Lecture 1. Basic concepts of ICT, the role and applicability of ICT in modern society.

Definition - What does Information and Communications Technology (ICT) mean?

Information and communications technology (ICT) is an extended term for **information technology (IT)** which stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals), computers as well as necessary enterprise software, middleware, storage, and audio-visual systems, which enable users to access, store, transmit, and manipulate information.

The term ICT is also used to refer to the convergence of audio-visual and telephone networks with computer networks through a single cabling or link system. There are large economic incentives (huge cost savings due to elimination of the telephone network) to merge the telephone network with the computer network system using a single unified system of cabling, signal distribution and management.

However, ICT has no universal definition, as "the concepts, methods and applications involved in ICT are constantly evolving on an almost daily basis." The broadness of ICT covers any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form, e.g. personal computers, digital television, email, robots. For clarity, Zuppo provided an ICT hierarchy where all levels of the hierarchy "contain some degree of commonality in that they are related to technologies that facilitate the transfer of information and various types of electronically mediated communications". Skills Framework for the Information Age is one of many models for describing and managing competencies for ICT professionals for the 21st century.

ICT (information and communications technology - or technologies) is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning. ICTs are often spoken of in a particular context, such as ICTs in education, health care, or libraries.

The phrase *Information and Communication Technology* has been used by academic researchers since the 1980s, and the term *ICT* became popular after it was used in a report to the UK government by Dennis Stevenson in 1997 and in the revised National Curriculum for England, Wales and Northern Ireland in 2000. But in 2012, the Royal Society recommended that the term *ICT* should no longer be used in British schools "as it has attracted too many negative connotations", and with effect from 2014 the National Curriculum was changed to use the word *computing* reflecting the addition of computer programming to the curriculum. A leading group of universities consider ICT to be a soft subject and advise students against studying A-level ICT, preferring instead A-level Computer Science. Variations of the phrase have spread worldwide, with the United Nations creating a "United Nations Information and Communication Technologies Task Force" and an internal "Office of Information and Communications Technology".

Basic concepts of ICT

IT (Information Technology) encompasses all of the technology that we use to collect, process, protect and store information. It refers to hardware, software (computer programs), and computer networks.

ICT (Information and Communication Technology)

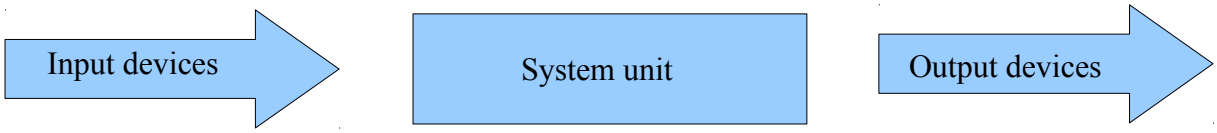
This concept involves transfer and use of all kinds of information. ICT is the foundation of economy and a driving force of social changes in the 21st century. Distance is no longer an issue when it comes to accessing information; for example, working-from-home, distance learning, e-banking, and e-government are now possible from any place with an Internet connection and a computing device.

HARDWARE

1.1. HARDWARE BASICS

The concept of hardware includes computer components, the physical and tangible parts of the computer, i.e., electrical, electronic and mechanical parts which comprise a computer.

Computer working principle:



Computer working principle: data are entered into a computer via input devices, then are processed and stored in a system unit, and are finally displayed by the output device.

PERSONAL COMPUTER

Personal computer (PC), as the name suggests, is intended for personal use, as opposed to the server, which is used by a larger number of people simultaneously, from different locations, often via terminals. If you do not intend to move your computer frequently from one place to another, and at the same time you want maximal price/performance ratio, then you should use a desktop computer. In comparison to laptops or tablet computers, it is much larger in size, inconvenient to carry/move, consumes more electricity but has a much better price/performance ratio. Also, they are much easier to upgrade.

