact disc of Elvis's songs or movies by Elvis. Almira may see advertisements about other popular 70's record albums on sale or travel tours featuring a trip to an Elvis museum or Web sites selling Elvis memorabilia. These are all based on the cookies' perception of Almira's interest in Elvis as shown by her search for a book about Elvis. Lastly, if Almira chooses to postpone her purchase, the cookie will store data so that when she comes back to continue her shopping, the books or other items she had left in her virtual shopping cart will still be there.

How can cookies become a privacy breach?

Cookies gather information to help make things convenient for a user. But when information is directly identifiable to a particular person and is used for purposes other than a user's convenience, there could be a privacy breach.

Going back to the analogy of cookies acting like a patient's card, if the doctor began to divulge information about the patient to a third party (e.g., to health insurance or pharmaceutical companies), the person's privacy would be compromised. In Almira's case, her privacy is breached when information gathered by the online bookstore is sold to other vendors.

There is a privacy breach when a Web site does not inform the user about the kind of information stored in a cookie and how this information is used.

Can a cookie "read" other files in a computer?

No, cookies do not have access to files in a person's computer. Neither can cookies spread viruses. The only information available to cookies is information that has been divulged by the user such as his/her name, address, and credit card number. The privacy policy of a Web site is relevant here. In privacy statements, a Web site should state how they handle information exchanged between their Web site and a visitor's computer.

What is a privacy policy? Why is it important?

A privacy policy is a declaration by Web sites or corporations that informs visitors about the kind of information gathered on the site and how this information is used. It states how the Web site protects the privacy of the visitor.

According to a study by Forrester Research, Inc., 90% of Web sites fail to comply with basic privacy principles.[9] Also, the vast majority of such policies use vague terms and legal jargon that serve to protect companies and not individuals. The study showed that only about 10% of the companies studied adequately addressed the basic privacy of users.

How should governments handle online privacy problems?

There are four general approaches to privacy problems: laissez-faire, self-regulation, technology, and legislation/government.

Laissez-faire or "hands off" refers to the principle that governments need not regulate the marketplace, as the marketplace is guided by an "invisible hand" toward the most ideal balance of supply and demand. In the context of online privacy, the laissez-faire approach states that if people really feel concerned about their privacy, they will visit only Web sites with a clearly defined privacy policy. If the number of hits for Web sites with no or with inadequate privacy policy actually decreases as a consequence, this development would goad these Web sites to improve online privacy. In this scenario, consumer action defines the level of privacy protection that the consumers get.

Industry self-regulation is where there is cooperation and agreement between sectors in the industry regarding what is appropriate privacy policy. The policy will be based on recommendations of industry experts that balance the needs of businesses and consumers. Some tools for the implementation of industry self-regulation are seal programs, industry guidelines, and privacy organizations.

For example, the World Wide Web Consortium (W3C; www.w3c.org) has developed a privacy standard called Platform for Privacy Preferences Project (P3P). The W3C was created to help realize the Web's full potential by developing common protocols that promote its evolution and ensure its interoperability. Simply stated, P3P lets a user declare a set of customized privacy rules. These rules will be used to determine whether or not a Web site has acceptable privacy policies. Software based on P3P will help a user determine the actions to be taken when a Web site's privacy policies do not match the user's privacy rules.

Technology is a solution that can be taken up by private individuals, enterprises and interest groups. Many of the technology solutions involve working with browsers which inform a user of the privacy levels upheld by the Web site being visited.

Box 3. Examples of P3P Tools

Privacy Bird by AT&T
http://privacybird.com

P3P Demonstration site
http://p3p.jrc.it/modelsite/index.php

P3P Toolbox
http://www.p3ptoolbox.org/

Technology and industry standards have become complimentary solutions to privacy issues. For example, there are tools developed based on P3P standards that automatically look up the privacy statement of the Web site. If the Web site's privacy policies are within the specified standards of the user, navigation of the site is continued. Otherwise, the user is informed of the level of privacy protection afforded by the Web site. This is all done automatically, with minimal intervention of the user, by embedding machine-readable codes that are read by P3P tools. Tools are being developed by companies independent of W3C, which encourages private companies to develop software that will enable the use of P3P.

Governments sometimes play an active role in protecting privacy on the Internet. Korea, for example, has been vigilant in protecting citizen privacy, promulgating the "Information Infrastructure Protection Act" and "The Act on Promotion of Utilization of Information and Communication Network and Data Protection" in 2001.[10]

What kinds of privacy legislation have been passed?

A study of the privacy laws of 15 jurisdictions[11] reveals the following:

- Eleven jurisdictions impose restrictions on the transfer of data across borders. Only Brazil, Russia and the United States do not. Chinese law does not address cross-border data transfers.
- Twelve jurisdictions have existing or proposed laws that address both traditional privacy and data protection. The privacy laws in Japan and Sweden are focused primarily on data protection.
- Most of the jurisdictions require notice to the data-subject that data is being collected and its use, some form of consent by the subject for the data to be collected and used, protection of the subject's right to access the data, and maintenance of data security by the data controller.
- In all but three jurisdictions-Australia, Hong Kong and Japan-a data-subject may go to court to enforce privacy laws.
- In 13 jurisdictions in the survey, violations of privacy law can be criminal.

Box 4. Fair Information Practices of the United States and the OECD

The United States and the Organisation for Economic Cooperation and Development (OECD) have their own versions of fair information practices.
In the US, the Federal Trade Commission has summarized the main elements of fair information practices into five categories: notice, choice, access, security, and contact.

- Notice - Informs an individual exactly what information is being collected, how it is collected, how the information will be used, and with whom it will be shared.
- Choice - Allows consumers to exercise control over the use of their data (for example, whether to join or to be excluded from electronic newsletters or marketing campaigns).
- Access - Allows individuals to review the information that has been collected about them. It also gives individuals the ability to correct or delete inaccurate information.
- Security - Requires data collectors to protect the information they have gathered, both during transmission and storage.
- Contact - Requires collectors of information to provide individuals with reliable contact information.

