By Sazilah Salam

Introduction to Web Technology

Learning Outcome

At the end of this lesson, students should be able to:

- Compare the difference between the Internet and the Web technology
- Explain the Web technologies used to develop Web applications
- Compare the difference between Frontend, Backend and Full Stack Developers

History of the Internet

Years	Events
1960s	The US Department of Defense funded a project called ARPANET (Advanced Research Projects Agency Network) to connect computers at different universities and research centers, allowing researchers to share information and resources.
1970s	Email was developed and became one of the first applications of the internet. TCP/IP (Transmission Control Protocol/Internet Protocol) was also developed providing a standardized way for computers to communicate with each other over a network.
1980s	The internet began to expand beyond academic and research communities, as businesses and governments started to use it for communication and commerce. The World Wide Web was invented in 1989 by Tim Berners-Lee, a researcher at CERN (the European Organization for Nuclear Research), who developed the first web browser and web server.
1990s	The internet experienced a rapid expansion, as more people gained access to it through personal computers and the development of the first graphical web browsers, such as Mosaic and Netscape Navigator. E-commerce also emerged during this time, with the first online stores and marketplaces being established.
2000s	The internet became a more social and interactive space, with the rise of social networking sites like MySpace and Facebook, as well as the development of blogs and online forums. The introduction of smartphones and mobile internet also revolutionized the way people access and use the internet.

How does Internet work?

What is the Internet?

◉ A huge collection of computers connected by **TCP/IP** (Transmission Control Protocol/Internet Protocol) in a network

• IP addresses
  • Set of four integers uniquely identifying each node
  • Example: 128.135.197.76

• Since numbers are difficult to remember, the Internet evolved DNS addresses
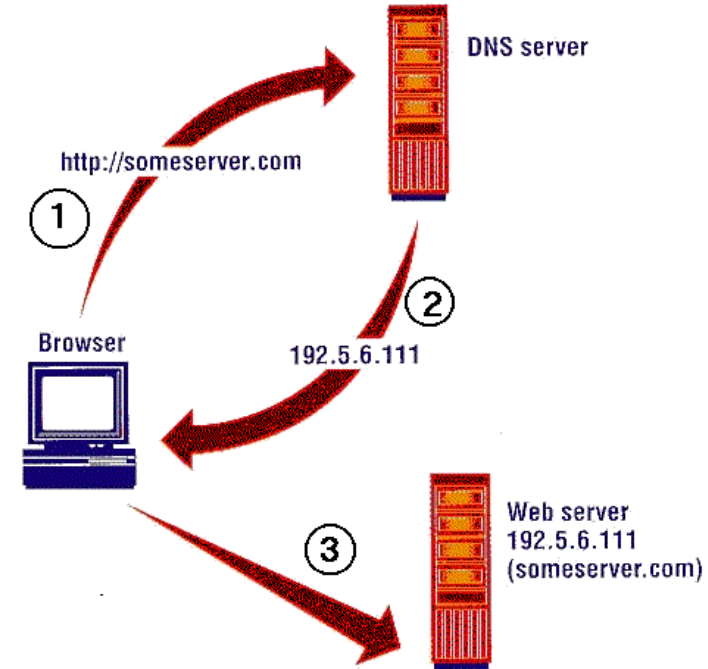
Internet Protocol (IP)

Computers are identified by unique numeric addresses

Form: 32-bit binary number

Example : **191.57.126.0** to **191.57.126.255** has 256 IP addresses

Written as four 8-bit numbers, separated by periods

Organizations are assigned groups of IPs for their computers

Domain Name System (DNS)

- ❑ DNS translates domain names to network addresses. For example:
  - altavista.com is 192.136.112.39
- ❑ Separate domain administrations:
  - Defined types: COM, EDU, GOV, BIZ, TEL, NET, ORG, INFO, NAME, MOBI
  - Countries: US, JP, FR, MY, RU, CH, UK, etc.
- ❑ Tree structured directory
- ❑ A DNS address (ftmk.utem.edu.my) consists of:
  - Domain name for organizations (**ftmk.utem.edu.my**)
    - institutional site name (**ftmk.utem**)
    - top-level domain(tld) name (**edu.my**)
  - host name for individual machines (**ftmk)**