LAPTOP OR TABLET PC

Laptop or tablet PC is used by individuals who have the need to travel with a computer or simply use them for aesthetic reasons when computing power is not an issue. Laptop computers, as opposed to tablet PCs, more closely resemble a personal computer when it comes to data input. Data entry is done via keyboard and mouse, while the tablet PC data entry is done via touch screen.

Unlike desktop computers, notebooks and tablet PCs are optimized for portability, low power requirements at the expense of performance and can be used (for a limited period of time-i.e. until the batteries are depleted) without connection to the power grid. In order to prepare a laptop or a tablet computer for use without a power connection, it is necessary to recharge the batteries.

PORTABLE DIGITAL DEVICES

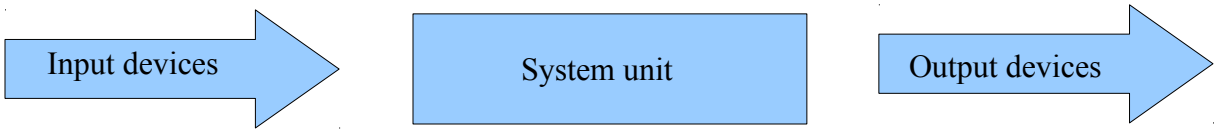
PDA-Personal Digital Assistant (PALM) is a convenient small sized computer. It easily connects to mobile phones and can prove a good solution for less demanding users. As the name suggests, it is a device that fits in the user's palm. Its name directly tells us that this computer is more of an assistant and not a workstation-whose name suggests the superiority in capabilities and computing power, especially in comparison with PDA.

Mobile phone is a portable electronic device used for distant communication. In recent years, mobile phone has evolved from simple communication device into a multi-functional device. Additional functions, such as short text messaging (SMS), electronic mail, Internet access, contact registration, calculator, clock, alarm, recording and photograph displaying, recording and playback of video clips, sending/ receiving multimedia messages (MMS), audio recording and playback, etc. has turned the mobile phone into an extremely useful device, whose absence would make active involvement and participation in a modern society not possible.

Smartphone is a device that merges functionality of phones, PDAs, cameras, camcorders and computers. To function properly, Smart phones use operating systems, which are the basis for application development. Some smart phones can be connected to an external screen and keypad, which creates a working environment, similar to that of a laptop or a desktop computer. Some operating systems for Smartphone are: GoogleAndroid, Symbian, Blackberry, PalmPilot, and WindowsPhone.

MAIN COMPUTER PARTS

As already stated, computer's functionality can be divided into:



Basic computer working principle: data is entered into a computer via input devices, processed and stored in a system unit, and displayed by the output device.

SYSTEM UNIT

The system unit (case) contains a computer's vital parts. There are two basic types of cases:

- Desktop casing is placed on a desk in a horizontal orientation.
- Towers come in 3 sizes (mini-tower, mid-tower and full-tower) and it is vertically orientated.

Motherboard, MBO is computer's basic circuit, to which all computer components are connected, directly or indirectly. Devices are connected to the motherboard through a system bus. System bus connects all devices, ensures data flow and communication between different devices using predefined protocols.

Protocol describes a manner in which communication between devices is defined. It enables them to address each other and defines how they should look for each other on either system bus or network. Buses can, according to the purpose, be divided into:

- Serial-USB, Firewire, etc.
- Parallel-AGP, PCI, etc.
- Mixed-Hyper Transport, InfiniBand, PCI, etc..

Central Processing Unit (CPU or processor) is a central part of a computer (and can be referred to as the computer's "brain"). It manages all other computer parts, monitors their mutual communication and performs arithmetic-logical operations. Processor speed is measured in hertz (or megahertz or gigahertz). Most famous manufacturers for personal computer processors are Intel and AMD.

Cache is a small capacity memory which allows quick access to data. By storing data from working memory in cache, the speed of communication between processor and RAM is increased. Microprocessors use three levels of fast cache, L1, L2 and L3, used to store often used data.