The OECD expanded on these principles, adopting a set of eight fair information practices. The additional three principles are purpose specification, use limitation and individual participation.

- Purpose specification - The purposes for which personal data are collected should be specified no later than at the time of data collection.
- Use limitation - Data collectors are required to keep confidential any personal information, unless disclosure is with the consent of the individual or by authority of law.
- Individual Participation - An individual has the right to get confirmation of the existence of data, request access, challenge data, and have data erased, rectified, completed or amended.

Sources: Jared Straus and Ken Rogerson, "Policies for Online Privacy in the United States and the European Union," Regulating the Internet: EU & US Perspectives [home page online]; available from http://jsis.artsci.washington.edu/programs/europe/Netconference/Strauss-RogersonPaper.htm; accessed 4 September 2002.
James S. Huggins, "OECD Privacy-D-Personal Data Privacy Goes International," James S. Huggins' Refrigerator Door [home page online]; available from http://www.jamesshuggins.com/h/bas1/oecd_privacy_d.htm; accessed 4 September 2002.

What are the security issues on the Internet?

The CERT Coordination Center (CERT/CC; www.cert.org), a center for Internet security expertise, has suggested that the increasing speed and sophistication of attack tools, faster discovery of vulnerabilities, and increasing permeability of firewalls are important trends related to Internet security.[12]

Notably, there is an increasing threat from infrastructure attacks. There are four types of infrastructure attacks. The first type is Denial of Service (DoS) where excessive network traffic caused by malicious attacks crowd out legitimate users from using the network. The second type of attack is through worms, which are self-propagating malicious code such as "Code Red", "Nimda" and "Klez". The Code Red worm infected more than 250,000 systems in just nine hours. Third, attacks on the Internet domain name systems (DNS) can render Web sites inaccessible, vandalize legitimate Web sites or re-direct Web site traffic to the attacker's Web site. Government and military Web sites are common targets of this kind of attacks. The fourth type

consists of attacks against or using routers. Attacks on routers can result in interception of information or a slowing down of information delivery.

What measures can be taken to prevent computer cracking and other security breaches?

There are three countermeasures to threats of cracking: technology, people and policy.

Advances in technology continue to improve the security of computer systems. Software and hardware are being developed to guard against computer break-ins. Among the countermeasures that can be implemented are a secure DSL connection, installation of a personal firewall, installation of anti-virus software, safe email practices, and regular backups.

But technology is effective only until the next cracker discovers another security hole. Thus, it is important for people (security experts, programmers, administrators) to be able to effectively monitor a system. Especially when computers, networks or servers contain sensitive information, it is imperative that experts can protect the security of the system.

Definition

Hacker - slang term for a computer enthusiast, i.e., a person who enjoys learning programming languages and computer systems and who can often be considered an expert on the subject(s).

Cracker - individuals who gain unauthorized access to computer systems for the purpose of stealing and corrupting data.

The terms hacker and cracker have erroneously been used interchangeably. But hackers maintain that they have a strict code of conduct which limits them to acts which DO NOT do harm and are NOT malicious in intent.

Source: Webopedia.com

Lastly, policies for punishing crackers are important. Recently, new laws in cybercrime have been put to the test. Legislators are learning whether or not the laws effectively address cybercrimes. Read more about this in the primer on cyberlaw.

Box 5. Korea Information Security Agency

The Korea Information Security Agency (KISA) was established in 1996 to respond effectively to a variety of electronic infringement and intrusion acts and thereby create a safe, reliable information distribution climate. KISA has devoted itself to enhancing the security and reliability of electronic transactions by developing and supplying cryptographic algorithms, including SEED and KCDSA. In addition, KISA has led the development of information security in Korea through the IT security system evaluation, information security education and public awareness campaign, and information security policy and legislative framework research.

With the coming into effect of the Information Infrastructure Protection Act and The Act on the Promotion of Utilization of Information and Communication Network and Data Protection in July 2001, KISA acquired additional duties, such as analysis and evaluation of the vulnerability of the critical information infrastructure, IT security system certification, and operation of the Secretariat of Personal Information Mediation Committee.

Korea Information Security Agency, "About Korea Information Security Agency," KISA [home page online]; available from http://www.kisa.or.kr/english/about_kisa_01.html; accessed 18 September 2002.

Is there a conflict between national security and privacy of the citizen in the online world?

The challenge is to protect the privacy of citizens online without impairing the State's right to examine documents and transmissions that threaten national security. The September 11 terrorist attacks in the USA introduced a new perspective into the Security of the State vs. Privacy of the Citizen debate. On the one hand, there is a continued campaign for the protection of personal privacy. On the other hand, governments (particularly the US government) have turned to information technology as a tool to combat terrorism.

In the years prior to the September 11 attack, financial institutions developed systems for securing direct mail, credit card offers and other kinds of targeted marketing.13 Other systems specifically targeted the detection of money-laundering activities. This involved the collection of millions of transactions from various financial institutions and identifying trends that appear suspicious. This sharing of information between financial institutions was dropped as it was considered by many as an encroachment of privacy. After September 11, however, "some specialists believe the scrutiny of consumers on the government's behalf is going even deeper".[14]

What is the digital divide?

The digital divide refers to the division of the world into people who have access to ICTs and those who do not have access to these technologies. Inasmuch as ICTs are the enabling technologies in the Information age, the digital divide is an important development concern of the 21st century.

A digital divide can exist between urban dwellers and rural folk, between the educated and the uneducated, between socio-economic classes, between ethnic groups, and between men and women. There is also a digital divide between countries and geographical regions. Specifically, in terms of Internet backbones, the US, Canada and European countries are well connected whereas Asia, the Pacific region, Latin America and the Carribean still have to improve their Internet backbones.

Are women more disadvantaged in the information age?

In a research paper titled "Gender, Information Technology, and Developing Countries: An Analytic Study," Nancy Hafkin and Nancy Taggart argue that "[w]omen within developing countries are in the deepest part of the [digital] divide, further removed from the information age than are the men whose poverty they share." Among the obstacles to greater women's access to ICTs are literacy and education, language, time, geographical location, and social and cultural norms.

