Summary

# Basics of IT

EASY4ME

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# 1. Basics of ICT

## 1.1. Information and communication technology (ICT)

**Information and communication technology (ICT)** refers to all technical systems and applications that collect, store, process and pass on information. These include computers, smartphones, networks and the Internet.

Today, ICT is an essential part of daily life and enables digital work processes, worldwide communication and rapid exchange of information.

## 1.2. Areas of application of ICT

- **Education**: Online learning platforms, digital classrooms, e-learning and simulations support learning processes.
- **Economy**: Companies use ICT for e-mail, video conferencing, databases, online shops and digital production control.
- **Administration**: Citizen services (e.g., online tax returns, e-government), electronic file management.
- **Communication**: Social networks, messaging services, video telephony enable worldwide contacts in real time.
- **Leisure**: Streaming services, online gaming, social media, digital photography, and music.

ICT permeates almost all areas of life and is changing the world of work and society in the long term.

**Example:**
A student uses a learning platform for homework, her parents do their tax return online, and in the evening the family streams a movie.

## 1.3. Cloud computing

Cloud computing means that data, programs, or computing power are no longer stored or executed only on one's own device but are provided via the Internet by external providers.

**Advantages:**

- Access from **anywhere**, **anytime**.
- Real-time collaboration (e.g., Google Docs, Microsoft 365)
- **Flexible** memory size, no need for your own server.

**Risks:**

- **Data protection**: Data is stored on third-party servers – risk of misuse or inadequate security.
- **Dependency on the provider**: Availability and access rights depend on the service provider.
- **Internet connection required**: No access without network.

**Example:**
A company stores documents in the cloud so that all employees can access them even when working from home.

## 1.4. Hardware

Hardware includes all the technical parts of a computer or device that can be touched: monitor, printer, mouse, computer, hard drives, smartphones, etc.

### Types of computers

- **Personal computers (PCs)** are used by individuals. Forms:
  - **Desktop computer:** stands on or under the desk
  - **Notebook/laptop:** portable computer with integrated keyboard, screen, and battery
- **Tablet PC:** particularly light, flat device with touchscreen, usually without a fixed keyboard; Operation via finger or stylus
- **Smartphone:** Mobile phone with internet access and the ability to install apps.

*Processor*

### Main components of the computer

- **Processor – CPU (Central Processing Unit)**
  The central processing unit of the computer, which executes commands and controls processes.
- **Working Memory (RAM = Random Access Memory)**
  Temporary memory for data that is needed during use. Parts of the operating system are loaded into RAM at startup. Attention: RAM is a **volatile memory** – after turning it off, all data stored in it will be lost.
- **Hard disk (HDD)** or **SSD**: Data storage with a capacity of several terabytes. SSDs work like hard drives but have no moving parts and are significantly faster.


*RAM Memory*


*Hard drive open, 2 TB*


*SSD*

### What factors affect computer performance?

- **Processor speed (CPU clock speed):**
  Measured in megahertz (MHz) or gigahertz (GHz). Modern processors reach clock speeds of up to 5 GHz.
- **Number of processor cores**
  The more cores there are, the more tasks the processor can process at the same time. Examples: single-core (1 core), dual-core (2 cores), quad-core (4 cores), etc.
- **Working Memory (RAM)**
  A larger RAM reduces the number of accesses to the significantly slower hard drive. Standard PCs today usually have 8 GB or more of RAM. For special tasks such as video editing, RAM up to 64 GB may be required.
  *The Windows + Pause key combination can be used to display the size of the built-in RAM.*
- **Disk Speed (SSD vs. Hard Drive)**
  SSDs read and write data significantly faster than traditional hard drives. Replacing a hard drive with an SSD can significantly increase system performance.
- **Number of programs running at the same time**
  Many open programs consume memory and slow down the system. Applications that are not

needed can be closed to free up performance. → All running programs are visible in the taskbar. **Right-clicking** on the icon and the **Close window option** will close the program.