ROM (Read Only Memory) is a type of permanent, internal memory that is used solely for reading. BIOS (Basic Input/Output System), a program which is located in a separate ROM on the motherboard, and defines, as the name suggests, basic input/output system, is a good example. Please note that not all BIOS programs are stored in ROM.

RAM (Random Access Memory) is a working memory in which analyzed data and programs are stored, while computer runs. It allows reading and writing data, and is deleted/cleared when the computer shuts down.

Hard Disk Drive (HDD) is a place for permanent data storage (it does not delete/clear when computer shuts down). Its features are: large capacity, faster performance in comparison to optical devices but slower in comparison to RAM and are used for permanent data storage. We can distinguish between internal and external hard drives.

Floppy Disk Drive is used for storing and reading data stored on a floppy disk. Disk capacity is 1.44MB. Before memory stick and a wider usage of CD recorders, it was used as data carrier. 'Modern memory sticks have a memory capacity measured in GB while floppy disks only have memory capacity of 1.44MB, indicating that floppy disks are becoming obsolete.

CD-ROM drive is used for reading CD media.

DVD drive is used for reading DVD discs. DVD disc capacity ranges from 4.7 to 18GB.

Soundcard is a device used for sound creation and production by means of computer speakers.

Graphics card is responsible for image processing and displaying it on a monitor. It has its own graphics processor and memory. Image quality depends on the strength of these components.

Modem enables computers to communicate via telephone lines. They connect computers to the Internet.

Connectors or ports are slots visible in the back and the front side of a computer.

COMMON INPUT / OUTPUT PORTS

Universal Serial Bus (USB) is used to connect various devices (mouse, keyboard, USB memory).

Serial port is used for example in connecting a mouse (labeled COM1 or COM2).

Parallel port is used for connecting a local printer (LPT1 or LPT2).

Network port is used for connecting computers to a network.

Firewire - used for connecting computers and audio-video devices (digital cameras, etc.).

1.2. COMPUTER PERFORMACE

Factors affecting computer performance:

- processor clock speed, amount of cache and number of kernels
- the amount of installed RAM
- graphics card-its memory and processor
- clockbus
- number of running applications

Applications use computing resources. The processor runs applications and performs code that defines applications; therefore processors get the most workload when it comes to running the application. In order for processors to execute the application, it is necessary for application code to be loaded into the system memory. As a result, running applications take up a certain amount of working memory. The more applications are running, the greater the load on the processor and RAM .That is why the computer's performance depends on both the processor (clock speed, number of cores, cache memory), and the amount of working memory, as well as the number of applications running.

Processor speed is measured in hertz (Hz), and due to a large working clock speed of today's processors, it is expressed in megahertz (MHz) or gigahertz (GHz). Besides the frequency, the processor performance depends on the number of operations that the arithmetic-logic unit (ALU) performs in one clock cycle.

1.3. MEMORY AND STORAGE DEVICES

ROM (Read Only Memory) is a type of permanent, internal memory that is used solely for reading. BIOS (Basic Input/Output System), a program which is located in a separate ROM on the motherboard, and defines, as the name suggests, basic input/output system, is a good example

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Measurement units

Bit (binary digit) is the basic unit used to measure the amount of information. A byte or octet contains eight bits.

1 KB (kilobyte) - 1024 B (approx. 1000 B)
1 **MB (megabyte)** - 1024 KB (approx. 1000 KB)
1 GB (gigabyte) - 1024 MB (approx. 1000 MB)
1 TB(terabyte) - 1024 GB (approx. 1000 GB)

BASIC TYPES OF STORAGE DEVICES

CD (Compact Disc) is an optical disc used for data storage. The standard capacity of a CD is 700MB. CD-R is used for reading and writing data one time-only, while CD-RW for reading and writing data multiple times.

DVD (Digital Versatile Disc) is an optical disc which is, due to the larger capacity (about 4.7 GB), mostly used for video storage.

