Week 1

❖ How the internet works :

- The internet is a network made of at least two devices that connect and communicate via a wired or wireless connection. One network switch can connect to another switch to link two networks.

- When we use websites or video streaming services on the all we get through all these by computers called **Servers**

- User computers known as **Clients** and the relation that connects the clients to servers via network is called **Client-Server Model**

❖ What is a server :

- A server is a computer that runs applications and services ranging from websites to instant messaging
- Servers stored in places called **Data centers**
- Data centers store 100s or 1000s of servers all running different services and have many different systems to ensure that servers have continuous power, internet connection and are kept called 24 hours per day
- Data centers are all over the world, Many websites use these to allow you to access your content quickly from the data center nearest to you
- Servers are built based on the service that provides(their Hardware and Software)
- Servers have many variants and have many functions to use one of these server is **WEB server**

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Week 1

❖ Web server functions :

- ➢ web storage
- ➢ administration
- ➢ data storage
- ➢ security
- ➢ managing email
- ➢ web request

❖ Websites and Webpages:

- web page is a document that displays images, texts, videos and other content in the web browser
- website is a collection of webpages that link together
- web pages is just like a text document you can open an edit it in any text editor
- you can also edit the web pages with more better tools that usually developers use HTML, CSS and JavaScript

❖The Key tools for web development :

- HTML(HyperText Markup Language) :
    - ➢ the structure of the webpage and the content you see
    - ➢ works with somethings called Markup tags
    - ➢ these tags describe the content of that is displayed in the browser window
    - ➢ The way that it describe with it is called Markup
- CSS(cascading style sheets) :
    - ➢ It enhance the form and décor of HTML
    - ➢ Controls the style and colors
    - ➢ Add visual enhancement like layouts
- JavaScript :
    - ➢ The powerhouse of web page
    - ➢ responsible for the user interaction
    - ➢ programming language built into the browser
    - ➢ provide tools with interactivity, data processing, control

Week 1

❖ How the code really works :

1. It works by sending web pages from Web server to browser
2. each line of code is processed in sequential order from first to last
3. then browser creates a building block which is visual representation that user sees

✓ This process is all known as page rendering

❖ What is browser and how it works :

- Browser : is a software application that you use to browse the World Wide Web
- works by sending a request to the web server then receives the respond with content to display
- once you open the browser you found address bar it's where you put the URL
- URL(Uniform Resource Allocator):
  - ➤ used for reaching the website you want
  - ➤ it separates into three sections :
    1. Protocol: HTTP(HyperText Transfer Protocol) or HTTPS
    2. Domain name : Usually the name of the website
    3. File path : the path of the web page you want to log

- The browser usually uses the protocol to communicate with server this process called **request response cycle**

Week 1

- Request response cycle : is a bunch of processes that browser deals with which are:
  1. the browser takes the domain name from user
  2. the browser sends requests to server via network and trying to connect the server device
  3. The web server responds by sending a webpage back to the browser
  4. Then the browser put the data in search engine in coded way
  5. The search engine present data in a visible way
- ✓ All these data stored in databases connected to web server

❖ Web Hosting :

- Web hosting can vary and it has many variants that you can use :
  1. Shared Hosting
  2. Virtual private Hosting
  3. Dedicated Hosting
  4. Cloud Hosting

- Shared Hosting :
  - ➢ the cheapest form of Web hosting
  - ➢ Has many web hosting accounts in the server sharing the same processing power, memory and bandwidth
    - ▪ Advantages :
      - o Better use for practice project or one who wants to know about network
      - o Better use for small projects with small visitors
    - ▪ Disadvantages :
      - o The interaction of other websites may cause a slower performance

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- VPS(Virtual Private Service):
  - ➢ Virtual server with dedicated CPU, memory and bandwidth
  - ➢ It runs on a hardware server with preferred and fixed resources for its VPS instance

Note: VPS Instance is a virtual machine that runs its own copy of an operating system (OS) within a physical server

- Advantages :
  - o Your websites isn't affected by other VPS instances and still share the appropriate performance
- Disadvantages :
  - o More expensive than the shared hosting

