# IS Course 1 - Information Systems - Definitions and Concepts

# 1- Information System Definitions:

## Definition 1:

"An information system (IS) can be technically defined as a set of interdependent components that collect, process, store, and distribute information to support decision-making and control within an organization".

## Definition 2:

"Information systems are combinations of hardware, software, and telecommunications networks that people build and use to collect, create, and distribute useful data, usually within organizational contexts".

## Definition 3:

"Information systems are interdependent components working together to collect, process, store, and disseminate information to support decision-making, coordination, control, analysis, and visualization within an organization".

In summary, an information system is described by:

- The elements that compose it;
- the role each of these components plays in a given organization.

# 2- Components of an Information System:

We can consider these five main components of an information system: : Hardware, Software, Data, People, Processes.
The first three are technological. The last two components, People and Processes, separate the notion of an information system from more technical fields, such as computing = the less technical components.

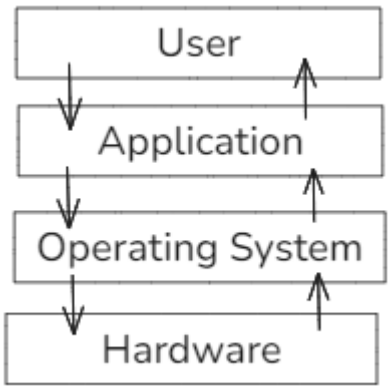
## 2-1- Technology

Technology can be considered as the application of scientific knowledge for practical purposes. This category includes the following components: hardware, software, data, and communication networks.

## 2-1-1- Hardware

Hardware is the tangible, physical part of an information system—the part you can touch. For example: Computers, keyboards, disk drives, and flash drives. -

## 2-1-2-Software




- Software includes all the instructions that tell the hardware what to do.
- Software is not tangible - it cannot be touched.
- The two important categories of software are:
  - *Operating systems*: provide the interface between hardware and application software. For example: Microsoft Windows and Ubuntu Linux for personal computers. Google Android and Apple iOS for mobile phones.
  - *Application software*: allows the user to perform specific tasks, such as creating documents, saving data in a spreadsheet, or sending a message to a friend.

## 2-1-3- Data:

- It can be thought of as a collection of facts.
- For example, a postal address, telephone number, are all pieces of data.
- Data is also intangible, impossible to see in its original state.
- Fragments of unrelated data are useless.
- It becomes a powerful tool for organizations if:
  - it is indexed and organized in a database
  - Organizations collect all kinds of data and use it to make decisions that can then be analyzed for effectiveness. - Data analysis is then used to improve the performance of the organization. -

## 2-2 Network communications:

- An information system can exist without the ability to communicate: the first personal computers were stand-alone machines that did not access the Internet.
- However, in today's hyperconnected world, it is extremely rare for a computer not to connect to another device or an electronic network.

- Technically, the network communication component is composed of hardware and software,
- but since it constitutes an essential functionality in today's information systems, the network communication component has become a category in its own right.

## 2-2 People

The people involved in information systems are an important element. After studying the technological components to be integrated into an information system, the next step is to identify the people who interact with the system. For example:
front-line users, support staff, systems analysts, developers, information managers

## 2-3 Processes:

A process is a series of steps taken to achieve a result or a desired goal. Information systems are increasingly integrated into organizational processes, bringing greater productivity and better control over these processes. The ultimate goal is to improve both internal and external processes, by improving interfaces with suppliers and customers. For example, enterprise resource planning, all have to do with the continuous improvement of these business procedures and the integration of technology
Companies hoping to gain a competitive advantage over their rivals place great importance on this.