Blu-ray disc (BD) - the successor to DVD, is an optical disk storage, it comes in different capacities, depending on how many layers it has and the capacity of each layer. Currently, the capacity of one layer is between 27 GB and 33 GB, while the overall capacity is the product of the number of layers and capacity of each layer.

Memory card is a type of flash memory used to store data in digital cameras, cell phones, MP3 players etc.

USB Stick is a data storage device. It features small dimensions, relatively high capacity, reliability and speed. It belongs to the type of flash memory that remembers data, even when not under voltage i.e. they do not need electric power to maintain data integrity.

There is a difference between an internal hard disk drive, which is embedded in the computer case, and an external hard disk drive, which is connected to a computer by using an appropriate cable or USB port, and is usually used to transfer data from one computer to another or for backup.

1.4. INPUT AND OUTPUT DEVICES

Input devices:

Mouse is an input device that facilitates work with the graphical user interface (GUI). The mouse transmits hand movements and the screen displays the cursor (mouse pointer) movements. They are divided into mechanical and optical (with respect to a transfer movement), and wired and wireless (with respect to connection).

Trackball, unlike a mouse, is not movable. Hand movements are transmitted to the screen by rolling the ball which is located on the upperside of the device.

Keyboard is used for data entry and is suing commands. They can also be wired or wireless.

Scanner is used to load data (image, text, etc.) from the printed material into a computer. The result of scanning is an image, but with special programs, if we scan the text, we can get a text as a result. Software used to recognize text from image is called a text recognition tool.

Touchpad is used for transmission of hand movement, but unlike working with a mouse, the user is the one who determines the position of the cursor by touching the touchpad.

Lightpen enables handwriting on screen and can be used as a mouse. It requires an appropriate monitor type.

Joystick: mainly used in computer games. Unlike a mouse, it has many buttons which allow control over game objects.

Microphone is a device that converts sound into an electrical signal, which can be stored on a computer. It is mainly used for recording sound, communication between players in online games, in combination with a web camera in video conferencing, for converting voice into text on a computer (speech-to-text processing (e.g., textual files or emails), etc.

Webcam is a camera that stores video signal in a format appropriate for video transfer over the Internet in realtime.

Digital camera, unlike analog, stores photographs in digital format. It can be directly connected to a computer and photographs can be downloaded. Photograph quality is expressed in megapixels. More megapixels mean better quality of photograph, however more memory is occupied.

Output devices:

Monitor displays images from the computer, it enables us to see, work and control computers. In other words, working on a computer without a monitor would be inconceivable. Common types of monitors, with regard to manufacturing technology, are the CRT and LCD. CRT monitors have been present on the market for a long time, and other technologies are pushing them out. They are based on cathode tube technology. LCD monitors use liquid crystal technology. In comparison with CRT monitors, LCD monitors use less electrical energy, do not emit radiation and their price is higher, however due to smaller dimensions, more attractive design and a good picture quality, they are pushing CRT monitors out of the market. Monitor size is expressed by the size of screen diagonal and measured in inches ("). Picture quality is expressed with the notion of resolution, which is a number of horizontal

and vertical dots (pixels) (e.g. 1920x1080).

Projector is a device used to project a computer image or other images from independent devices, such as DVD players, Blu-ray player, etc. onto canvas or a wall.

Printer is a device used for printing data from a computer onto a paper. We distinguish between local printer (connected directly to the computer) and network printer (connected directly to network using a network card). Also, printers also differ according to print technology: dot matrix, laser, inkjet, thermal printer and plotter.

Dot matrix printers are the oldest, with the lowest price of print per paper, they are slow, make a lot of noise while printing, and are mostly appropriate for printing text.

Laser printers are similar to photocopy devices when it comes to technology. They have exceptional print quality, speed and are quiet. Downsides of laser printers are their high price and high price of toners.

Inkjet printers have a high print quality (somewhat lower in comparison with laser printer), they are quiet while printing, and have low initial investment. Ink price, especially color ink, can cost as much as the printer itself. Printing technology is based onink dispersion from container onto paper.