- Dedicated Hosting :
  - ➢ hardware server that is dedicate to one user
  - ➢ All hardware, CPU, memory, and bandwidth resources are yours to use
  - Advantages :
    - o Get all the facilities and capabilities to do any service from the server
  - Disadvantages :
    - o The most expensive host to get and use

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- Cloud Hosting :
  - ➢ The most popular and used host
  - ➢ Works in cloud environment which spans across multiple physical and virtual servers
    - ▪ Advantages :
      - o Your website will still run even the physical or virtual server you connect with fails
      - o You can use as many as resources you need without hardware limitations
    - ▪ Disadvantages :
      - o Paid on resources you use it could be expensive

❖ Introduction to internet protocols :

- All data sent using IPs that they are the same as addresses in postal system and the transfer process made by protocols
- The way that thankfully we can send this data is by using two IP versions :
  - ➢ IP version4: IP address contains four octet. It's separated by periods or dots. For example 192.0.2.235
  - ➢ IP version6: IP address contains eight groups of hexadecimal digits separated by a colon. For example 4527:0a00:1567:0200:ff00:0042:8329
- Data always sent in series of messages called IP packets (Data grams)
- IP packets in high level contain header and payload (data)
  - ➢ Header contains the sender and receiver IP and other related information
  - ➢ Payload contains the data , packages and some protocols

Week 1

- The protocols used for store and observe the data are but the most common protocols are :
  - TCP (Transmission Control Protocol) :
    - used for solving the problem that can prevent the message from being sent like (out of order, damaged, dropped or losing during transit)
    - used for sending the data that must arrive correctly and in order such as a text or image files
  - UDP (User Datagram Protocol) :
    - solves the corrupt packet issue
    - used for sending data that can tolerate some data loss such as voice calls or live video streaming

- ✓ regardless the TCP can send data to user without any errors or lack of data but that cost delay when send it
- ✓ even if the UDP solves the corrupt packet issue but it may not sent or be out of order

❖ Introduction to HTTP :

- HTTP(HyperText Transfer Protocol) :
  - The core operational protocol of world wide web
  - It is what enables your web browser to communicate with a web server
  - It is a protocol used for transferring web resources such as HTML documents, images, styles, and other files
  - request response based protocol
    - A web browser or client sends an HTTP request to a server and the web server sends the HTTP response back to the browser

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- HTTP request consists of
    1. **Methods**: can vary but the most common methods are :
        - ➤ GET : used to retrieve information from the given server
        - ➤ POST : used to send data to the server
        - ➤ PUT : updates whatever currently exists on the web server with something else
        - ➤ DELETE : removes the resource
    2. **Path** : the representation of where the resource is stored on the web server
    3. **Version** : there are many http versions but the most used are 1.1 and 2.0
    4. **Headers :** contain additional information about the request and the client that is making the request
    5. **The body of content :** it is what the client sent

- HTTP response similar to HTTP request consists of :
    1. **Headers**
    2. **Message body :** consisting of the response contents such as the HTML document, the image file and so forth
    3. **HTTP status code :** which is contained with the header store
        - ➤ The indication if the http requested successfully
        - ➤ The code values which are in the range of 100 to 599
        - ➤ Status message which is representation of status code

Week 1

- Status code consists of 5 ranges they are grouped by the first digit of the error number :
  - ➢ informational is grouped 100-199
    - o provisional responses sent by the server
    - o interim before the actual response
    - o The most common information response is 100 it indicates if the web client should request or ignore
  - ➢ successful responses is grouped from 200-299
    - o Successful responses indicate that the request was successfully processed by the web server
    - o The most common response is 200 (OK) you received it every day you use internet and it depends on the server method :
      1) GET : it means that the resource is found and it includes the body
      2) POST : means the data transmitted and fully submitted
      3) PUT : means the update added successfully
      4) DELETE : means the resource is deleted
  - ➢ Redirection message are 300-399
    - o indicate to the web client that the requested resource has been moved to a different path
    - o The most common response codes used are 301 moved permanently and 302 found
    - o The difference between 301 and 302
      - ✓ 301 is permanently move
      - ✓ 302 is temporary move

