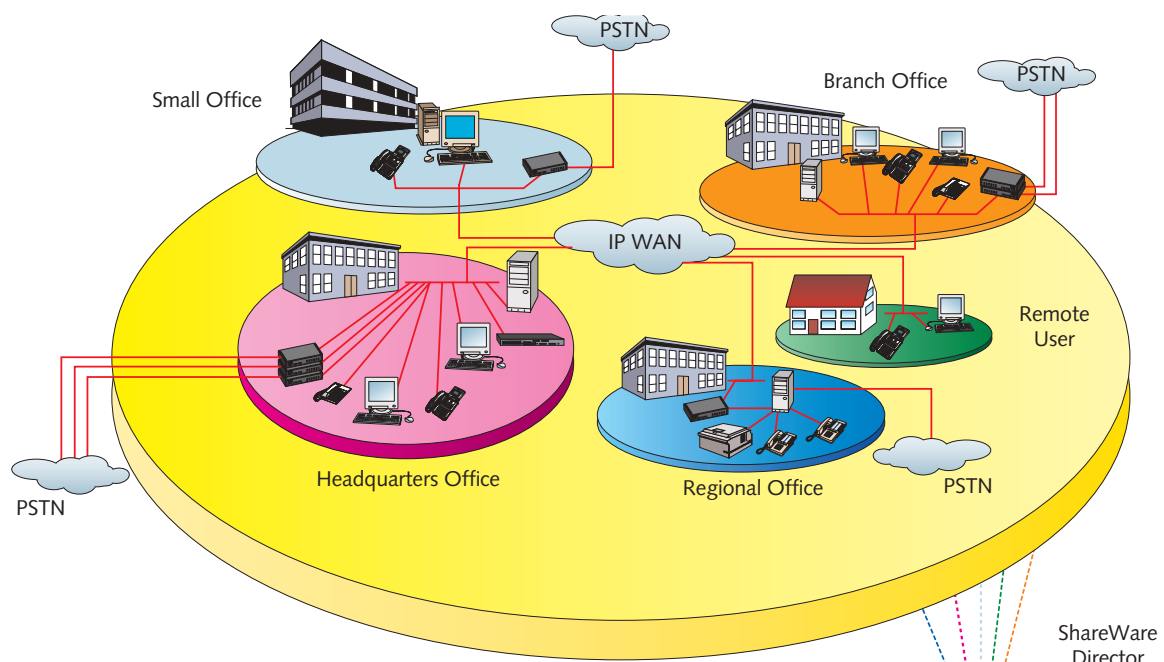# NETWORKS

This Unit deals with different types of networks, their components and characteristics and the advantages of networking. It also looks at wireless communications and the new service of cloud computing system.

A. LANS AND WANS

1 *Go through the paragraphs and label them choosing from the list below.*

Par. 1:	☐	**a.** Definition of a LAN.
Par. 2:	☐	**b.** LANs and WANs.
Par. 3:	☐	**c.** Between LANs and WANs.
Par. 4:	☐	**d.** Components of a network.
Par. 5:	☐	**e.** What a network is.
Par. 6:	☐	**f.** Connecting networks.
Par. 7:	☐	**g.** Why a network.

Par. 1 – A **network** is a set of computers which are linked together on a permanent basis. This can mean two computers cabled together on the same desk or office or thousands of computers across the world. Most computer networks have at least one server. A **server** is a powerful computer that provides one or more services to a network and its users. For example, file storage and email.

Par. 2 – A network allows users to **share hardware** like scanners and printers, to **access data** stored on other people's computers and even **run programs** that are installed not on their own computers but elsewhere in the network.

Par. 3 – A typical network consists of:
• **nodes**, the different computers (workstations) or devices;
• **a connecting medium**, which can be wired or wireless;
• **routers** or **hubs**, specialised computers that send your messages and those of every other Internet user to their destinations along thousands of pathways;
• **switches**, which allow different nodes of a network to communicate directly with one another in a smooth and efficient manner.