# 3- The Role of Information Systems:

The information system is composed of tangible, intangible, and human elements. The role of these components is to:
collect, store, organize, and distribute data throughout the organization. The other role of information systems is to:
transform data into information, and transform this information into organizational knowledge. With the development of technology, information systems have become an integral part of virtually every business. This integration has progressed over the decades.

| Era | Hardware | Operating System | Applications |
|---|---|---|---|
| Mainframe (1970s) | Terminals connected to the mainframe | Time-sharing across multiple virtual storages | Custom MRP software |
| PC (mid-1980s) | IBM PC or compatible. | MS-DOS | WordPerfect, Lotus 1-2-3 |
| Client-Server (late 1980s to early 1990s) | IBM PC clone on a Novell network. | Windows for workgroups | Microsoft Word, Microsoft Excel |

| Era | Hardware | Operating System | Applications |
|---|---|---|---|
| World Wide Web (mid-1990s to early 2000s) | IBM PC clone connected to the company intranet. | Windows XP | Microsoft Office, Internet Explorer |
| Web 2.0 (mid-2000s - present) | Laptop connected to company Wi-Fi. | Windows 10 | Microsoft Office |
| Post-PC (today and beyond) | SmartPhones | Android, iOS | Mobile-friendly websites, mobile apps |

## 2-1 Mainframe Computer (1970s)

Used only by large companies, universities, and government agencies. Access to computer functions was managed through "Time Sharing." The use of these computers has evolved: Previously, the main job was to organize and store large volumes of information that was tedious to manage manually. Data processing consisted of performing scientific calculations and accounting operations. With the advent of Manufacturing Resource Planning (MRP) systems, computers were used to manage manufacturing processes, such as inventory tracking and production planning.

The arrival of this software allowed the integration of these computers into more and more companies.

## 3-2 Personal Computer:

In the 1970s, the Altair 8800 sparked the imagination of entrepreneurs and led to a wave of new companies manufacturing personal computers. Early adopters were computer enthusiasts, but improvements in usability and software availability led to wider adoption, particularly among small businesses. The IBM PC, released in 1981, gained popularity due to its open architecture, which allowed other companies to clone it. This lowered prices and spurred innovation, leading to the development of Microsoft's Windows operating system (later, around 1992). Typical uses for personal computers during this period included word processing, spreadsheets, and databases.

## 3-3- Client-Server Systems

The mid-1980s saw the rise of client-server architecture, enabling resource sharing and collaboration within businesses. Electronic data exchange remained specialized, while computers became essential for internal collaboration. The first ERP systems emerged, centralizing business operations and representing advanced information systems integration.

## 3-4- Internet, World Wide Web, and E-Commerce

The first long-distance transmission between two computers took place in 1969, marking the beginning of the Internet. ARPA Net, the precursor to the Internet, was initially limited to universities, government agencies, and researchers. In 1989, Tim Berners-Lee developed the World Wide Web, paving the way for commercial use of the Internet. The 1990s saw the rise and collapse of the dot-com bubble, fueled by investments in Internet-based businesses. This period also saw the rise of e-commerce applications. The expansion of the Internet led to the development of computer and Internet security measures.

## 3-5- Web 2.0

The bursting of the dot-com bubble was followed by the rise of Web 2.0, characterized by interactive websites and online interactions. Web 2.0 technologies have disrupted traditional industries such as bookselling, video rentals, and travel agencies. The rise of Web 2.0 has led to disintermediation, where technology has replaced intermediaries in transactions. The rapid growth of the internet has raised ethical questions regarding access, copyright, privacy, and data collection from children.

## 3-6- The Post-PC World

PC sales have declined slightly, while smartphone sales have skyrocketed. PCs will remain important for businesses, but their role will diminish as mobility increases. Cloud computing allows mobile access to data and applications, making the PC a communications channel. Innovation in technology and communications will drive business forward.