### Internal devices – permanently installed in the computer:

- **SSD** or **hard drive** – serve as mass storage for data
- **Optical drives**—e.g., Blu-ray and/or DVD drives, rarely used anymore
- **Touchpad** – controls the mouse cursor in notebooks-**Touchscreen:** Smartphones, tablets and some notebooks, e-book readers, navigation devices, ticket machines, ATMs in banks have a touch-sensitive monitor that is operated with a finger or pen.
- **Webcam and microphone** – integrated into many mobile devices

### External devices (*peripherals*) – are connected to the computer:

- **Input Devices:** Mouse, Keyboard
- **Output Devices:** Monitor, Speakers
- **Storage devices:** external hard drives (USB), USB flash drives, SD memory cards
- **Printer:** Laser or inkjet printer
- **Scanners:** digitize images and texts; files are created from photos or printed material.
  Example: Large companies such as insurance companies scan incoming letters directly, so that employees only process them digitally on their PCs.

### Interfaces – connect computers to devices:

- **USB** (**U**niversal **S**erial **B**us**):** common interface for connecting external devices such as mouse, keyboard, printer, scanner, hard drives, USB flash drives, cameras etc.
- **USB-C:** modern, reversible USB connector; supports very fast data transfer, high charging power (Power Delivery), and often video/audio transmission (e.g., DisplayPort Alt Mode). Increasingly replaces older USB types.
- **HDMI:** digital interface for transmitting image and sound; used for TVs, projectors, and monitors.
- **VGA:** older, largely outdated interface for monitors.
- **DisplayPort:** digital interface for image and sound transmission, similar to HDMI, often used for computer monitors.
- **Network connection (Ethernet)**: for connecting to a LAN or the Internet.


*USB*


*USB-C*


*HDMI*


*DisplayPort*


*VGA*


*Network Plug*

## 1.5. Software and Licensing

**Software** refers to all types of computer programs. A distinction is made between **operating systems** and **application programs**.

## Operating systems

The **operating system** is the most important software of a computer or smartphone – it ensures that programs run and the hardware (keyboard, mouse, screen, etc.) works. Before an application program or app can be installed, an operating system must be in place.

Examples of operating systems:

- **PC:** Microsoft Windows, Linux, MacOS
- **Smartphone/tablet:** Android, iOS (Apple)

### Updates and Patches[1]

Regular updates are important because they fix bugs, close security gaps and bring new functions. This keeps devices secure, stable and compatible with new software.

### Driver

Drivers are small programs that ensure that devices such as printers or graphics cards work properly.

## Applications

Application programs, often simply called "**apps**", perform special tasks for the user. They can be downloaded and installed on computers, smartphones, or tablets.

Examples of application programs:

- **Word Processor**: Word, LibreOffice Writer
- **Spreadsheet**: Excel, LibreOffice Calc
- **Databases**: Access, MySQL, LibreOffice Base
- **Presentations**: PowerPoint, LibreOffice Impress
- Email **Programs**: Outlook, Thunderbird, Windows Mail
- **Web browsers**: Edge, Firefox, Chrome, Opera, Safari
- **Image Editing**: Photoshop, GIMP, Paint.NET
- **Games**

## Software installation / uninstallation

Software can be used **locally** (e.g., Microsoft Office) or **online** (e.g., Office 365, Google Drive, online Photoshop).

During **installation**, the program data is copied to the device.

If a program is no longer needed, it can be **uninstalled** – the program files are removed in the process.

## Proprietary Software vs. Open Source

### Proprietary software

(Proprietary = not generally freely available, but under the control of the owner.)

- Source code is **not public**.
- Use is only allowed under the **terms of the license** (usually for a fee).

[1] A patch specifically fixes bugs or security vulnerabilities, while an update is a more comprehensive update (new features, improvements, etc.).

- Examples: **Microsoft Windows**, Adobe Photoshop, Microsoft Office.
- Pros: Professional support, often user-friendly, lots of extra features.
- Cons: Paid, limited customization, dependence on the manufacturer.

**Open source software**

- The source code is freely accessible.
- Programs may usually **be used, modified and passed on** free of charge.
- Examples: **Linux**, **LibreOffice**, GIMP.
- *Pros*: Cost-effective, customizable, large developer community.
- *Cons*: Sometimes less support, sometimes limited usability.

### Licensing

Licensing describes the **rights and conditions under which software may be used**. It determines how, where and how often a program may be used.