Par. 4 – Networks can be categorised in several different ways. Generally, a network is defined according to the geographic area it spans.
A **LAN** is a **Local Area Network**. This is a network of computers that are in the same general physical location, usually within a building or a campus. Besides operating in a limited space, LANs include several other distinctive features: they are typically owned, controlled and managed by a single person or organisation and use certain specific connectivity technologies, primarily Ethernet and Token Ring.
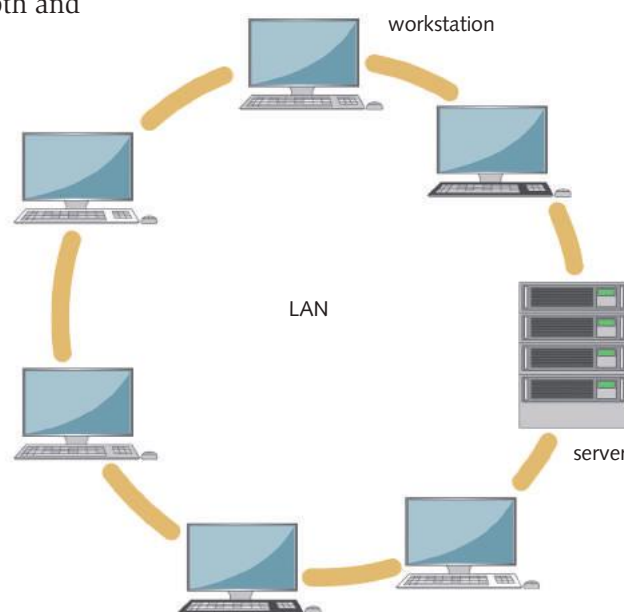
GLOSSARY

elsewhere: da qualche altra parte
to span: estendersi

Par. 5 – A **WAN** is a **Wide Area Network**. As the term implies, a wide-area network spans a large physical distance. A WAN like the Internet spans most of the world. A WAN is a geographically-dispersed collection of LANs. A network device called a **router** connects LANs to a WAN. In networking, the router maintains both a LAN and a WAN address. Like the Internet, most WANs are not owned by any one organisation but rather exist under collective or distributed ownership and management.
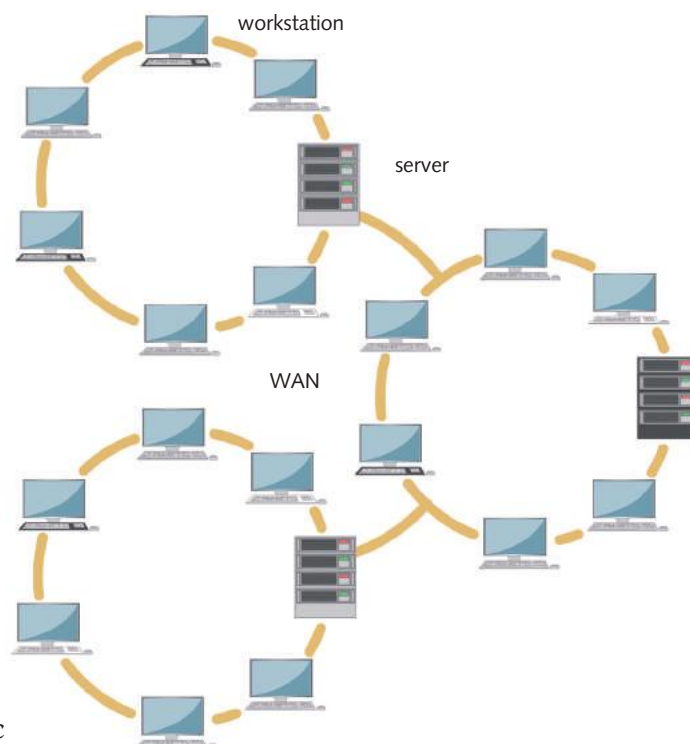
Par. 6 – A **MAN** is a **Metropolitan Area Network**. This connects an area larger than a LAN but smaller than a WAN, such as a city, with dedicated or high-performanc hardware.

workstation

server

WAN

Par. 7 – Networks can be connected to each other, too. A combination of software and hardware must be used to do the job.
A **gateway** connects networks of different kinds, like connecting a network of PCs to a main frame network.
A **bridge** connects networks of the same type.
A **router** connects several networks. A router is used to pick the right path for communications traffic. If there is a partial failure of the network, a router looks for an alternate route.

MOVING DEEPER

frame: sistema
to imply: suggerire, implicare
to own: essere di proprietà

to pick: scegliere
**stand-alone**: indipendente

Advantages and disadvantages of networks

Advantages
- Sharing devices such as printers saves money.
- Site (software) licenses are likely to be cheaper than buying several stand-alone licenses.
- Files can easily be shared between users.
- Network users can communicate by email and instant messenger.
- Security is good – users cannot see other users' files unlike on stand-alone machines.
- Data is easy to back up as all the data is stored on the file server.

Disadvantages
- The network cabling and file servers can be expensive.
- Managing a large network is complicated, requires training and a network manager usually needs to be employed.
- If the file server breaks down, the files on the file server become inaccessible, although email might still work if it is on a separate server. The computers can still be used but are isolated.
- Viruses can spread to other computers throughout a computer network.
- There is a danger of hacking, particularly with wide area networks. Security procedures, e.g. a firewall, are needed to prevent such abuse.