# 4- Hardware

This concerns digital devices. They can be divided into two categories:

## 4-1- Main devices:

- Personal computers: The main components are: CPU (Central Processing Unit), motherboard, memory, hard drive, SSD (Solid State Drives). These components are generally found inside the PC case (with some exceptions).
- Laptops: Portable computing has evolved considerably, with laptops and netbooks offering lightweight designs, extended battery life, and increased portability.
- Netbooks, in particular, are distinguished by their extreme lightness, relying on cloud storage instead of a traditional hard drive. Their reliance on a Wi-Fi connection allows them to efficiently run web browsers and word processors.
- Smartphones: Mobile internet use is exploding, with 3.7 billion users worldwide. Mobile app engagement is high, with 90% of mobile time spent in apps. Mobile commerce is expected to account for 45% of all e-commerce activity by 2020.
- Tablets: A tablet computer uses a touchscreen as its primary input method and is small and light enough to be easily carried. However, the popularity of tablets has declined significantly in recent years.

## 4-2- Peripherals

- Removable (external) storage devices:
  - Floppy disk , CD-ROM , USB (Universal Serial Bus) flash drives + External hard drives.
- Input and output devices:
  - Computers must be able to receive input from the user and produce output. Previously, there were specific ports for each type of device. Now these ports are standardized:
    - USB ports
    - Wireless technology: Bluetooth
  - Examples of input devices: Keyboard, mouse, touchscreen, scanners, microphones, webcams.
  - Examples of output devices: display screen, speakers, printers.
- Network communication devices:
  - Communication between computers was possible by adding expansion cards, particularly Network Interface Cards.
  - Later, Ethernet ports were integrated into motherboards.
  - Wireless networking technology also emerged.

# 5- Software

- There are two main types of software: operating systems and application software.
- Operating systems manage the hardware and create the interface between it and the user.
- Application software performs specific tasks such as word processing, accounting, database management, video games, or...

## 5-1 Operating Systems

- An operating system is the first program loaded into the computer by the boot loader.
- Operating systems provide these key functions:
  - manage the computer's hardware resources;
  - provide user interface components;
  - and provide a platform for software developers to write applications.
- All computing devices require an operating system.
- The most popular operating systems for personal computers are Microsoft Windows, Apple macOS, and various versions of Linux.
- Smartphones and tablets also use operating systems, such as iOS (Apple), Android (Google), Windows Mobile (Microsoft), and Blackberry.

## 5-2 Application Software

The second main category of software is application software. Application software is used today to accomplish a specific goal, such as word processing, spreadsheet calculations, or browsing the Internet.

## 5-2-1 Utility Software:

Used to repair or modify the computer.
Examples: anti-malware software, unwanted software uninstallers, disk defragmenters, and more. These fill in the gaps in operating systems.

## 5-2-2 Productivity Software:

- These programs allow office workers to efficiently complete their daily work. These applications are often bundled together, such as Microsoft's Office suite. Here is a list of some of these applications and their basic functions:
  - Word Processing:
    Users can create and edit documents, enter and modify text, format fonts and paragraphs, and add, move, and delete text within the document. Tables and images can be inserted. Documents can be saved in various electronic formats, with Microsoft Word's DOCX format being the most popular. Documents can also be converted to other formats such as Adobe PDF or a .TXT file.
  - Spreadsheet:
    This category of software allows for numerical calculations and analyses, displaying the results in graphs. The workspace is divided into rows and columns, where users can enter numbers, text, or formulas. It is the formulas that make a spreadsheet powerful, allowing the user to perform complex calculations that can vary depending on the numbers entered. The most popular spreadsheet program is Microsoft Excel, which saves its files in XLSX format.
  - Presentation:
    Users can create presentations in slideshow format. Slides can be projected, printed, or distributed. Text, images, audio, and visual elements can all be added to the slides. The most popular software currently is Microsoft PowerPoint, which saves its files in the PPTX format.
- Some office suites include other types of software. For example, Microsoft Office includes:
  - Outlook: an email program;
  - OneNote: a collaboration tool for gathering information;
  - Microsoft Access: a database software.

## 5-2-3 Programming Software:

- Used to create software.
- Provides an environment for developers to write, test, and compile code.