Domain Name System
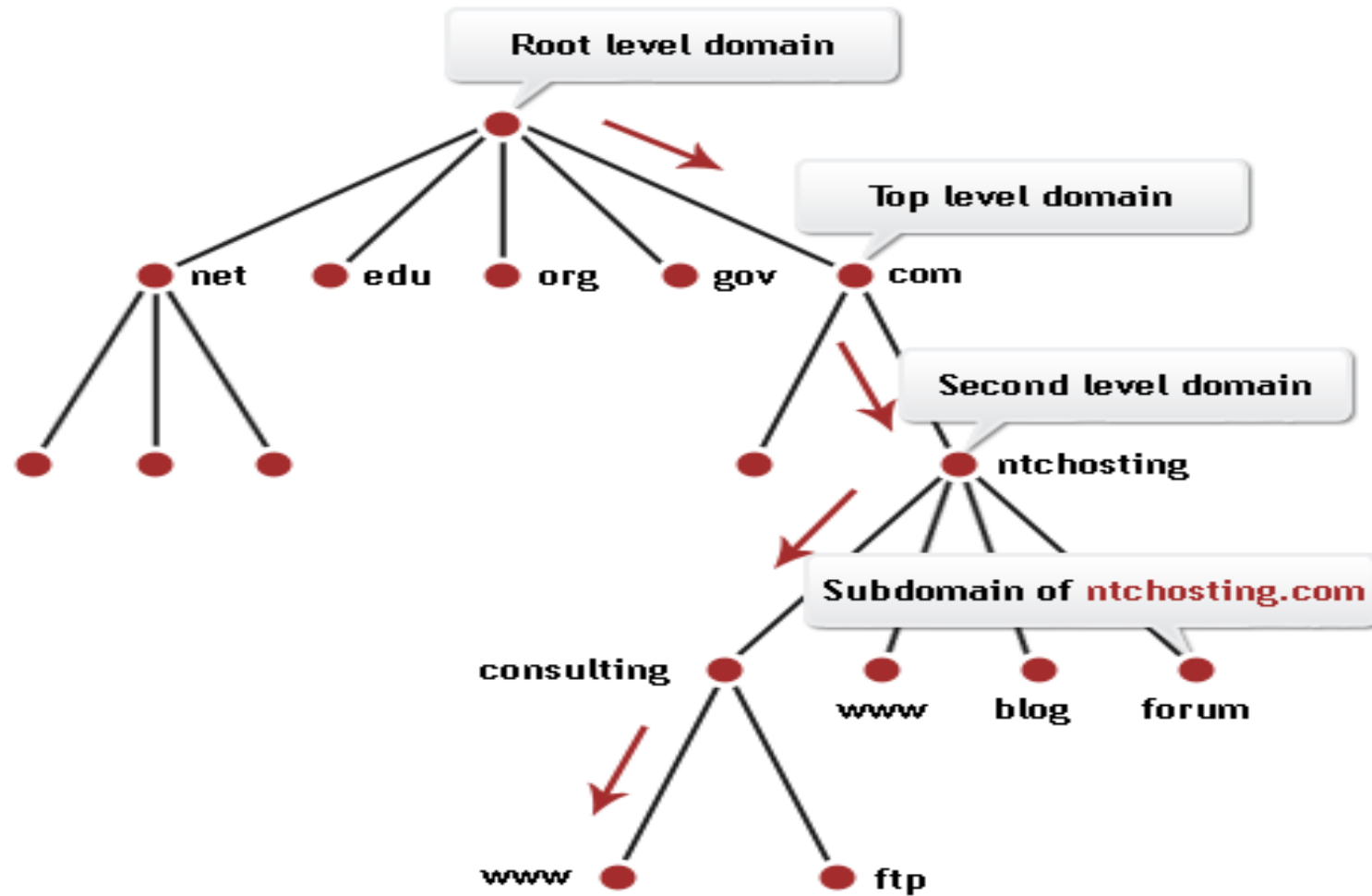
Domain Naming Rules

Max 255 characters per name

From 2 to 5 labels per domain name

- faizal.uhost.co.tv has 4 labels

Labels of up to 63 characters

Allowable characters are A-Z, 0-9, and '-'