Nodes

Internet

Router

Segments

Nodes
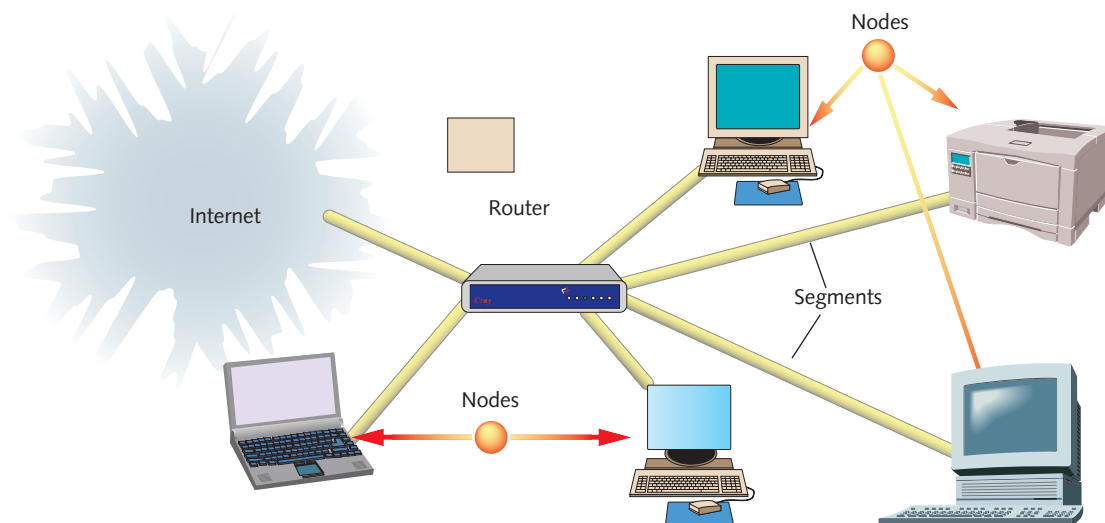
2 Here are some of the fundamental parts of a network. Match the words to the correct definitions.

1. network   ☐   **a.** Crucial device that lets messages flow between networks.

2. node   ☐   **b.** Any portion of a network that is separated, by a switch, bridge or router, from other parts of the network.

3. segment   ☐   **c.** A group of computers connected together in a way that allows information to be exchanged between the computers.

4. router   ☐   **d.** The way that each node is physically connected to the network.

5. topology   ☐   **e.** Anything that is connected to the network, typically a computer, but it can also be something like a printer or CD-ROM tower.

6. gateway   ☐   **f.** Connection of networks of the same type.

7. bridge   ☐   **g.** Connection of networks with different architectures.

3 Refer back to the reading passage on p. 207-208 and find the English words for the following Italian translations.

a. collegati via cavo ....
b. mette in grado ....
c. da qualche altra parte ....
d. percorsi ....

e. regolare, agevole ....
f. parecchi ....
g. di proprietà ....
h. interruzione ....

4 Pair Work. Refer back to the text and in turns ask and answer the following questions.

a. What are the advantages of using a network?
b. What is a network made up of?
c. What is a LAN?
d. What is a WAN?
e. How can you connect networks of different kinds?
f. Why is a router an essential device in a group of networks?

B. NETWORK TOPOLOGIES

There are different ways to connect computers together to form **networks**. The **topology** of connections depends on the distance involved, since that determines what hardware must be used and on the degree of stability needed for the network.

◼ The bus network

In a bus network all the workstations, servers and printers are joined to one cable (the bus). At each end of the cable a terminator is fitted to stop signals reflecting back down the bus.


A bus network connecting several workstations, servers and printers.
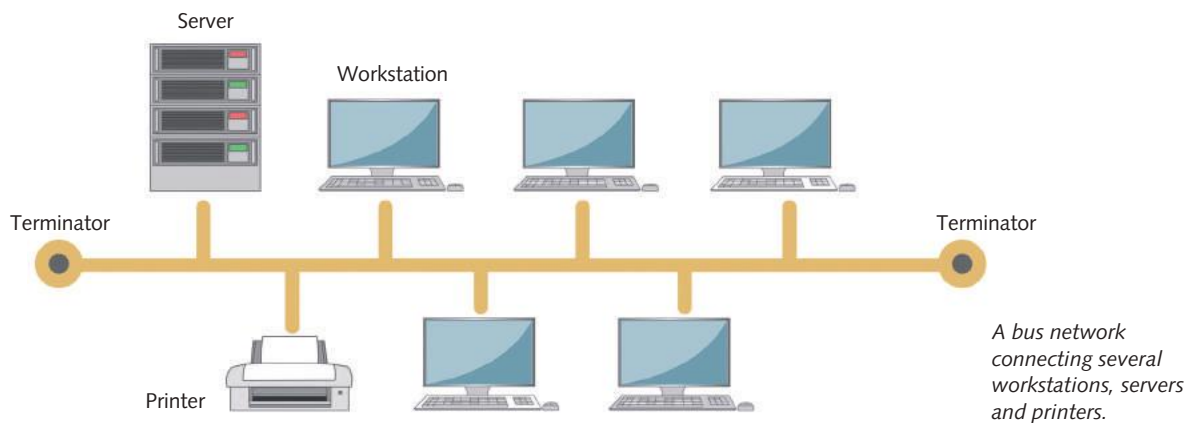
Advantages and disadvantages of a bus network

