MODULE 6. Computer Networks
The plan

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1.Definition of a network and its main characteristics.

Network - is a three or more computers connected together. Network consists of network devices,network media, network interface (to communicate between different hosts) and network protocol.

2.Classification of networks based on scope and size: PAN,LAN,MAN,WAN

There are 4 main classification of networks : PAN,LAN,MAN and WAN.
1.**PAN** (Personal Area Network) connects smart devices or electronics within a range of 10 metres, without wires and cables.
2.**LAN** (Local Area Network) connects personal computers within a very limited area such as building or organisations.
3.**MAN** (Metropolitan Area Network) covers a town or city, for example it is widely used in cable television.
4.**WAN** (Wide Area Network) is unlimited and consists of several smaller networks.

3.Communication channels and their main types

Communication channel is the medium used to transform information from one network device to another. Communication channels are divided into two general classifications : wired and wireless.

Wired channels transport data through wires and cables,for instance in fibre-optic cables by light impulses, copper cables by electric signals.

Wireless channels transport data from one device to another without cables and wires. Wireless channels include Wi-Fi(wireless fidelity), which distributes information by radio waves, satellite - by microwaves.
4.Network topology. Network architecture : client-to-server and peer-to-peer.

The arrangement of devices in a network is referred to as its **physical topology**. There are 5 main Network topologies:

1.**Point-to-point**. In this method, the network consists of a direct link between two computers.
2. In **Star** topology the network is arranged as a central connection point for all workstation and peripherals. The central connection is not necessarily a server, more typically it is a network device or a hub.
3.**Full mash**. In this topology, every node or device is directly connected with each other.
4.**Partial mesh**. In this topology some of the devices are connected to many devices together, but other devices are connected only to one or two devices.
5. **Bus topology** uses a single cable which connects all the included nodes. The main cable acts as a spine for the entire network.

Network architecture
In a **client-to-server** (star topology)network a computer acts as a server and stores and distributes information to other nodes,or clients, when in a **peer-to-peer** () network all computers have the same capabilities, that's why we need a server.

5.Network protocols

Network protocols are a set of rules,by which computers communicate with each other. **HTTP (HyperText transfer protocol)** is responsible for transferring all data on the Internet. It works with **TCP**(transmission control protocol) and **IP**(internet protocol). TCP is responsible for grouping data in small packets, while IP addresses these packets.

6.Cloud computing

Thanks to **cloud computing** we don't need to use the capacity of our hard disk, because all data is stored on servers. We don't need our personal gadgets to get access to information we need. Cloud computing is possible because of virtualisation. **Virtualisation** allows for the creation of a simulated,digital-only virtual computer,that behaves as a physical computer. **Virtual machine** is a technician term for this computer.
By running many virtual machines at once,one server can run many **virtual servers**.
Sandboxing - is a secure practice, when you run applications that you don't trust so that they cannot damage your computer or steal data.(This helps run any app without the risk of damage to the system.) Thanks to sandboxing files and applications from one virtual machine are not visible to others even if they are on the same physical machine.
Data centre - is a physical facility that organisations use to house their critical applications and **data**.
Cloud server - this is a cloud-based service that allows you to use the resources of the provider company.They are located in data centres all over the world.

7.Definition of the internet

Internet - is a connection between all computers in the world,which allows sharing and finding information. The Internet first appeared in the 60's in the USA and became popular in the 90's.
Web - is an Internet technology for finding something on the Internet.

8.Types of the internet connection

Wired(wired connection is cheaper and always-on):
1.**Dial-up**. (is the oldest one) A dial-up connection is a narrowband connection that uses a modem to establish data connections over the telephone network. It's cheap and slow,but it may be the only option available in some areas. Dial-up is an old form of telephone connection, ADSL - is modern.
2.**DSL** - Digital Subscriber Line is a broadband technology for getting bandwidth over telephone lines. It's known as broadband connection and it offers much faster speeds.