Literacy and education are prerequisites in the use of information technologies. However, girls and women especially in developing countries are less likely than men to earn the basic education needed to use information technologies. Similarly, women and other marginalized groups are less likely to learn an international language such as English, which limits them to resources written in their native tongue.

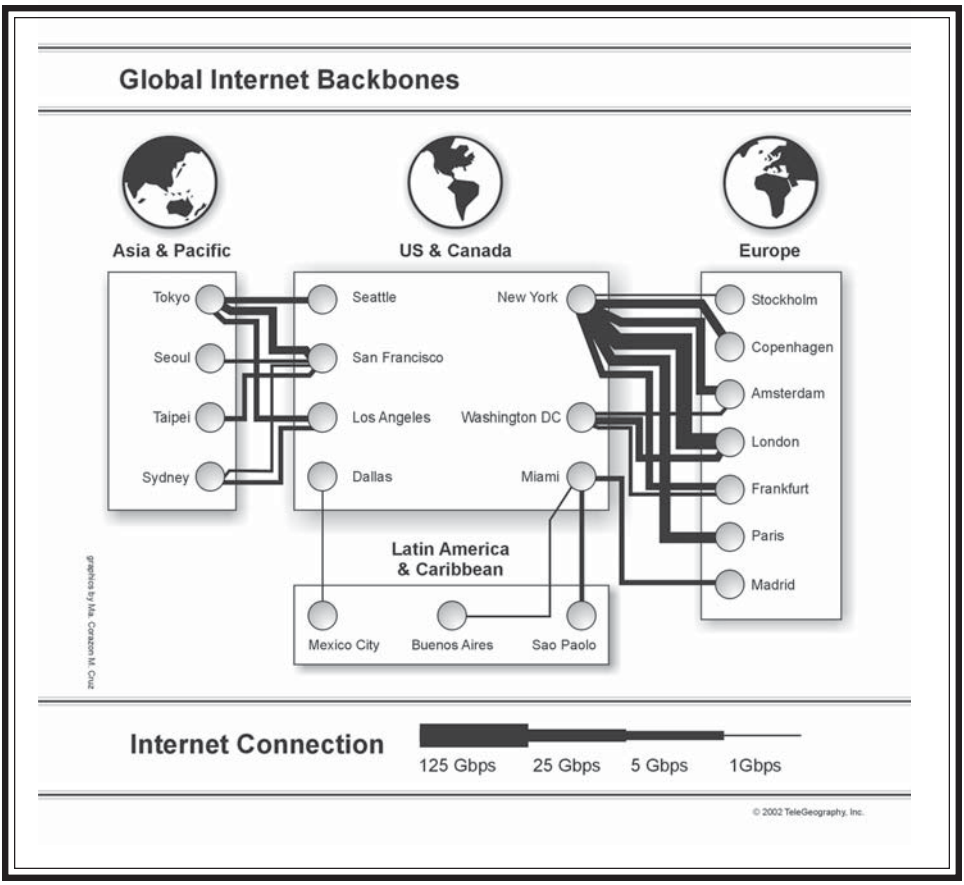


Figure 2. Internet backbones connecting regions worldwide (as of mid-2001)

Women's time is a resource that is in high demand but in short supply. That women are often burdened with domestic concerns such as childcare and household work keeps them from devoting time to Internet use, which is viewed as a leisure activity.

In developing countries, the geographical location of Internet public access centers also affects women's access to the Internet. The more popular model of the Internet café tends to alienate women. Internet cafés have predominantly male users. In order to increase access for women, public access centers to the Internet should be located in more gender-neutral areas such as libraries, schools and public markets.

Women's access to information technologies is also affected by social and cultural norms. Some cultures discourage women from interacting with men outside their family. This limits women's learning opportunities. One way of addressing this limitation is to hold "women only" days in public access centers and to have "women only" telecenters.

Box 6. Impact of Information Technology on Gender Issues: Trafficking

One of the most sinister aspects of information technology, especially the Internet, is its contribution to the sexual exploitation of women. The amount of sexually explicit material on the Web and the ease of access to it are well known. The most common search performed on any search engine on the Internet is for the word "sex". Recently, the Internet has become a tool for the prostitution of women, with women being tricked or forced into performing sex acts recorded as digital photos that appear on globally accessible Web sites. There are many ways of selling sex on the Internet. In Brazil customers can book prostitutes on the Web. Global sex syndicates use the Web to recruit women from all over the globe. These point to the globalization of the sex trade.

On the other hand, anti-trafficking activists in Brazil and elsewhere are setting up Web sites to warn women about sex slavery. The MiraMed Institute in Russia operates a Web site, an electronic newsletter and an Internet chat room in Russian to combat trafficking in girls and women from Russia. Thus, information technology is employed by both the profiteers and their opponents.

Source: Nancy Hafkin and Nancy Taggart, "Gender, Information Technology, and Developing Countries: An Analytic Study," *Office of Women in Development* [home page online] (June 2001); available from http://www.usaid.gov/wid/pubs/it01.htm; accessed 4 September 2002.

What about access to the Internet for those with physical disabilities?

Korea is a leader in the effort to build an information environment that encourages persons with disabilities to use information technologies. In December 2000, Korea passed the Digital Divide Law "to help ensure universal, unlimited access to the telecommunications networks and use of the telecommunications services for low-income earners, rural residents, the disabled, the aged, women, etc., who have difficulties in accessing or using the telecommunications services for economic, regional, physical or social reasons...[to] improve the quality of living for these people and thereby contribute to the balanced growth of the national economy."[15]

Box 7. Web Access for people with disabilities

Bobby is a comprehensive Web accessibility software tool designed to help expose and repair barriers to accessibility and encourage compliance with existing accessibility guidelines. Bobby was created at CAST (http://www.cast.org), a non-profit research and development organization whose goal is to expand opportunities for people with disabilities through the innovative use of computer technology.