Advantages	Disadvantages
easy to install	if the main cable fails or is damaged, the whole network will fail
cheap to install, as little cable is required	as more workstations are connected, the performance of the network will become slower because of data collisions
	every workstation on the network "sees" all of the data on the network – this is a security risk

◼ The ring network

In a ring network, each device (workstation, server, printer) is connected to two other devices, forming a ring for the signals to travel around. Each packet of data (token) on the network travels in one direction and each device receives each packet in turn until the destination device receives it. Only the node with the token is allowed to send data. This topology is often referred to as a **Token Ring**.

A ring network, where each device is connected to two other devices to form a ring.
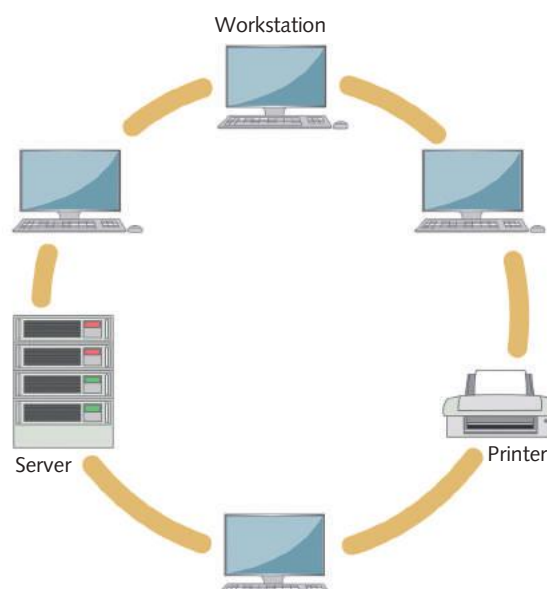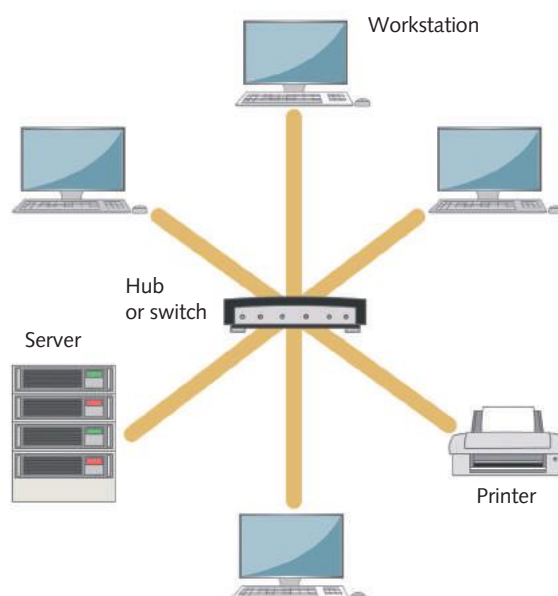
Advantages and disadvantages of a ring network

Advantages	Disadvantages
can transfer data quickly, even if a large number of devices are connected because the data only flows in one direction, so there will be no data collisions	if the main cable fails or any device is faulty, the whole network will fail
requires less cabling and so is less expensive	

▇ The star network

In a star network, each device on the network has its own cable that connects to a central device, which can be a **switch** or a **hub**. A hub sends every packet of data to every device, whereas a switch sends only a packet of data to the destination device. This configuration is good for businesses that have large amounts of rapidly-changing data, like banks and airline reservation offices.

A star network, where devices are connected to a central hub or switch.