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- ➢ Client error responses range from 400-499
    - o indicate that the requests contained bad syntax or content and cannot be processed by the web server
    - o the most used codes 400,401,403 and 404
        - ✓ 400 is used when the web browser or client submitted bad data to the web server
        - ✓ 401 is used to indicate that the user must log into an account before the request can be processed
        - ✓ 403 is used when the request is valid but the server refuse to process it like the client doesn't have the permission
        - ✓ 404 used when the server can't find the source(page not found)
- ➢ server error responses are 500-599
    - o indicate that a failure occurred on the web server while trying to process the request
    - o The most common code used is 500 internal server error
    - o 500 means that the server failed to process
- • HTTPS is the secure version of HTTP
    - ➢ It is secure information by encrypt it
    - ➢ It is the same as http in all commands and requests and responses but encrypted so no one can log to it

- • HTTP request line
    - ➢ The begin of every http request
    - ➢ Consists of http method ,request resource and protocol version
- ▪ EX : `GET /home.html HTTP/1.1`

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- HTTP request header
  - ➤ The next part of the request after the request line followed by a break line
  - ➤ The header consists of case-insensitive name and its value
- EX : **Host**: example.com

  User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10.9; rv:50.0) Gecko/20100101 Firefox/50.0
  Accept: */*
  Accept-Language: en
  Content-type: text/json

- The `Host` header specifies the host of the server and indicates where the resource is requested from.

- The `User-Agent` header informs the web server of the application that is making the request. It often includes the operating system (Windows, Mac, Linux), version and application vendor.

- The `Accept` header informs the web server what type of content the client will accept as the response.

- The `Accept-Language` header indicates the language and optionally the locale that the client prefers.

- The `Content-type` header indicates the type of content being transmitted in the request body

- HTTP request body
  - ➤ Often used when the method we use is post or put
- EX : PUT /users/1 HTTP/1.1

  Host: example.com
  Content-type: text/json

  {"key1":"value1"}

Week 1

- HTTP response status line
  - ➢ The first line of the response
  - ➢ Shows the client if the request was successful or error
  - ➢ The status line consists of protocol version , status code and reason phrase(textual representation for the code)
- EX : `HTTP/1.1 200 OK`

- HTTP response Header
  - ➢ The next part of the response after the status line followed by a break line
- EX : Date: Fri, 11 Feb 2022 15:00:00 GMT+2

  Server: Apache/2.2.14 (Linux)

  Content-Length: 84

  Content-Type: text/html

- The `Date` header specifies the date and time the HTTP response was generated.

- The `Server` header describes the web server software used to generate the response.

- The `Content-Length` header describes the length of the response.

- The `Content-Type` header describes the media type of the resource returned (e.g. HTML document, image and video).

- HTTP response body
  - ➢ The main content of HTTP response
  - ➢ Contains images , videos and HTML documents
- EX : HTTP/1.1 200 OK

  Date: Fri, 11 Feb 2022 15:00:00 GMT+2
  Server: Apache/2.2.14 (Linux)
  Content-Length: 84
  Content-Type: text/html

  ```
  <html>
  <head><title>Test</title></head>
  <body>Test HTML page.</body>
  </html>
  ```

Week 1

❖ Other internet protocols :

- Dynamic Host Configuration Protocol (DHCP)
  - ➢ Used to assign your computer an IP address.
  - ➢ Let the computer communicate using UDP with others in network
- Domain Name System Protocol (DNS)
  - ➢ Used for searching and know the website place by associating with the domain name and then returns the correct IP address.
- Internet Message Access Protocol (IMAP)
  - ➢ Manage your mailbox on the server storing your emails.
- Simple Mail Transfer Protocol (SMTP)
  - ➢ Used for sending and receiving mails
- Post Office Protocol (POP)
  - ➢ is an older protocol used to download emails to an email client
  - ➢ The main difference in using POP instead of IMAP is that POP will delete the emails on the server once they have been downloaded to your local device
  - ➢ It is often now used only for email automation
- File Transfer Protocol (FTP)
  - ➢ Used for send, list, receive and delete files on a server
- Secure Shell Protocol (SSH)
  - ➢ Used for encrypt the data so third parties can't log it
- SSH File Transfer Protocol (SFTP)
  - ➢ A merge protocol between SSH and FTP

✓ NOTE: HTTP protocols are used on the top of TCP to transfer webpages and other content from websites.