**EULA (End User License Agreement)**

The contract between the software manufacturer and the user. This sets out the terms of use, rights and obligations that you must accept before you can use the software.

## 1.6. Startup and shutdown computer

When you turn it on, the computer will automatically start the operating system. This process is also known as "booting". After logging in by entering your username and password, you have access to your data and programs.

If you leave the computer, you should log out so that another user can log in with your own credentials.

If the PC is not used for a long time, it can either be shut down or put into a power-saving sleep mode.

## 1.7. Storage of data

### Memory sizes

**Bit**: is the smallest unit of measurement for information. Only two states are possible: 0 or 1

**Byte**: 1 byte = 8 bitsA letter or digit requires at least one byte of space.

| | | |
|---|---|---|
| Kilobytes (KB) | ≈ 1,000 bytes | *A text page has about 2000 characters (2 KB).* |
| Megabytes (MB) | ≈ 1,000 KB | *Typical photos are about 1 MB to 6 MB.* |
| Gigabytes (GB) | ≈ 1,000 MB | *A movie/video has 4 to 8 GB file size.* |
| Terabytes (TB) | ≈ 1,000 GB | *corresponds to about 200 hours of film or 1 million books or 200,000 photos.* |

*For the sake of simplicity, instead of the correct conversion number 1024 (= 210), 1000 is calculated.*

## Storage

- **SSDs** or **hard drives**
  SSDs or hard drives can either be permanently installed in the PC or connected as external devices. Current models offer storage capacities ranging from 250 GB to several terabytes (TB).

- **USB sticks** and **memory cards**: small, portable storage media.
  It is important to never remove USB sticks or memory cards during an ongoing storage process, otherwise data can be damaged or lost.

  To avoid this, the storage medium should always be ejected safely. This is usually done via an icon in the notification area of the taskbar on the computer.

*Safely remove data carriers (with right-click)*

- **Cloud storage vs. local storage**

  **Local storage**: Files are stored directly on your own computer or USB stick.

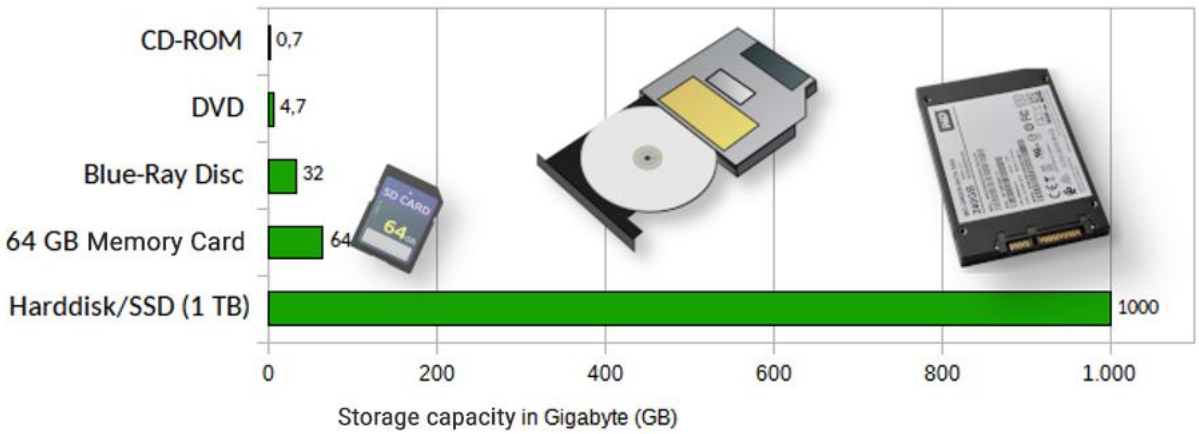
  **Cloud storage**: Data is stored over the internet on vendor servers and can be accessed from anywhere. Are provided by various providers on the Internet. Well-known services include **OneDrive** (Microsoft), **Dropbox** and **Google Drive**.

  They make it possible to store data centrally in the cloud instead of storing it exclusively locally on a device. This means that you can access your files from anywhere with Internet access – whether from a computer, tablet or smartphone.

  In addition, many online data storage systems offer automatic synchronizations, so files on different devices are always up to date. Many services also regularly back up the data to protect it from loss.