Advantages and disadvantages of a star network

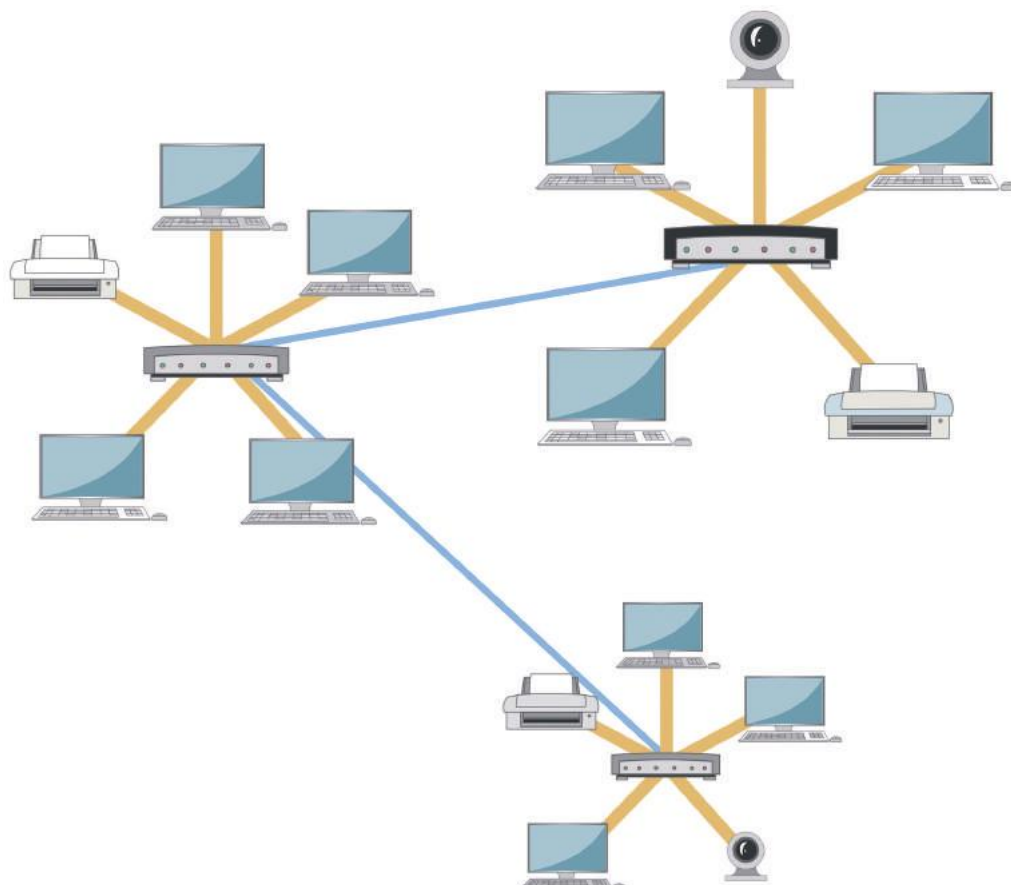| Advantages	Disadvantages
very reliable – if one cable or device fails, all the others will continue to work	expensive to install as this type of network uses the most cable (network cable is expensive)
high performing, as no data collisions can occur	extra hardware required (hubs or switches) which adds to cost
gives close control of data as each PC sees all the data	if a hub or switch fails all the devices connected to will have no network connection it
users always see up-to-date data	

GLOSSARY

token: gettone	**up-to-date**: aggiornato

The star-bus network

Probably the most common network topology in use today, the star bus combines elements of the star and bus topologies to create a versatile network environment. Nodes in particular areas are connected to hubs (creating stars), and the hubs are connected together along the network backbone (like a bus network). Quite often, stars are nested within stars, as seen in the example below.

Advantages and disadvantages of a star-bus network

Advantages	Disadvantages
supports future expandability of the network much better than a bus (limited by the number of devices due to the broadcast traffic it generates) or a star (limited by the number of hub ports) alone	if one of the hubs or its software goes down, the whole network is down
a computer out of order does not affect the others	

**5** *Decide if the following statements are true (T) or false (F) and correct the false ones.*

		T	F
a.	The choice of the topology of connection depends exclusively on the location of computers.	☐	☐
b.	In a bus network all the computers are arranged one after the other.	☐	☐
c.	In the bus topology there is a server which controls the flow of data.	☐	☐
d.	In a star network data always have to pass through the hub.	☐	☐
e.	The switch in a star network sends data to every device.	☐	☐
f.	In a ring connection, communication can flow in both directions along the ring.	☐	☐
g.	In a ring network, each node can send data.	☐	☐

6 *Tick the correct option.*

a. Which of the following statements about a network is false?
☐ Resources such as printers can be shared.
☐ Viruses can spread to other computers throughout a computer network.
☐ Files cannot be shared between users.

b. Which of these statements is true about a LAN?
☐ A LAN connects computers in a small area such as an office.
☐ A modem is needed to connect a computer to a LAN.
☐ A LAN consists of only one computer.

c. What is a server in a computer network?
☐ Someone who manages the network.
☐ The name for a large number of computer cables.
☐ A powerful computer that provides a service, such as centralised file storage.