Plotter is used for printing large drawings (up to A0). They are extremely expensive and used only for professional purposes, such as in designing firms for printing technical drawings (blueprints).

Thermal printer, as its name states, leaves a print on the paper by utilizing heat. They use paper sensitive to heat, feature small dimensions; they are quiet while printing and relatively cheap. They are usually used for printing receipts, and owing to that they are called POS printer (printer of sale). Also, they are used as calculator printers and due to their small dimensions, as portable printers.

Input and output devices

Storage devices, due to necessity for writing and reading data, they are classified as input/output devices.

Touch screen (i.e. monitor sensitive to touch) is out device while displaying computer image, and at the same time input device while receiving manual orders.

2. SOFTWARE

Software is, unlike hardware, intangible part of the computer. It consists of a sequence of commands, written according to strict rules. Programs are written by programmers, in various programming languages.

Software types:

Operating system is a program which manages computer hardware. First computers did not have operating systems; they had programs that were directly loaded into the computer (e.g. punchcards). Today, computers have an operating system which loads into the computer's memory during its startup. Computer functions are based on its operating system. Within operating system, drivers (responsible for the functioning of a computer) and various utility programs (responsible for the functionality of a computer) are installed. The most famous operating systems are:

1. Linux (Debian, Ubuntu, Fedora, Knoppix,...) - open source software
2. Microsoft Windows (XP, Vista, 7,...) - proprietary software
3. Mac OS X (Cheetah, Panther, Snow Leopard,...) - proprietary software

Application Software (Utility programs) are all programs that users use to perform different tasks or for problem solving. Users, according to his/her needs, install the appropriate utility software. Computer functions and tasks that computers can perform are defined by the installed utility software. Utility software can often cost more than computer hardware unless the software is open source.

Common utility softwares are:

Text processing software is used for creating and forming text documents and nowadays, they can contain images, charts and tables. Examples of such programs are OpenOffice.org Writer (open source software) and MicrosoftWord (proprietary software).

Spreadsheet calculations software is used for performing various calculations and

presentation of results in charts. Examples of such programs are OpenOffice.org Calc Writer (open source software) and MicrosoftExcel (proprietary software).

Software for presentations is used to create professional presentations that consist of slides with graphical and textual elements. Such a presentation can afterwards be displayed as a "slide show" by using a projector. Examples of such programs are OpenOffice.org Impress (open source software) and MicrosoftPowerPoint (proprietary software).

Software for creating and managing database helps to manage a collection of structured data. Examples of such programs are OpenOffice.org Base (open source software) and MicrosoftAccess (proprietary software).

Common utility software installed on a computer:
- office programs - OpenOffice.org, Microsoft Office
- antivirus programs – Avira, Sophos, Kaspersky, Antivir etc.
- Internet browser: Mozilla Firefox, Microsoft Internet Explorer, Opera, Safari etc.
- programs for image editing: Adobe Photoshop, Canvas, CorelDraw, Draw etc.

2.1. PROGRAMS TO FACILITATE EASIER COMPUT ER ACCESSIBILITY

We can access accessibility options: Start menu → All Programs → Accessories → Ease of Access

Magnifier is used to enhance a part of the screen.

On-Screen Keyboard – text is entered using a mouse to click on the on-screen keyboard.

Narrator is commonly used by users with visual impairment - it can read text displayed on monitor, it tells current cursor position, and describes certain events, like warning and error messages generated by OS.

Windows Speech Recognition enables speech recognition, i.e. recognizes spoken word, transfers it to text and enters it into a document; therefore it enables you to dictate a text to a computer, to browse the web using your voice etc.

3. NETWORKS

Computer network is comprised of at least two, connected, by wire or wireless, computers that can exchange data i.e. communicate. There are many reasons for connecting computers into a network, and some of them are:

- exchange of data between users that have network access,
- access to shared devices, such as network printers, network disks, etc.,
- enables user communication and socializing, etc.