- Known as an integrated development environment (IDE).
- Usually free and provided by the creators of the programming language used.

# 6- Mobile Applications

- Personal computers and mobile devices such as smartphones and tablet computers have operating systems and application software.
- Mobile devices are essentially smaller versions of personal computers.
- Mobile applications are designed to run specifically on mobile devices.
- Smartphones are becoming the dominant form of computing, surpassing personal computers.
- Companies are investing more in mobile application development to keep up with this trend.
- The number of mobile apps in the Apple App Store grew from zero in 2008 to over 2 million in 2017.

# 7- Cloud Computing

- Cloud computing refers to applications, services, and data storage over the Internet.
- Cloud service providers use large server centers and vast storage devices connected via the Internet.
- Users can access software and data storage services online.

## 7-1 Common Uses of the Cloud:

- Many people already use cloud computing, such as accessing their email via a web browser or using Google Drive applications.
- Cloud computing includes both free and professional services, not limited to web applications.

## 7-2 Advantages of Cloud Computing:

- No need to install or maintain software.
- Accessible from any computer connected to the Internet.
- Easily scalable to accommodate multiple users.
- Quick setup for new applications.
- Services can be rented for specific periods as needed.
- Data is secure even in the event of a local device failure or loss.
- No limitations due to local memory or disk space.

## 7-3 Disadvantages of Cloud Computing:

- Data is stored on someone else's servers.
- Internet access is required to use it.
- Dependence on third-party providers for services.
- Impact on Organizations:
- Cloud computing can change the way organizations manage technology.
- This calls into question the need for in-house IT services when only an internet connection is required.

## 7-4 Using a Private Cloud

- Many organizations may be hesitant to cede control of their data and applications through cloud computing.
- However, they recognize the benefits of getting rid of the instalocal software and the addition of additional disk storage. T
- he concept of a private cloud offers a solution to this dilemma.
- In a private cloud, the cloud service provider allocates web server space exclusively to a specific organization. T
- he organization retains complete control over this server space while enjoying some of the benefits of cloud computing.

## 7-5 Virtualization

- Virtualization is the use of software to simulate a computer or other devices.
- It allows a single physical computer to perform the functions of multiple virtual computers (virtual machines, or VMs).
- Organizations use virtualization to reduce the number of physical servers needed to provide services to users.
- This reduction in physical servers results in less electricity consumption to run and cool them.

# 8- Software Creation

- Modern software applications are created using programming languages such as Java, Visual C, C++, Python, etc.
- A programming language is composed of commands and syntaxes that allow specific functions to be logically organized.
- Using this language, a programmer writes a program called "source code."
- This source code can then be compiled into a machine-readable form, consisting of zeros and ones, to be executed by the processor.
- Languages such as HTML and JavaScript are used for developing web pages.

# 9- Open-Source Software (Free Software)

- Some companies fear open-source software because of its vulnerability, while others believe that open collaboration enhances security.
- Thousands of open-source applications are available for download, for example, the Open Office suite, or LibreOffice.
- In the early days of personal computers, computer enthusiasts collaborated to create applications and solve problems.
- They shared their programs and solutions to innovate and solve problems more quickly.
- As software became more of a business, sharing became less common, leading to restrictive software licenses.
- This model is often referred to as "closed source" because the source code is not accessible to others.
- However, the open-source movement emerged in the 1990s, promoting the sharing of source code to foster innovation and progress.
- Open-source software makes source code available to everyone, although modifying existing code is complex for most.
- Although the source code of open-source software is available, most of this software is available in compiled, downloadable, and installable format.
- This movement spawned popular software such as Firefox, Linux, and Apache.
- Some of this software is available for download at sourceforge.net or GitHub.

# Bibliographic References

Bourgeois, David T., James L. Smith, Shouhong Wang, and Joseph Mortati. *Information systems for business and beyond*. Saylor Academy, 2019