d. Which of the following networks is least likely to be a WAN?
☐ The Internet.
☐ A school network.
☐ A network of bank cash dispensers.

e. Which type of network needs 'terminators' to function correctly?
☐ A bus.
☐ A ring.
☐ A star.

f. Which type of network needs a 'hub' or 'switch'?
☐ A bus.
☐ A ring.
☐ A star.

g. What is a workstation?
☐ A small train station.
☐ A computer connected to a network.
☐ Another name for a hub.

h. What can lead to a data collision?
☐ When two devices on a network transmit data at the same time.
☐ When one device on a network transmits data.
☐ When two devices on a network transmit at separate times.
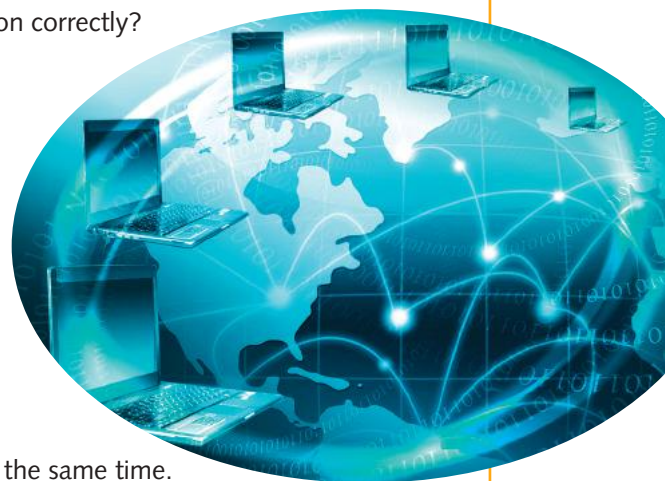
7 *Refer back to the text and complete the table.*

Topology	Arrangement	Advantages	Disadvantages
BUS		easy and cheap to install	
STAR	each device on the network has its own cable that connects to a switch or hub.		
RING			if the main cable fails or any device is faulty, the whole network will fail.
STAR-BUS		– supports expandability of the network. – an out of order computer does not affect the others.	

8 *The students are divided into groups of four. Each student in a group prepares a short oral report on one of the network topologies, referring to the table above, once completed.*

C. WIRELESS COMMUNICATION

Wireless operations permit services, such as long range communications that are impossible or impractical to implement with the use of wires. In telecommunications, **wireless communication** may be used to transfer information over short distances (a few metres as in television remote control) or long distances (thousands or millions of kilometres for radio communications). Wireless communication is convenient as it can be available all the time and almost anywhere. It is used for radio programmes, mobile phones, GPS units and computer networks. In addition, digital signals are less affected by interference than analogue signals.

Wireless communication has several advantages over wired communication:
• distances beyond the capabilities of typical cabling can be covered;
• situations where normal cabling is difficult or financially impractical can be overcome;
• no wires need to be run through buildings, over or under ground;
• wireless devices can be portable.

Wireless communication can be via:
• **radio frequency** communication (radio waves are used to transmit television and radio programmes); radio stations with similar transmission frequencies can interfere with each other's signals;
• **microwave communication**, used to transmit mobile phone calls and to connect computers, especially laptop computers;
• **infrared** (IR) short-range communication, for example from consumer IR devices such as remote controls or via Infrared Data Association (IrDA).

9 *Answer the following questions.*

1. What is wireless communication used for?
2. Why is it convenient?
3. Why are digital signals better than analogue signals?
4. What are the advantages of wireless communication over wired communication?
5. What are radio waves used for?
6. What happens if two radio stations work with similar frequencies?
7. What is microwave communication used for?
8. Give an example of a device which uses infrared communication.

MOVING DEEPER

Wireless vs. cordless

The term "wireless" should not be confused with the term "cordless", which is generally used to refer to powered electrical or electronic devices that operate from a portable power source (e.g. a battery pack) with no cable or cord to the mains power supply limiting the mobility of the cordless device through a connection. Some cordless devices, such as cordless telephones, are also wireless in the sense that information is transferred from the cordless telephone to the telephone's base unit via some type of wireless communications link.

GLOSSARY

to affect: influenzare	**to implement**: realizzare	**to overcome**: superare

D. WHY WI-FI?

Wi-Fi®, which stands for **Wireless Fidelity**, is a mechanism for wirelessly connecting electronic devices. A device enabled with Wi-Fi, such as a personal computer, video game console, Smartphone, or digital audio player, can connect to the Internet via a wireless network access point. In a Wi-Fi network, computers with Wi-Fi network cards connect wirelessly to a wireless router. The router is connected to the Internet by means of a modem, typically a cable or DSL modem. An access point, called a **hotspot**, has a range of about 20 metres indoors and a greater range outdoors. Multiple overlapping access points can cover large areas.