Bobby is designed for developers to test web pages and generate summary reports highlighting the most critical issues affecting site accessibility before posting to the Web or to Intranets.

CAST has worked closely with the World Wide Web Consortium's (W3C) Web Accessibility Initiative (WAI) to develop an evaluation tool that employs their Web Content Accessibility Guidelines and provides page and site evaluation support for developers.

Source: Bobby Worldwide, "About Bobby," Bobby Worldwide [home page online]; available from http://bobby.watchfire.com/bobby/html/en/index.jsp; accessed 18 September 2002.

The law sets accessibility guidelines for telecommunications services to help the poor. Other provisions would subsidize PC purchases of poor and disabled people; support the development of access technologies for the disabled; and support information providers for the disabled, the elderly, the poor, and the fishing and farming industry.

The private sector also participates by providing infrastructure using satellite and solar-power technologies. Telephone lines and broadband Internet access have been installed in lightly populated small islands.[16]

Are people unable to access the Net because of language?

One aspect of the digital divide is the dominance of one language-English-in the Internet. Sixty-eight percent of Web content is written in English and 40.2% of Internet users access the Internet in English.[17] But non-English speaking users outnumber English-speaking users of the Internet. The most widely spoken language worldwide is Chinese, with more than 1.2 billion speakers (as of 2000). But only 3.9% of Web content is written in Chinese and only 9.8% of Internet users access the Internet in Chinese.

Japanese is only the tenth most widely spoken language (with 126 million people) but Japanese is the second most important language (in terms of content) on the Web. Hindi, Arabic, Bengali and Malay are all in the top 9 most widely spoken languages but these languages do not have a significant share of Web content.

Table 5. Languages of the Internet

	Number of speakers (in millions)[a]	Percentage of Web content written in each language[b]	Percentage of online language users[c][UP1]
Chinese	1,200	3.9 %	9.8 %
English	470	68.4 %	40.2 %
Hindi	418		
Spanish	381	2.4 %	7.2 %
Russian	288	1.6 %	2.0 %
Arabic	218		0.8 %
Bengali	196		
Portuguese	182	1.4 %	2.6 %
Malay	155		
Japanese	126	5.9 %	9.2 %
French	124	3.0 %	3.8 %
German	121	5.8 %	6.8 %
Italian		1.6 %	
Korean		1.3 %	

Notes:
a. Globaware International (http://www.globaware.com/div/pdf/paper1.pdf)
b. Vilaweb.com, as quoted by eMarketer (http://global-reach.biz/globstats/refs.php3), March 2002.
c. Global Internet Statistics (http://www.glreach.com/globstats/), March 2002.
Total World Online Population: 560 million

How does the Internet handle fonts and characters of different languages?

Different languages are encoded differently, making machine translation difficult.

Thus, the Unicode was established. The Unicode Standard is "a character coding system designed to support the worldwide interchange, processing, and display of the written texts of the diverse languages of the modern world."[18] Developed, extended and promoted by a non-profit organization, the Unicode Consortium (www.unicode.org), the Unicode Standard makes international communication easier. Work at the Unicode Consortium is continuous as it aims to extend the Unicode Standard to accommodate all the characters needed in international communication.

Box 8. The tribulations of the Khmer font on the Internet[19]

There are many difficulties in using the Khmer language in the Internet. First, the Khmer language represents a relatively small market. There are only about 12 million Khmer speakers in the world. Of the 11.4 million living in Cambodia, less than 10,000 use the Internet. This in turn contributes to the difficulty in creating Khmer content. Second, text entry is difficult. The Khmer alphabet has 150 letters, while a standard keyboard has only 47 keys. Typing Khmer language is highly complex. Almost all consonants, for example, have two different forms, depending on their position within a word. Written Khmer also omits spacing between words. In order to avoid manually inserting a space at the end of every line, the user has to download a special software that adds invisible spaces in between words. Moreover, whereas English only needs one alphabet layer, and French up to two (to accommodate accented letters), the Khmer script uses up to four layers.

There are a variety of initiatives and projects to facilitate the electronic use of the Khmer language. The Open Forum of Cambodia, for example, offers a file conversion program that translates texts from Khmer to Khmer. This may sound odd but it is necessary because there are different Khmer font systems that are incompatible with each other. The UNICODE Consortium, which is in charge of the character coding system to facilitate "worldwide interchange, processing and display of the written texts of the diverse languages of the modern world," has proposed a solution for the Khmer language. However, there are complaints that the solution is flawed, not user-friendly, and was developed without any official Cambodian input.

Source: Khmer Internet: Cambodia Case Study; available from http://www.itu.int/ITU-D/ict/cs/cambodia/material/KHM%20CS.pdf

How is technology addressing language barriers?

Various (machine) translation services are available. While their quality is not as good as that of professional (human) translation, translation software continues to be developed and improved. Some of these translation tools are downloadable software; some are automated online services; and others are Web services rendered by human translators.

> "One of the things that I'm looking forward to is the ability to translate languages in real time, breaking language barriers. You'll be able to speak on

> the telephone in one language, and the caller will be able to hear you in another language. It will allow many people to have immediate access to more information at their fingertips."
>
> (David K. Allison, technology historian, on the potential of the microprocessor in the next 25 years.)

Human translation is far more accurate than machine translation. But prices for these services are sometimes prohibitive. A translation expert from www.wordzone.com says the price for their services is based on the languages to be used and the number of words in the text.[20]

What is open source? How does it help narrow the digital divide?

Open source is a certification standard issued by the Open Source Initiative (OSI) that states that the source code of a computer program is made available free of charge to the general public. The rationale for this movement is that a larger group of programmers will be able to produce more useful and more stable programs for everyone to use if they are able to examine the source code. The concept relies on peer-review and collaborative software development by programmers from around the world.

In contrast, closed software has source codes that are kept confidential by the developer, like a secret recipe. The limitation is that only the developer can make improvements on the software.

Open source software is not only robust but also relatively inexpensive. Countries that are unable to spend on proprietary software and want to uphold intellectual property rights would find open source software very attractive.