  **Advantages:**

  - Access stored data from anywhere with an internet connection.
  - Easily share files and folders with other users, with the option to allow viewing only or editing as well.



*Memory sizes in comparison*

### Data Organization

Folder structures and clear file names help to find data quickly. For example, you can create a folder "School" and create subfolders for "Math", "German" or "Projects" in it.

### File formats

Files can have different extensions that indicate what type of file it is.

- **.docx** → text document (e.g., Word file)
- **.Pdf** → PDF, a fixed document that is not so easy to change
- **.jpg / .png** → image files
- **.mp3** → music or sound
- **.mp4** → video
- **.zip** → compressed file

### Compression of files or folders

Files can be reduced in size, e.g. as ZIP files. This saves storage space and makes it easier to send by e-mail or the Internet.
Folders can also be "zipped", i.e. combined into a **compressed file** .
***How?*** With a program like Windows: Right-click on the file or folder > send it to > ZIP-compressed folder

## 1.8. Network terms

A network is created when different devices such as computers, printers and servers are connected to each other.

An important advantage is the sharing of resources: printers, storage space and access to the Internet can be used by all computers on the network.

A computer network is also used for internal communication in companies and schools.

### Network Security

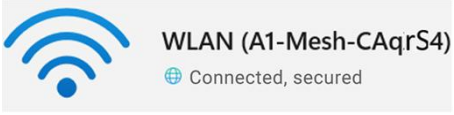
A network allows multiple computers to access shared data.

Logging in with a username and password ensures that only authorized persons can view this data.

**Wi-Fi (Wireless Local Area Network)**

- Many computers, especially laptops, are connected to each other via radio. Such Wi-Fi networks are also available in public places such as libraries, airports, train stations, restaurants or hotels. These places are called "hotspots".

  **Secured Wi-Fi:**
  Data is encrypted to protect it from unauthorized access.

  *Secured Wi-Fi with encryption*

  Secure methods such as WPA, WPA2 or WPA3 are used for this purpose. To use a protected Wi-Fi, a password is required.

**Open Wi-Fi**
Public Wi-Fi is often open, which means that the data is not encrypted. You can connect without a password, but the connection is less secure.

- **LAN** (**Local Area** Network), a wired connection between devices.
  A LAN is a network in a building, for example in a school or company.

- **Intranet**
  An intranet is an internal network within a company or organization. It is not accessible to everyone on the internet, but only to employees.

- **(VPN) Virtual Private Network**:
  A VPN allows encrypted and secure access to a network from the outside – as if you were right in it. For example, an employee on a business trip can access all company data as if he were sitting at his workplace in the office.

- **Network Drive**:
  A folder on a server that is shared with everyone on the network. All users can save and open files there. Network drives are convenient for collaboration.

- **Internet**:
  The Internet is the largest computer network in the world. It connects millions of computers and offers many services:

  **E-mail:** Send and receive electronic letters.

  **WWW** (**World Wide Web**):
  Websites that are linked to each other.

  **Instant messaging (IM):**
  Chat in real time, for example via Facebook or WhatsApp.

  **VOIP** (**Voice Over Internet Protocol**):
  Make calls over the Internet, for example with Microsoft Teams, Zoom or WhatsApp. Calls are converted into data packets and transmitted over the Internet.

  **FTP** (**File Transfer Protocol**): A protocol for transferring files between computers, often for large amounts of data. Programs like FileZilla can be used to connect to a server to upload or download files.

## Data upload, download, and transfer speed

- **Upload**: The transfer of data from a local device to the Internet or to a server – for example, when uploading a photo to a social network.
- **Download**: Downloading data from the Internet to your computer or other device – for example, a music file or a program.
- **Transmission Speed** = **Transmission Rate = Data Rate:**

  Unlike the usual memory data in bytes, the transfer speed is measured in bits per second (1 byte = 8 bits).

  **Bits/sec** (Bit per second) = Number of bits transmitted per second

  **Kbps** (kilobits per second) = 1024 bit/s (approx. 1000 bit/s)

**Mbps** (megabits per second) = 1,048,576 bit/s (approx. 1 million bit/s)

**Gbit/s** (Gigabits per second) = approx. 1 billion bits/s

Fast internet access (broadband connection) can reach up to 300 Mbit/s. In a local network, the data rate can be over 1 Gbit/s.