Wi-Fi® is a trademark of the Wi-Fi Alliance and the brand name for products using the IEEE 802.11 family of standards, which was developed by the Institute of Electrical and Electronics Engineers (IEEE) and released in 1997. Wi-Fi is used by over 800 million people. There are over 5 million hotspots around the world, and about 700 million new Wi-Fi devices are sold every year.

Wi-Fi provides services in private homes and offices as well as in public spaces at Wi-Fi hotspots set up either free of charge or commercially. So Wi-Fi networks can either be "open", and anyone can use them, or "closed", in which case a password is needed. Organizations and businesses such as airports, hotels, and restaurants often provide free-use hotspots to attract or assist clients.

To connect to a Wi-Fi LAN, a computer has to be equipped with a **wireless network interface controller**. The combination of computer and interface controller is called a station. All stations share a single radio frequency communication channel. Transmissions on this channel are received by all stations within range. Each station is constantly tuned in the radio frequency communication channel to pick up available transmissions.

Routers that incorporate a DSL modem or a cable modem and a Wi-Fi access point – often set up in homes or other buildings – provide Internet access to all devices tuned into them, wirelessly or via cable. With a portable Wi-Fi router, people can easily create their own Wi-Fi hotspots that connect to the Internet via cellular networks.

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10 *In the text find the English for these Italian words.*

1. per mezzo di: ....
2. abilitare: ....
3. sovrapporre: ....
4. marca: ....

5. sviluppare: ....
6. essere dotato: ....
7. condividere: ....
8. cavo: ....

11 *What is the Italian for these English words in the text?*

1. to release: ....
2. typically: ....
3. range: ....
4. free of charge: ....

5. to be tuned: ....
6. available: ....
7. to pick up: ....
8. via: ....

GLOSSARY

business: azienda   **set up**: creare, avviare

E. NETWORK SOFTWARE and PROTOCOLS

12 *In which paragraphs can you find the following topics?*

Par. 1: ☐ **a.** An example of control protocol used in LANs.

Par. 2: ☐ **b.** It controls the connection between network devices and the movement of data.

Par. 3: ☐ **c.** Why a control protocol is used.

Par. 4: ☐ **d.** It allows users to share information.

Par. 5: ☐ **e.** The Internet control protocols.

Par. 6: ☐ **f.** It is the physical part of the network.

Par. 1 – A network has three layers of components: **network hardware**, **application software**, and **network software**. **Application software** consists of computer programs that interface with network users and permit the sharing of information, such as files, graphics and video, and resources, such as printers and disks.

Par. 2 – **Network hardware** is made up of the physical components that connect computers, the transmission media that carry the computer signals, and the network adapter, which accesses the physical media that link computers, receives packets from network software, and transmits instructions and requests to other computers.

Par. 3 – **Network software** consists of computer programs that establish **protocols**, or rules, for computers to talk to one another. These protocols are carried out by sending and receiving formatted instructions of data called **packets**. Protocols make logical connections between network applications, direct the movement of packets through the physical network, and minimise the possibility of collisions between packets sent at the same time.

Par. 4 – When computers share physical connections to transmit information packets, a set of Media Access Control (**MAC**) protocols are used to allow information to flow smoothly through the network. An efficient MAC protocol ensures that the transmission medium is not idle if computers have information to transmit. It also prevents collisions due to simultaneous transmission that would waste media capacity.

Par. 5 – One type of MAC is **Ethernet** which is used by bus or star network topologies. An Ethernet-linked computer first checks if the shared medium is in use. If not, the computer transmits. Since two computers can both sense an idle medium and send packets at the same time, transmitting computers continue to monitor the shared connection and stop transmitting information if a collision occurs. Ethernet can transmit information at a rate of 10 Mbps.

Par. 6 – The Transmission Control Protocol/Internet Protocol (**TCP/IP**), and the Hypertext Transfer Protocol (**HTTP**) are the most common sets of logical connections used by the Internet.

13 *Answer the following questions which refer to the previous passage.*

a. What is meant by application software?

b. What is network hardware made up of?

c. What are the protocols?

d. What is a packet?

e. What is a MAC used for?

f. What is the Ethernet?