Is open source the same as freeware? And shareware?

Open source, freeware and shareware are terms that are used to describe programs depending on how these programs are distributed.

Programs are called open source when they are distributed with their source code. The OSI uses a more formal definition upon which they base the certification of a program. [21]

Freeware, on the other hand, are programs that are distributed for free. The source code is not necessarily distributed with the software.

Shareware is used to describe a program that is distributed for free but with restrictions. Common restrictions are that the program will work for only 30 or 60 days, or that some features are not fully functional. These restrictions are usually removed once the user pays a fee.

Should developing countries consider using open source?

Yes. Open source software (OSS) has been touted as a highly viable option for developing countries, for several reasons.

Open source is interoperable. By its very nature, open source software is able to operate in a variety of machines and operating systems. It is also a good foundation for Government Information Systems. It is easier to facilitate data exchange among the databases of various companies or government agencies using open source. Data exchange is crucial in the development of a robust e-government infrastructure.

The cost and copyright issues with open source are fewer. The cost of OSS, if any, is usually just the distribution costs. It can be copied and, generally speaking, used freely with no restrictive copyright problems. While there will be training costs in the use of the software, these will be at local rates.

The adaptability of open source allows it to be used in old computers. The hardware requirements of open source are not high, and existing computers can be used. Furthermore, open source software integrates well with networks running other software.

Open source is reliable. This stems from the fact that it is open to scrutiny by any interested programmer. When bugs are found during the development of an open source program, thousands of programmers from around the world have the potential to examine the code and find a solution (often called a “fix”) in the program’s source code. Moreover, security holes and virus outbreaks are quickly addressed because of access to the source code. This is all done for free by volunteers in the open source community. In contrast, closed source programs rely on in-house program developers to create a fix.

Technical support of open source is outstanding due to the culture of cooperation in the open source community. Volunteers give free technical support to users. Web sites are set up for reporting of bugs and sharing of fixes for free. On the other hand, with commercial software millions of dollars are spent in setting up call centers and technical support facilities. These costs are ultimately transferred to the customer.

What is the disadvantage of open source?

Unlike proprietary software, OSS is less likely to provide documentation and professional technical support.[22] In general, OSS does not have as much documentation as proprietary software. Neither does OSS have a full-time technical support department to address customer’s questions or complaints. Although the open source community has Web sites that give support to people who have questions, support is given on a voluntary basis. There is no accountability in OSS. An OSS user cannot complain to any particular company when a question or complaint about OSS is left unanswered. Thus, while OSS usually costs less to acquire, the cost of total ownership must be considered when deciding on OSS or proprietary software.

Box 9. Best Technical Support Award Goes to an Open Source Community

In 1997, the International Data Group (IDG), a world leader in Technology media, research and events bestowed the Best Technical Support Award to the Linux Community. Linux is an open source operating system.

As something you can download for free, Linux doesn't come with the support of a commercial entity, but that's exactly why many readers said they like it. "The online support via Usenet, Web pages, and IRC is far better than anything that you can get from a commercial vendor, as far as resolving real-world problems," wrote one InfoWorld Electric forum participant, who offered the analogy of a Microsoft Access customer calling Microsoft on a hard-to-solve problem. "So imagine, if you will, that the Microsoft staffer on the line directs you to a Web page where you can download free of charge the latest release of SQL Server and a free copy of C++ in order to solve your problem, and then follows this up a week later by emailing you a program that was written in his/her spare time that extends your program in some new way ... `Impossible! [It will] never happen!' you say ... [but] this sort of thing literally happens hundreds of times, every day of the week, all year long."

But can free support from other users really be relied upon as much as support that you've paid for? Many Linux users insist that it can. "While it seems to defy logic, it coincides with my experience," another reader wrote. "With most commercial software, you pay and still don't get any support. Many times [the vendors] deny that there are bugs in their software. If I have problems with a widely used freeware program, there is somebody or other on Usenet who knows the answers. Even better, a search may tell you that your question has already been posed and answered. On the other hand, if I am using free software that is not widely used, the author is usually not swamped with questions and hence [is] always willing to answer questions about his or her baby."

Source: InfoWorld, "Best Technical Support Award goes to an Open Source Community," InfoWorld [home page online]; available from http://ww1.infoworld.com/cgi-bin/displayTC.pl?/97poy.supp.htm; accessed 4 September 2002.

What are developing countries doing to develop their information infrastructure?

The biggest challenge is still how to ensure that adequate and reliable information and communication services are available. Majority of developing countries have low telephone density and low PC penetration. These translate to low Internet penetration.

To develop their information infrastructures, most countries have universal service/access strategies/policies.

The International Telecommunication Union defines universal service as "the provision of telecommunications services permitting access to a defined minimum service of specified quality to all users everywhere, and, in light of the specific national conditions, at an affordable price. The notion of universal service also includes service to disadvantaged users."

The World Trade Organization (WTO) has established a regulatory framework for basic telecommunications services that includes a set of principles that signatories should follow when developing their universal service policies.[23] The universal service

core principles include:[24] (1) transparency; (2) non-discrimination; (3) competitive neutrality; (4) non-burdensome application; and (5) affordable rates.

The concept of universal access has also been introduced in the development literature. Universal access has its roots in the US Communications Act of 1934, which covers telephone, telegraph and radio services and aims to ensure adequate facilities at reasonable charges. The law aims to prevent discrimination on the basis of race, religion, national origin or gender.

The advent of the information society requires the extension of the concept of universal access beyond telephone, telegraph and radio services. Technology has introduced communication and information products and services that require a higher level of skills and abilities, such as the mobile phone or the Internet. But in essence, universal access remains a target for the quality of delivery of certain technologies.

Universal access is a goal that a country can define in many ways-for example, in terms of the ratio of telephones to people and in terms of a percentage of the population within a certain distance or travel time from a phone (e.g., the country's entire population is within 20 kms or 1 hour travel of a telephone).