***Example***: *Connection to the Internet: 100 Mbit/s. Can the download of 20 MB (megabytes) take less than a second?*

***Solution***: *20 MB equals 160 Mbit, 8 x 20 = 160. Since a maximum of 100 Mbit can be downloaded in one second, the download will take more than a second.*

## Connection to the Internet:

There are various techniques for establishing access to the Internet:

- **Telephone line via ADSL:** Broadband connection (broadband = faster) via an existing landline connection.
  The existing telephone line **is used** simultaneously for **telephony and fast Internet (ADSL)** without them blocking each other.
- **Mobile communications**: **UMTS/3G** (up to 42 Mbit/s), **LTE/4G** and **5G** (latest technology, over 1 Gbit/s). With mobile communications, you can also access the Internet on the go – on a smartphone, tablet or notebook – without Wi-Fi. The connection is via the mobile network (e.g., 4G or 5G) and requires a SIM card. This means that websites can be opened, videos streamed or messages sent almost anywhere.
- **Cable**: Internet access via the existing TV cable network. Here, the existing cable TV line is used to provide very high data transmission rates for the Internet connection.
- **Wi-Fi** or **WLAN**: (**Wireless Local Area Network**): - Wireless local area network through which devices connect to a router. The router establishes the connection to the Internet and enables wireless access for PCs, laptops, tablets, smartphones or smart home devices.
- **Satellite**: Internet access via satellite connection. Especially suitable for remote or hard-to-reach regions where cable or cellular networks are not available.

**Internet Service Provider (ISP):** Companies that provide access to the Internet for a fee. These include, for example, mobile phone providers, landline providers or cable TV providers.

**Broadband connections** are often offered as **a flat rate** – an unlimited amount of data is available at a fixed monthly price.

### Which Internet Service Provider (ISP) should I choose?

The following criteria play a role in the selection:

- **Download and upload speed** – as needed, for example for streaming, gaming or home office.
- **Fixed monthly price** – the costs should be proportional to the service offered.

# 2. Safety and well-being

## 2.1. Protect data and devices

PCs, smartphones and tablets contain or process valuable information. Appropriate security measures should be taken to protect this data from loss, misuse, spying, or unauthorized alteration.

### Use good passwords

Username and password ensure that only authorized persons have access.

A good password should:

- consist of lowercase and uppercase letters, numbers and special characters,
- be at least 8 characters long,
- are not in the dictionary,
- have no personal connection (such as date of birth or name),
- be changed regularly.

Example of a good password:

`mVi1983g!`

(Reminder: **my father died in 1983!**)

Examples of bad passwords:

`12345, qwerty, secret, hello, boss, password ...`

**Important:** A separate password should be used for each access! For example, if someone knows your Facebook password, they can also read your emails and get more personal information.

### Firewall

A firewall monitors and controls traffic between computers and networks. It protects devices from unwanted access from the network.

Modern operating systems such as Windows or Linux have built-in firewall software as standard.

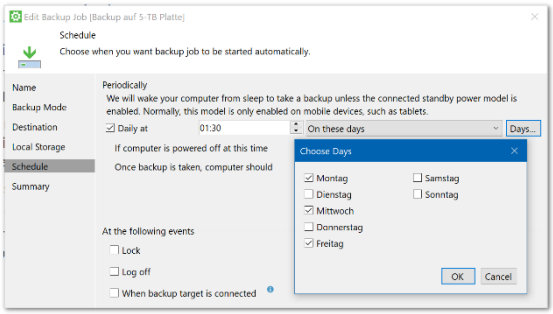
### Backup

SSDs or hard drives can become unusable due to defects, fire, or other damage. Computer viruses can also delete or encrypt data. If a notebook is stolen, the information stored on it is also lost. That's why **regular backups are** indispensable in order to store data safely and to be able to restore it in an emergency.

Complete data loss can have serious consequences. To avoid this, backups should be made regularly – either on **external storage media** such as hard drives or SSDs or via the **network** to other computers or to the **cloud**. This means that the data is also available in an emergency.

It is also important to keep the backups **spatially separate** from the main device so that they are not lost at the same time in the event of a fire, theft or the like.