GLOSSARY

due to: dovuto a/causato da   **idle**: inattivo

F. CLOUD COMPUTING

Cloud computing is the delivery of computing as a service rather than a product, whereby shared resources, software and information are provided to computers and other devices as a utility (like the electricity grid) over a network (typically the Internet). Cloud computing provides computation, software, data access, and storage services that do not require end-user knowledge of the physical location and configuration of the system that delivers the services. Cloud computing providers deliver applications via the Internet, which are accessed from a Web browser, while the business software and data are stored on servers at a remote location. In this way

Cloud computing logical diagram

- services are provided on-demand; customers can pay for them as they go, without the need to invest in a data-centre;
- hardware management is abstracted from the customers;
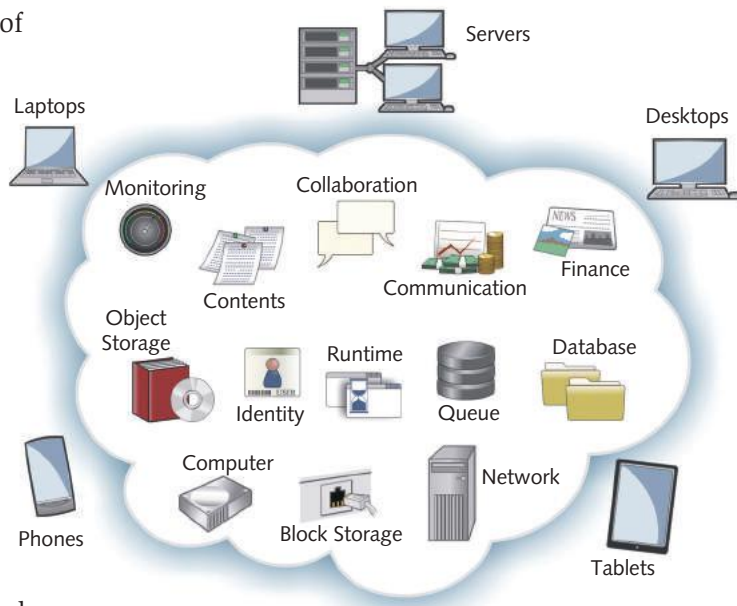- infrastructure capacities are elastic and can easily scale up and down.

There is a powerful economic force behind this simple model: providing and consuming cloud computing services generally allows far more efficient resource utilization, compared to self-hosting and data centre type of hosting.

Once an Internet Protocol connection is established between several computers, it is possible to share services within any one of the following layers.

Client
Application
Platform
Infrastructure
Server

- ■ A **cloud client** consists of computer hardware and/or computer software that relies on cloud computing for application delivery and is in essence useless without it.
- ■ **Cloud application services** deliver software as a service over the Internet, eliminating the need to install and run the application on the customer's own computers and simplifying maintenance and support.

- **Cloud platform services** deliver a computing platform as a service, often consuming cloud infrastructure and sustaining cloud applications.
- **Cloud infrastructure services** deliver computer infrastructure as a service, along with storage and networking. Rather than purchasing servers, software, data-centre space or network equipment, clients instead buy those resources as a fully outsourced service. Suppliers typically bill such services on a utility computing basis; the amount of resources consumed, and therefore the cost, will typically reflect the level of activity.
- **The server's layer** consists of computer hardware and/or computer software products that are specifically designed for the delivery of cloud services, including multi-core processors, cloud-specific operating systems and combined offerings.

Cloud computing exhibits the following key characteristics:
- **agility** improves with users' ability to re-provision technological infrastructure resources;
- **cost** is claimed to be reduced;
- **device** and **location independence** enable users to access systems using a web browser regardless of their location or what device they are using (e.g., PC, mobile phone); as infrastructure is off-site (typically provided by a third party) and accessed via the Internet, users can connect from anywhere;
- **reliability** is improved if multiple sites are used, which makes well-designed cloud computing suitable for business continuity and disaster recovery;
- **multi-tenancy** enables sharing of resources and costs across a large pool of users;
- **maintenance** of cloud computing applications is easier, because they do not need to be installed on each user's computer; they are easier to support and to improve, as the changes reach the clients instantly.

---

14 *Complete the following sentences with words from the text.*

1. With cloud computing resources, software and information are provided to ....
2. Cloud computing providers deliver applications via ....
3. The business software and data are stored on ....
4. Once an Internet Protocol connection is established between several computers, it is possible to ....
5. A cloud client consists of computer hardware and/or ....
6. Cloud application services deliver software as a service over the Internet, eliminating ....
7. Rather than purchasing servers, software, data-centre space or network equipment, clients instead ....
8. Suppliers typically bill such services on ....

GLOSSARY

along with: insieme con
as they go: quando sono in funzione
to bill: fatturare
to claim: sostenere
layer: livello

maintenance: manutenzione
multi-tenancy: multi proprietà
offerings: proposta / offerta
off-site: esterno
outsourced: esterno
regardless: a prescindere da

to rely: basarsi
to re-provision: rifornire
scale up: incrementare
self-hosting: autogestione
whereby: per cui
within: all'interno