Box 10. Malaysia Phones Home

Malaysia has made tremendous strides in providing universal access to telecommunication services. From less than 50,000 main telephone lines in 1960, the Malaysian network grew to over 4.5 million by 2000. Teledensity (main telephone lines per 100 inhabitants) has grown 34 times over the same period, from 0.6 to 19.9. The rise in teledensity has paralleled Malaysia's impressive economic growth.

Malaysia has also made impressive strides in household telephone penetration, the basic measurement of universal service. Less than 10% of Malaysian families had a fixed telephone line 20 years ago whereas by the end of 2000 that figure had risen to 69%.

Malaysia has taken a number of steps to reduce discrepancies in nationwide telephone access. A rural public telephone programme has been successful in installing at least one public telephone in all of Malaysia's 4,000 or so villages. The country's telephone tariffs are also pro-rural in that fixed line rentals are cheaper for inhabitants of Sabah and Sarawak and those connected to small exchanges.

The Malaysian Communications and Multimedia Commission (MCMC) proposes to create a fund to which all operators would contribute based on their revenue. Telekom Malaysia Berhad (TMB) is one of five major telecommunications companies. Designated as the Universal Service Obligation (USO) provider under the previous universal service regime, TMB receives contributions from the fund for providing service in uneconomic areas. The MCMC is proposing that other operators assume this responsibility in areas where TMB is not present.

The MCMC distinguishes between collective and individual access. Collective access is through public locations such as payphones, whereas individual access is availability of service in the home. Priority should be given to collective access, says MCMC, and Internet access should be included in the definition of universal service.

Source: "Multimedia Malaysia: Internet Case Study"; available from http://www.itu.int/asean2001/reports/material/MYS%20CS.pdf

The idea of universal service is not new. What are they doing differently today?

Today countries are looking at a market-based approach to expanding information and communications infrastructure and services.

The telecommunication sector has traditionally been seen as a natural monopoly[25]. In the past, many government-operated telecommunications facilities established a State-run monopoly as part of the strategy for jump-starting national telecom infrastructure.

Recently, however, government-owned telecom monopolies have come under criticism. Competition, now considered as one of the most important principles in telecommunications reforms, is projected to encourage the flow of private capital, which is likely to bring down the prices of telecom services. Competition drives telecoms to widen service areas to untapped markets. This helps improve the deployment of telecommunications to niche sectors that a monopoly may refuse to serve altogether. Last but not the least, innovations in telecommunications technologies are more easily deployed in a competitive market where players need to set themselves apart from the other players.

Does liberalization work?

In April 2000, Singapore opened the telecommunications market to full competition as part of the move to strengthen the competitiveness of Singapore as the region's leading communications and information technology hub. It is estimated that within three years following full market liberalization, the total investment from the new activities (excluding 3G mobile and fixed wireless investments) will be about US$1.8 billion. It is further estimated that some 2,500 new jobs will be created.[26]

In 1995, the Telecommunications Act of the Philippines was enacted, setting a policy of competition and liberalization for the telecommunications sector. The years that followed showed a marked increase in the number of main lines installed,[27] with the number more than doubling from 1.4 million in 1995 to 3.35 million in 1996. This figure increased to 5.77 million in 1997. This striking increase in penetration was brought about by the entry of new telecommunications companies in a competitive arena.

These are only two examples of the positive effect of introducing competition in the telecommunications markets.

What are governments doing to improve their national information infrastructure?

Many governments in the Asia Pacific have developed national information infrastructure plans.

Box 11. Competition in Estonia

When Estonia regained independence in 1991, the government embarked on an ambitious project to bring the nation into the digital age. Today, Estonia boasts of one of the most modern telecommunications networks in Europe, low connectivity costs and high rates of computer literacy, even by Western European standards. Twenty-eight percent of Estonia's population is connected to the Internet.

Estonia's strategic investment in wiring the entire country has led to an explosion in ICT applications in banking, education, health, transport and public administration. Through a progressive de-monopolization of the telecommunications industry-mostly through the liberalization of the wireless sector-a more aggressive and diversified approach to the advancement of ICT-related solutions has emerged. These varied options-combining wireless, lease lines and fiber-optic networks-allow for a sustained roll out of infrastructure and improved rural connectivity.

Source: Creating a Development Dynamic: Final Report of the Digital Opportunity Initiative; available from http://www.opt-init.org/framework/pages/appendix3Case3.html

Singapore is already into its fourth ICT development plan. From 1981 to 1985, Singapore implemented its National Computerisation Plan with a focus on a Civil Service Computerisation Program and on developing the IT industry and IT manpower. The years 1986 to 1991 saw the extension of government IT systems to the private sector under the National IT Plan. IT 2000, implemented between 1992 and 2000, called for transforming Singapore into an Intelligent Island. The current plan, Infocomm 21, 2000 - 2005, envisions Singapore as a global infocomm capital, e-economy and e-society.

Japan has created an IT Strategy Council to develop a strategy and plan on infostructure development.[28] Priority will be placed on the following five policy areas:

1. Promotion of High-Speed and Ultra-High-Speed Internet Infrastructure
2. Digitization of School Education and Reinforcement of Human Resource Development
3. Enhancement of Network Content
4. Promotion of Electronic Government and Electronic Local Government
5. Reinforcement of International Activities

Thailand has also been moving toward becoming an information-oriented society. Its National IT Policy focuses on three pillars of IT development.[29] First, invest in the nation's national information infrastructure. Second, invest in the improvement and development of human resources. The third pillar is a government computerization program which runs parallel to the more active role the government plays in facilitating the country's IT development.

Thailand's National IT Policy, IT2000[30], also focuses on the need to provide universal telecommunications service to both urban and rural areas. This is supported by a telecommunications master plan that attempts to address three themes: liberaliza-

tion, privatization, and the establishment of a telecommunications regulatory regime. There are also efforts to promote computer utilization by reducing import tariffs for computers (hardware and software) and imposing mandatory computer literacy for civil servants.

What about broadband deployment?