3.**ADSL** - is an Asymmetric Digital Subscriber Line. It's the same as DSL, but It is faster than the traditional dial-up connection. It's called asymmetric, because upload and download speed are differ.
4.In **cables(copper or coaxial)** data transfers by electric signals. A cable is a collection of wires twisted together to provide a path for electrical signals.Cable connection offers much faster speeds and uses your cable TV connection.
5.**Fiber-optic** cables transmit data through glass that are thinner than human hair by light impulses.

Wireless:
1.**WiFi** (or wireless fidelity) It is a technology that uses radio waves instead of wires to have an internet connection. (broadband is more than one frequency, narrowband only one frequency).
2.**Satellite**. The satellite network is used when the cable network is not possible. The satellite network is more expensive than the cable network because it uses the satellites in orbit to send data and the satellite is not owned by the company. Satellites use microwaves for transferring data.
3.**Cellular.** The cellular network is a type of network that covers a large geographical area and provides coverage over the entire region with a small number of base stations. This is one of the most popular networks used today and is highly reliable. The distance between me and my provider is divided into cells,and by transmitting signals from one cell to another we have cellular connection.
4.**3G/4G, often** used by smartphones, uses a cellphone , you need a built-in modem in your device,an account list provider and browser.

9.Definition of the World Wide Web

WWW (or World Wide Web) - is all the public websites or pages that users can access on their local computers and other devices through the internet.

10.Components and technologies of the Web

Web consists of Web server and Technologies.
Web server include:
1.**Web sites** is a collection of web pages and related content that is identified by a common domain name.
2.**Web links** is a set of connections between web pages.We can understand that it is a link, text may be underlined, highlighted or may be an image.
3.**Web pages** is a hypertext document provided by a website and displayed to a user in a web browser.
4.**Web server** is a host, which stores web-site content, its virtual one.
Technologies include:
1.**Browsers** - software used to get and display web pages.
2.**HTTP** (HyperText transfer protocol) is a standard protocol for communication between browsers and web servers.
3.**HTML (HyperText Markup Language)** is a set of elements for creating documents that a browser can display as a web page. HTML tag - is an instruction,how to display a document.
4.**URL(uniform resource locator)** is a unique address for web pages.

11.Process of accessing a website

1.User types web request.
2.Then browser sends this request for Web page to Web server using HTTP protocol.
3.Browser requests the domain name server (DNS) for the IP address.
4.Web Server receives requests and translates these data packets and checks its search for searches for the requested Web Page.
5.The Web browser receives the web page,intercepts it and displays the contents in the Web browser.

12.Definition and scale of the IoT

The Internet of Things (or IoT) is all devices connected to one network,which can apply analytics, can be recognized by other devices and using analytics and data from other devices they can make decisions without any human intervention. IoT ecosystem consists of:
1.**Sensor** is a detector for collecting and monitoring data.
2.**Gateway** is used for sorting this data.
3.**Platform** stores this sorted data (they are sorted in the database, which consists of fields, each field contains records and each record contains one item of data).
4.**Database** is built with historical records on a network server.
5.**Applications** apply to our specific needs.

13.Application of the IoT today

14.Benefits that IoT brings

1.**In business**. Businesses can collect data on how these devices work, operate and get access to all the devices remotely. Businesses have more data about their own products and their own internal system. Companies can also use the data from devices to make their systems and their supply chains more efficient
2.**For consumers**. IoT makes our homes and vehicles smarter,more measurable.

15.Problems related to the IoT and their solutions

1.**Lack of regulation about IoT.** Government regulation often takes a long time to catch up with the current state of technology.
2.**Understanding IoT.** IoT changes very fast and people need time to understand these changes.
3.**Challenges with compatibility**. Not all devices are compatible between each other.
4.**Cloud attacks**. Nowadays we use cloud storage and cloud providers are the main target of cyberterrorists.
5.**Limited AI**. AI is not clever enough from a person's point of view, and it requires powerful tools for identifying large amounts of data.

16.Future of the IoT

The IoT is big and getting bigger. By 2025 there will be more than 75 billion devices. Cybercriminals will continue to use IoT devices to facilitate DDoS attacks.Major wireless carriers will continue to roll out 5G networks,because it promises greater speed and ability to connect more smart devices at the same time. Artificial intelligence will continue to become a bigger thing. Network will be better secured,because router makers will continue to seek new ways to boost security.