Internet is the most famous and most widespread network with nearly2 billion users and the number of users is still growing.

3.1. TYPES OF NETWORKS

Types of networks according to their size:

- **LAN (Local Area Network)** - a network that covers a relatively small geographical area - it connects computers within a firm or household by wire,
- **WLAN(Wireless Local Area Network)** - a network that covers a relatively small geographical area - it connects computers within a firm or household wirelessly,
- **WAN (Wide Area Network)** - a network that covers a relatively large geographical area - it connects a greater number of computers and local networks.

Terms: client / server

Relationship client - server is defined in the following manner: client sends requests and server responds to those requests. We can use Internet as the best known example. User's computer, connected to the Internet, sends requests to a certain web page (by entering page address into the Internet browser Address bar), and the server responds. Web page is loaded into the user's computer Internet browser as a result of server response. From this example, we can see that communication between client and

server depends on connection speed (bandwidth). Since bandwidth is limited, the amount of data that can flow through network is limited too. Today, for instance, while purchasing access to mobile Internet, you will notice a limited amount of data that can be transferred within a package, i.e. amount of transferred data is what is charged.

The reason for that is limited bandwidth of mobile networks, and since companies that are offering mobile Internet access do not want networks to be congested, they de-stimulate their users by charging amounts of money related to the amount of transferred data. That was the case with ADSL Internet access. Today, once Internet providers have developed communication infrastructure, they do not need to de-stimulate users by charging based on the amount of transferred data, therefore they are offering so called "flat rate" access) charging only based on the access speed. That is why you will, while listening or reading news about communication technologies, have the opportunity to hear how important it is to develop communication infrastructure.

Types of networks according to their architecture:

- client-server - all clients are connected to the server,
- P2P (peer to peer) - all computers are clients and servers at the same time.

INTERNET, INTRANET, EXTRANET

Internet ("network of all networks") is a global system comprised of interconnected computers and computer networks, which communicate by means of using TCP/IP protocols. Although, in its beginnings, it emerged from the need for simple data exchange, today it affects all domains of society.

For example:

- Economy: Internet banking (paying bills, transferring funds, access to account, access to credit debt, etc.), electronic trading (stocks, various goods, intellectual services, etc), etc.
- Socializing: social networks, forums...
- Information: news portals, blogs etc.
- Healthcare: diagnosing disease, medical examinations (for people living on an island or in other remote places, some examinations, that require a specialist, can be done remotely), making appointments for medical examinations, the exchange of medical data between hospitals and institutes, surgery and remote surgery monitoring
- Education: online universities with webinars (web + seminar), websites with tutorials, expert advice, Ideas Worth Spreading @ www.TED.com, etc.

Internet really does have many applications and a huge social impact. Perhaps the most important trait is information exchange, because information exchange among people enables collaboration, collaboration of like-minded people leads to ideas and actions in real life, and coordinated actions of people results in social change.

Intranet is a private network of an organization to which only authorized employees have access (login and password).

Extranet is part of Intranet, to which independent collaborators have access.

DATA FLOW/TRANSFER

Download is a term that implies taking a copy of digital data from a network computer on a local computer, and upload means placing digital content on a network computer. For example, when you saved a copy of some book from the some web site to your computer, you have downloaded digital data, that is, the book. Likewise, when someone finished writing this book, he has placed it (uploaded) it on the network computer (his Internet server).

Bitrate represents speed at which data is transferred through a modem (network). It is measured in bit/s (bit per second). bit/s is/are a measurement unit for speed of digital data flow through the network. The number of bits transferred in one second tells us how many bits can be transferred through a network in one second.

1,000 bit/s rate = 1 kbit/s (one kilobit or one thousand bits per second)

1,000,000 bit/s rate = 1 Mbit/s (one megabit or one million bits per second)
1,000,000,000 bit/s rate = 1 Gbit/s (one gigabit or one billion bits per second)

Speed of data flow can be expressed in bytes per second. Since one byte has eight bits, such is the relation between bit/s and Bp/s, i.e. bits per second and bytes per second.