The various government efforts at hastening broadband deployment fall under three categories.[31] These are:

1. The light touch involves minimal government intervention in the private sector's expansion of broadband networks and services. This approach focuses on transparent regulatory frameworks to encourage competition and open access. Government commits additional funds to skills improvement, education and training, and occasionally research and development. Switzerland and New Zealand use this approach.

2. The cooperative approach focuses on reducing the digital divide by targeting areas and groups where market forces will not adequately address disparities in access. This approach acknowledges that private sector broadband services will provide business centers, major cities and other more affluent areas with broadband even without the assistance or intervention of the government. Thus, the government should be able to focus more on access in poorer rural areas. The government may also focus more on distance education or telemedicine. The United States, Australia, Germany and the United Kingdom use the cooperative approach.

3. Comprehensive National Broadband Plans are nationwide efforts to create an IT proficient populace through infrastructure development and training. Involving government and industry-wide coordination, this approach emphasizes universal broadband access, transparent regulation and extensive education and training programs. Korea, Norway, Malaysia, Singapore and Japan have comprehensive national information infrastructure programs.

How can governments promote convergence?

In most developing countries, the obstacles to convergence are more legal and regulatory than technological. While the technology to make convergence happen is readily available, existing legal and regulatory provisions-which were enacted at a time when communication technologies were separate, distinct and discrete (i.e., radio vis-à-vis television; broadcast vis-à-vis cable transmissions, among others)-impede its growth.

An example of a legislative approach to promoting convergence is the Communications and Multimedia Act (CMA) 1998 of Malaysia[32] (Table 4). This legislation provides for an institutional and regulatory framework to harness the potential of

convergence to drive the multimedia industry. The Malaysian model provides for generic main legislation, with specific issues addressed in regulations but subject to regular review. It created a new a horizontal licensing framework for the old telecoms and broadcasters as well as the online service providers that is not based on the technology employed but on the intentions of the parties in providing the types of services concerned. In addition, the process of deregulation was greatly expedited with the emphasis on access, interconnection, inter-operability of networks and services, competition and quality of service. All of these industries, some of which were already beginning to overlap, were then regulated under the CMA (Table 4).

Table 4. Industry categories[33] of Malaysia's Communications and Multimedia Act

License Category	Activities
Network Facilities Provider (NFP)	Includes ownership of facilities such as satellite earth stations, broadband fibre optic cables, telecommunications lines and exchanges, radio communications transmission equipment, mobile communications base stations and broadcasting transmission towers and equipment
Network Services Provider (NSP)	Includes providing basic connectivity and bandwidth to support a variety of applications
Applications Service Provider (ASP)	Includes providing functions such as voice services, data services, content-based services, electronic commerce and other transmission services
Content Applications Service Providers (CASP)	A special subset of applications service providers, including traditional broadcast services and newer services such as online publishing and information services

Source: Syed Hussein Mohamed, *New Regulatoy Framework For Communications And Multimedia Sector: Subsidiary Legislation* (Communications and Multimedia Commission); available from http://www.cmc.gov.my/cmc_papers/030400Asli.doc.

What are the regional efforts in developing regional information infrastructure?

In November 2000, the Association of Southeast Asian Nations (ASEAN; www.aseansec.org) put together an e-ASEAN Framework Agreement to help develop the competitiveness of the ASEAN ICT sector, reduce the digital divide, promote cooperation between the public and private sectors and promote the liberalization of trade in ICT products, ICT services and investments to support the e-ASEAN initiative.

The e-ASEAN Framework focuses on the implementation of five key initiatives:

1. Facilitation of the establishment of the ASEAN Information Infrastructure
2. Facilitation of the growth of electronic commerce
3. Liberalization and facilitation of trade in ICT products and ICT services, and of investments
4. Capacity building and e-society
5. E-government

The Asia-Pacific Economic Cooperation (APEC; www.apecsec.org.sg) Telecommunications and Information Working Group (TEL) has established a Program of Action for Information and Communications Infrastructure. Its initiatives include:

1. promoting the deployment of advanced, secure and reliable information infrastructure
2. encouraging greater build out of the Internet to promote greater broadband accessibility, availability and use,
3. examining the impact of the Internet and broadband accessibility, availability and use on the economy, especially on small and medium sized enterprises (SMEs);
4. facilitating R&D activities and analyses (financial, technical and policy) of technologies and applications to meet ICT access needs of the APEC region,
5. strengthening its participation and cooperation with the private/business sector in the development of information communications infrastructures and services
6. promoting further the cooperation among governments, businesses, academic communities and social institutions in meeting these challenges;
7. studying and undertaking collaborative projects to advance the implementation of next generation networks and technologies; and
8. continuing to support cooperative activities for better sharing and utilization of the information infrastructure among member economies.

To complement these goals, human capacity building is also on the TEL agenda. One of TEL's goals is to triple the number of people with access to the Internet. It aims to enhance cooperation among training and development organizations, promote e-commerce related training programs and experiences, and provide more opportunities in ICT. The TEL also intends to implement training projects specifically addressing the concerns of developing economies.

Also, at the Brunei APEC Summit in November 2000 the e-APEC Task Force was created to develop an e-APEC Strategy that identifies the necessary policy environment and specifies appropriate goals and actions. The e-APEC Strategy is a forward-looking, long term and action-oriented plan with three pillars.[34] First, it seeks to create an environment for strengthening market structures and institutions. Second, it aims to facilitate an environment for infrastructure investment and technology development. Lastly, it strives to enhance human capacity building and promote entrepreneurship.

Box 12. African Information Society Initiative (AISI)

In May 1996 the ECA Conference of Ministers adopted a resolution entitled "Implementation of the African Information Society Initiative." Its action framework calls for the elaboration and implementation of national information and communication infrastructure plans to include the development of institutional frameworks; human, information and technological resources in all African countries; and the pursuit of priority strategies, programmes and projects which can assist in the sustainable build up of an information society in African countries. The African ministers are convinced that building Africa's information society will help Africa to accelerate its development plans, stimulate growth, and provide new opportunities in education, trade, health care, job creation and food security, and thereby help African countries to leapfrog stages of development and raise their standards of living.