Domain names are not case sensitive

- Other parts of a URL may be case sensitive

Trademark owners get preference

History of the World Wide Web

Years	Events
1989	The World Wide Web (WWW or Web) was invented by Tim Berners-Lee, a researcher at CERN, as a way to share information between researchers in different countries. He developed the first web browser and web server, and created the first web page, which explained how the Web worked.
1990s	The Web began to expand beyond academic and research communities, as businesses and governments started to use it for communication and commerce. The first online stores and marketplaces were established, and the first search engines, such as Archie and Gopher, were developed.
1993	The first graphical web browser, Mosaic, was released, which allowed users to view images and navigate the Web more easily. This led to a rapid expansion of the Web, as more people gained access to it through personal computers and the development of new browsers, such as Netscape Navigator and Internet Explorer.
Late 1990s	The Web became a more commercial space, as companies began to establish their online presence and sell products and services directly to consumers. The dot-com boom and subsequent bust saw many internet-based companies rise and fall, but it also led to the development of new technologies and standards, such as HTML and CSS, that enabled the creation of more complex and interactive websites.
2000s	The Web became a more social and interactive space, with the rise of social networking sites like MySpace and Facebook, as well as the development of blogs and online forums. The introduction of

Web Browser

- Web Browser is a software application that is used to access and view web pages on the Internet. It allows users to navigate through the Web and interact with web content, including text, images, videos, and applications.

- It uses a rendering engine to interpret and display web content, such as HTML, CSS, and JavaScript.

- Support additional technologies, such as cookies, caching, and SSL encryption.

- Several popular web browsers available today, including Google Chrome, Mozilla Firefox, Microsoft Edge, Apple Safari, and Opera

- Web browsers have evolved over time with features such as tabbed browsing, bookmarking, and autofill, as well as extensions and add-ons that enhance their functionality.

- Also provide tools for developers, such as developer tools and debugging consoles, to help them build and test web applications.

- May run programs in JavaScript, Ruby, Dart, TypeScript, Phyton etc.

Web Server

- Web Server is a software application that responds to requests from web browsers or other client applications, and delivers web content over the Internet.

- The primary function of a web server is to store, process, and deliver web pages and other web-based applications to users who request them.

- Web servers use various protocols to communicate with client applications, including HTTP (Hypertext Transfer Protocol), which is the primary protocol used on the Web, as well as HTTPS (HTTP Secure) for secure connections.

- When a web browser requests a web page or other content from a web server, the server responds with the requested content, which is then rendered by the browser for the user to view.

- Popular web server software applications include Apache HTTP Server, Microsoft Internet Information Services (IIS), NGINX, and Lighttpd.

- Web servers can be used to host static web pages or dynamic web applications, such as e-commerce sites, social networking platforms.

- They can also provide various features, such as load balancing, caching, and SSL encryption, to enhance the performance and security of web applications.

Uniform Resource Locator (URL)

- All Web pages are addressed with URLs

- Format: *protocol* :*address*

  - *protocol* may be

    - ftp, http, mailto, telnet, etc

  - *address* specifies

    - A server name

    - A directory path (optional)
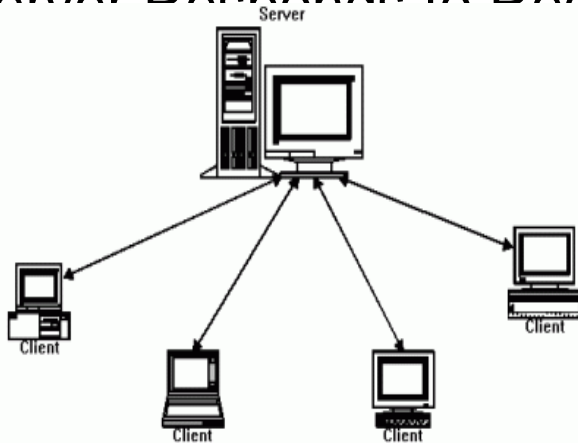
    - A filename

- Example:

  http://www.ftmk.utem.edu.my/bitm2113/rajah1.png

HTTP: Hypertext Transfer Protocol

Transactions between client and server:

- Client connects
- Client makes one or more Requests
- Server Responds to Requests
- C

HTTP client request has three parts:

1) a request line (HTTP method, the URL of the resource, and the HTTP version used)

Most frequently used methods are:

- GET retrieve a resource from the server.
- POST submit data to the server.
- PUT update a resource on the server.