Ways to connect to the Internet:

- Dial-up Internet access method uses a modem (56k) and a telephone line.
- Broadband is characterized by a high-speed data transfer, permanent access to the Internet, and thus the risk of unauthorized access to the network or your personal computer.

Connection methods:

- Mobile - connecting by using a mobile network (GPRS, EDGE, UMTS, HSPA)
- Satellite - commonly used in parts of the world where there is no proper infrastructure and there is no other way of accessing the Internet
- Wireless (Wi-Fi) - data is transferred between computers by using radio frequencies (2,4 GHz) and the corresponding antennaes
- Cable - connecting to the Internet through television cable network using a cable modem
- Broadband is characterized by a high-speed data transfer, permanent access to the Internet, and thus the risk of unauthorized access to the network or your personal computer. In the beginning of broadband Internet access, due to underdeveloped communication infrastructure, Internet providers charged based on the data traffic but not time spent on the Internet (unlike dial-up Internet access). Today, in large cities, telecommunications infrastructure is developed, therefore Internet providers do not charge money based on the time spent on the Internet or the amount of transferred data but they do charge by access speed.

The role and applicability of ICT in modern society

In modern society ICT is ever-present, with over three billion people having access to the Internet. With approximately 8 out of 10 Internet users owning a smartphone, information and data are increasing by leaps and bounds. This rapid growth, especially in developing countries, has led ICT to become a keystone of everyday life, in which life without some facet of technology renders most of clerical, work and routine tasks dysfunctional. The most recent authoritative data, released in 2014, shows "that Internet use continues to grow steadily, at 6.6% globally in 2014 (3.3% in developed countries, 8.7% in the developing world); the number of Internet users in developing countries has doubled in five years (2009-2014), with two thirds of all people online now living in the developing world."

However, hurdles are still at large. "Of the 4.3 billion people not yet using the Internet, 90% live in developing countries. In the world's 42 Least Connected Countries (LCCs), which are home to 2.5 billion people, access to ICTs remains largely out of reach, particularly for these countries' large rural populations." ICT has yet to penetrate the remote areas of some countries, with many developing countries dearth of any type of Internet. This also includes the availability of telephone lines, particularly the availability of cellular coverage, and other forms of electronic transmission of data. The latest "Measuring the Information Society Report" cautiously stated that the increase in the aforementioned cellular data coverage is ostensible, as "many users have multiple subscriptions, with global growth figures sometimes translating into little real improvement in the level of connectivity of those at the very bottom of the pyramid; an estimated 450 million people worldwide live in places which are still out of reach of mobile cellular service."

Favorably, the gap between the access to the Internet and mobile coverage has decreased substantially in the last fifteen years, in which "2015 is the deadline for achievements of the UN Millennium Development Goals (MDGs), which global leaders agreed upon in the year 2000, and the

new data show ICT progress and highlight remaining gaps." ICT continues to take on new form, with nanotechnology set to usher in a new wave of ICT electronics and gadgets. ICT newest editions into the modern electronic world include smart watches, such as the Apple Watch, smart wristbands such as the Nike+ FuelBand, and smart TVs such as Google TV. With desktops soon becoming part of a bygone era, and laptops becoming the preferred method of computing, ICT continues to insinuate and alter itself in the ever-changing globe.

Information communication technologies play a role in facilitating accelerated pluralism in new social movements today. The Internet according to Bruce Bimber is "accelerating the process of issue group formation and action" and coined the term accelerated pluralism to explain this new phenomena. ICTs are tools for "enabling social movement leaders and empowering dictators" in effect promoting societal change. ICTs can be used to garner grassroots support for a cause due to the Internet allowing for political discourse and direct interventions with state policy as well as change the way complaints from the populace are handled by governments.