The present programs of the AISI cater to different aspects of the development of the Region's Information Infrastructure:

- The National Information and Communication Infrastructure (NICI) provides the framework for integrating ICT strategies and plans into national and sectoral development plans to facilitate the achievement of national and sectoral development priorities and goals.
- Scan-ICT is an initiative that aims to build African capability to collect and manage key information needed to support the growing investment in ICTs. The goal is to create a pan-African ICT network that will be coordinated and supported by an observatory/research institute.
- Information Technology Centre for Africa (ITCA) focuses on making policy and decision makers aware of the many benefits of ICTs for accelerating the socio-economic development of the continent.

Source: "About the African Information Society Initiative," AISI [home page online]; available from http://www.uneca.org/aisi/abtaisi.htm; accessed 18 September 2002.

Will developing countries be able to catch up with developed countries with respect to ICT infrastructure?

Developing countries have unique advantages as they build their ICT infrastructure "late in the game". These are:

Knowledge of best practices. Developing countries have the advantage of knowing the best practices from countries that developed their infrastructure earlier. This knowledge is important for avoiding major mistakes that have occurred in the past.

Fully developed technology. Developing countries also have the advantage of choosing fully developed hardware and software. Customers who use technology or software that is prematurely deployed incur costs in maintenance or, worse, incompatibility. Developing countries will benefit by using reliable and mature technology.

Lower cost. As the technology of certain hardware matures, the production of the hardware further improves. This translates to a corresponding decrease in cost.

For developing countries, the question is not whether to build and/or improve their information infrastructure. The question is "when" and "how".

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Figure 2. Adapted from TeleGeography, “Major Interregional Internet Routes, 2001,” TeleGeography [home page online]; available from http://www.telegeography.com/resources/statistics/internet/pg02_major_internet_routes.html; accessed 18 September 2002.

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The Internet Time line. Adapted from “Hobbes’ Internet Timeline” Copyright (c) 1993-2003 by Robert H Zakon.

The cellular phone tower, fiber optic cable and satellite dish are building blocks of the global Internet infrastructure.

The cellular phone tower photograph is used with permission from EMF Services with website at http://www.emfservices.com .

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GLOSSARY

3G - Third Generation Wireless, wireless systems that provide high-speed data transmission (144kbps and higher). The system is equipped to handle regular mobile phone calls, short message service (SMS), email, Internet access and video.[35]

Bluetooth - a short-range wireless technology that links fixed or mobile devices such as mobile phones, PDAs, printers, audio players and other electronic appliances

Broadband - a type of data transfer in which a single wire can accommodate several data paths at once. Depending on the type of broadband connection, data speeds are from 2 to 20 times faster than ordinary dial-up connections.

Bug - an error or defect in software or hardware that causes a program to malfunction

Convergence - the coming together of two or more disparate disciplines or technologies

Cookie - a message stored by a Web site in a user's computer so that the Web site can adjust its features to suit the user

Cracker - individuals who gain unauthorized access to computer systems for the purpose of stealing and corrupting data. See also Hacker.

Cybercrime - a criminal offense that has been created or made possible by the advent of computer technology[36]

Denial of Service (DoS) - a type of attack that floods a network with excessive traffic, rendering it useless to legitimate customers

DNS - Domain Name System; Domain Name Service

DVD - Digital Video Disk

Firewall - data protection device that restricts and controls the flow of data traffic between networks, typically between an internal corporate network and the Internet

FTP - File Transfer Protocol, a protocol for transferring files from one device (e.g., a workstation or a server) to another

Hacker - A slang term for a computer enthusiast, i.e., a person who enjoys learning programming languages and computer systems and who is often considered an expert on the subject(s). See also Cracker.

HTML - Hypertext Markup Language, the authoring language used to create documents on the World Wide Web

HTTP - Hypertext Transfer Protocol, the underlying protocol used by the World Wide Web

Infrared - light waves used to transmit data

Internet Explorer - A Web browser developed by Microsoft Corporation

ISDN - Integrated Services Digital Network, the international communications standard for sending voice, video, and data over digital telephone lines or normal telephone wires

ISP - Internet Service Provider, a company that provides access to the Internet

LAN - Local Area Network, a computer network that spans a relatively small area, typically a small office or home
Last mile - the portion of the cable or telephone company that is wired directly to the customer's home

Modem - Modulation/Demodulation, a device that enables a computer to transmit data over telephone lines

Netscape Navigator/Communicator - a Web browser that revolutionized the computer software market by giving away for free its popular Navigator Web browser, thus acquiring an overwhelming market share in the mid-1990s

OSS - open source software

P3P - Platform for Privacy Preferences (P3P) Project

PGP - Pretty Good Privacy

POTS - Plain Old Telephone Service

PSTN - Public Switched Telephone Network

Protocol - an agreed-upon format for transmitting data between two devices

Source Code - a computer program's instructions in its original form

TCP/IP - Transmission Control Protocol / Internet Protocol

Telnet - allows users to log into remote computers and provides basic communication functions between computers

Telecenter - a public establishment that offers telecommunications services such as Internet access, landline or mobile phone calls, facsimile and video conferencing
Unicode - a standard for representing characters as integers designed to support the worldwide interchange, processing, and display of the written texts of the diverse languages of the modern world

USB - Universal Serial Bus, a data communication standard that can be used to connect to computer peripherals such as a mouse, printer, modem, audio device, digital camera etc.

VSAT - Very Small Aperture Terminal, an earthbound station used in satellite communications of data, voice and video signals, excluding broadcast television

W3C - World Wide Web Consortium, an organization that develops interoperable specifications, guidelines, software, and tools for the Web (Web site: http://www.w3.org)

WAP - Wireless Application Protocol, a communication protocol that allows users to access information instantly via handheld wireless devices

WLAN - Wireless Local Area Network

Wireless - technologies that transmit data between devices without using connecting cables

XML - Extensible Markup Language

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