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❖ Webpages, Websites and Webapps :

- Webpage: is one single page in the internet consist of html CSS and JavaScript it has content in web browser of photos videos texts etc.
- Websites : is just a collection of webpages that work on the same or familiar content and all link together under one domain name
- Webapp :same as website but more dynamic and centered on personalized data and interactivity at variant website more focused on being more informative

❖ Developer Tools :

- You can log into dev tools by many ways
  - ➢ You can press F12 (windows)
  - ➢ You can press command option J on Mac
  - ➢ You can just right click the page and choose inspect
- Console tab : tab outputs, JavaScript logs and errors from your web application
- Sources tab : shows all content resolved for the current page
- Network tab : you can inspect the timeline and details of http requests and responses for the web page
- Performance tab : shows what the web browser is doing over time
- Memory tab : displays the parts of your code that are consuming the most resources
- Element tab : the most used element tab it covers many properties for HTML and CSS

Week 1

❖Frameworks and Libraries :

- Ways to speed up development , make fewer errors and save more times
- It can be open source (that can anyone use or available in any place) or it might be proprietary (that you have to apply a license)
- Libraries : reusable pieces of code that can be used by your application that is just provided to do a specific function
- Framework : provide a structure for developers to build with
  - ➢ It handles the functionality that is common in all web applications then the developers add the code that implement the functionality of WepApp
- Libraries can be part of framework or can just used alone
- Frameworks are opinionated but libraries are opinionated
- The opinionatedness will vary between frameworks, but by definition they will always be more opinionated than a library.

	Advantages	Disadvantages
Framework	1. Time saving 2. Structure 3. Best practice	1. Structure constrains 2. compatibility
Library	1. replaceable 2. fewer errors 3. faster development	1. selecting library set 2. compatibility

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❖ APIs and services :

- API (Application Program Interface) : is a development tool which is set of functions and procedures for creating applications that access the features or data of an operating system
- The most common used APIs :
  - ➢ Browser API
  - ➢ REST API
  - ➢ Sensor-Based API
- API is a bridge between different components of system
  - ➢ Gateway
  - ➢ Middleware
- Browser API
  - ➢ extend the functionality of browser
  - ➢ simplify complex functions and provide easy syntax for building advanced features
  - ➢ Browser APIs type can vary but the most used is :
    - o Dom API : turns html into a node tree that represented as a JS object
    - o Geolocation API : returns coordinates of where the browser is located
    - o Fetching API :fetch data and sign it
    - o Canvas API(Graphics API)
    - o Web storage API
- REST API(representational state transfer)
  - ➢ Set of principles that help for building highly efficient API
  - ➢ Data provider for the mobile apps or websites
  - ➢ It can be called a web server
  - ➢ The most common data API

- Sensor based API
  - ➢ Internet of things API
  - ➢ It is an actual physics senses that is interconnected together

- ▪ **APIs functionality**
  - The API uses endpoint to specify how the resources can be accessed
  - Endpoints are part of the URL of the website
    - ✓ EX https://www.coursera.org/learn/introduction-to-front-end-development/lecture/G30rT/apis-and-services
      `apis-and-services` is the endpoint
  - Two common forms of responses
    - ➢ Full web pages
    - ➢ Json data form for JavaScript

- ❖ **IDE(Integrated Development Environment)**
  - IDEs like text editors but instead of documents you write codes
    - ➢ It could be specific for one programming language :
      - o Pycharm
      - o Codeblocks
    - ➢ It can be for many languages :
      - o Visual studio
      - o Atom
      - o NetBeans
  - IDEs can vary between its elements and the distinguish between variables and functions
  - IDEs have functions that can make many tasks such as refactoring that saves your time by changing the structure not the functionality

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- IDEs can effort other features such as :

  - ➢ Autocomplete
  - ➢ Error highlighting
  - ➢ Syntax error highlighting
  - ➢ intellisense