Data backups should be carried out according to a fixed schedule that determines how often, when and where the data is backed up (**schedule**).




*Schedule of a backup*

### Best Practice: The 3-2-1 Backup Rule

- **3 copies** of data:
  1 original + 2 backups
- **2 different storage types** (e.g., external hard drive and cloud storage)
- **1 copy in a different location** (physically separated, e.g., cloud or external data center)

With this method, the data is optimally protected against loss, damage, or attacks.

## 2.2. Malware and antivirus software

### What is malware?

Malware is a collective term for different types of malicious or unwanted programs.

Typical signs of infection are a significantly slower computer or malfunctions.

Malware can spy on, forward, change or even completely destroy personal data.

**Terms related to malware:**

- **Computer viruses:** Insert copies of themselves into programs, documents, or data carriers and continue to spread.
- **Ransomware:** Particularly dangerous variant that encrypts all documents after infection and then demands a ransom for decryption.
- **Computer worms:** Spread directly through networks such as the Internet and try to penetrate other computers.
- **Trojans:** Disguise themselves as seemingly useful programs. Once opened, they perform malicious actions in the background.
- **Spyware and Adware:**
  - *Spyware* spies on the computer and user behavior and transmits data to third parties without being noticed.
  - *Adware* displays unwanted ads, usually also associated with data collection. Spyware and adware are often installed unnoticed together with other software.

### How does malware get onto my PC?

- **Email and Internet downloads**: Infected files can get onto the PC via email attachments or when downloading from the Internet. When the program is opened, the malware spreads.

- **Drive-by download**: Even visiting a manipulated website can lead to an infection – especially if the operating system or browser is not up to date.

- **USB sticks**: Removable drives can also contain malware. Example: An employee finds a supposedly "lost" USB stick and inserts it into his PC to check the files. In the process, malware is installed unnoticed that spies on or encrypts data.

### How do I protect myself from malware?

- Only install programs and apps from trusted sources.
- Do not open unknown email attachments.
- use antivirus software; for private users, the Windows Defender integrated in Windows 10/11 is usually sufficient.
- Automatically update antivirus programs to detect new threats.
- Keep your operating system and programs up to date; many updates are automatic.

## 3. Ergonomics and Health

Ergonomics aims to protect workers from physical harm caused by their work. Workplaces that are not ergonomically designed can lead to complaints or long-term illnesses. Therefore, the workplace should be designed as optimally as possible:

- **Correct light**: No glare or backlight, for example, place the monitor at right angles to the window.
- **Optimal position**: Arrange the keyboard and monitor correctly, a height-adjustable and swivel office chair is recommended.
- **Take breaks**: Plan regular breaks when working on the computer. Movement and stretching exercises help to stay fit.

## 4. Computers and the Environment – Green-IT

**Green IT** is understood to mean efforts to make the production, use and disposal of devices as environmentally friendly as possible:

- Computers, smartphones, printers, batteries and rechargeable batteries contain valuable raw materials such as gold, copper and rare earths, which should be recycled to conserve resources and avoid environmental pollution.
- Printer cartridges and toner containers can be refilled or recycled.
- Computers consume electricity: PCs should be turned off when they are not in use. Modern devices switch to a power-saving mode with minimal power consumption when inactive.
- Mobile devices such as smartphones and tablets have a backlight. Lowering the brightness or automatically shutting it off after a short time significantly extends the battery life.

## 5. Accessibility, aids - not only for people with disabilities

Accessibility means that computers and software are designed in such a way that they can be used by as many people as possible – including people with disabilities. The aim is to avoid obstacles to operation and to facilitate access.

- **Speech recognition:** You can control the computer by voice and dictate texts without using a keyboard or mouse.

- **Screen reader:** A program that reads the content of the screen so that blind people can use the computer.
- **Magnifier:** Magnifies text and images on the screen to help people with low vision see better.
- **On-screen keyboard:** A keyboard on the screen that can be operated with the mouse or touch – important for people with limited mobility, for example.
- **High-contrast display:** Increases readability through clear colors and font contrasts, which is especially helpful for visually impaired people.

Accessibility thus ensures that everyone, regardless of their physical abilities, can use computers and digital services.