2) zero or more request headers

3) an optional request body

More info: https://www.tutorialspoint.com/http/index.htm

The Internet vs. The World Wide Web

- The Internet and the World Wide Web are both part of the Web technology.

- The Internet is a global network of interconnected computer networks that enables communication and the exchange of information between devices all over the world.

- The World Wide Web, on the other hand, is a system of interconnected documents and resources, accessed through the Internet, that are linked by hyperlinks and URLs.

- The World Wide Web is built on top of the Internet and relies on the Internet infrastructure to function. The Web uses a range of technologies, such as HTTP, HTML, CSS, JavaScript, and many others, to create and deliver content to users all over the world.

- Therefore, while the Internet and the World Wide Web are distinct entities, they are both essential components of the Web technology that underpins much of modern computing and communication.

Web Technology

Web technology refers to the collection of tools, platforms, programming languages, and protocols that are used to develop and operate web-based applications and services.

This includes technologies for both the frontend and backend of web applications, as well as technologies for web hosting, data storage, and security.

Web technology has enabled the development of a wide range of web-based applications and services, including websites, web applications, e-commerce platforms, social media, online banking, cloud computing, and many others.

Web technology has also had a significant impact on how we communicate, work, and consume information, and has become an essential part of modern society.

	Frontend Technologies	Backend Technologies
1.	HTML	Node.js
2.	CSS	PHP
3.	JavaScript	MySQL
4.	jQuery	MongoDB
5.	Angular	Ruby on Rails
6.	React	Django

Typical Frontend & Backend Technologies

Typical Frontend Technologies

Web Technology	Category	Description
Hypertext Markup Language (HTML)	Markup language	The standard markup language used to create web pages. It provides the structure and content of the web page.
Cascading Style Sheet (CSS)	Style sheets	Used to define the layout and appearance of web pages. It provides a way to separate content from presentation.
JavaScript	Programming language	Used to create interactive effects within web browsers. It can be used to create dynamic and responsive web applications.
jQuery	JavaScript library	It simplifies the process of writing JavaScript code. It provides a range of pre-built functions and features that can be used to create complex web applications.
Angular	JavaScript framework	Developed by Google. It provides a way to build large-scale, high-performance web applications.
React	JavaScript library	Developed by Facebook. It provides a way to build user interfaces using reusable components.

Typical Backend Technologies

Web Technology	Category	Description
Node.js	JavaScript runtime	A JavaScript runtime that allows developers to use JavaScript on the server-side. It provides a way to build fast and scalable web applications.
PHP	Scripting language	A server-side scripting language used to create dynamic web pages. It is widely used for web development due to its ease of use and compatibility with various databases
MySQL	Database	A popular open-source relational database management system used to store and manage data for web applications.
MongoDB	Database	A NoSQL database used for storing unstructured data. It is popular among web developers due to its scalability and flexibility.
Ruby on Rails	Web Application Framework	A web application framework written in the Ruby programming language. It provides a way to build complex web applications quickly and easily.
Django	Web Application Framework	A web application framework written in Python. It provides a way to build high-performance web applications with a clean and pragmatic design.

Frontend Developers

- A front-end Web developer is mainly in charge of
  › the user interface
  › the style of the website.
- The most commonly used languages a frontend developer uses are:

- These languages are essential to frontend developers and are very important in defining the actual design of a website.

Backend Developers

- A back-end web developer is mainly in charge of

  › How things work

  › Logic and data

- Need to be proficient in programming languages that render on the server-side of a website or application.

- The most popular backend programming languages are PHP, Ruby, Python, and JavaScript (Node.js

- Also need to be proficient in working with databases like MySQL, MongoDB, Oracle, and SQLServ

Full Stack Developers Skills (1)

Most common skills that full-stack developers possess are:

Category	Skills	Examples
Programming languages	Proficient in multiple programming languages	JavaScript, HTML, CSS, Python, Ruby, Java, C++
Front-end development	A good understanding of front-end technologies to design and develop user interfaces that are both intuitive and attractive.	HTML, CSS, JavaScript, jQuery, and AngularJS
Back-end development	Have knowledge of server-side programming languages to create and maintain databases, handle server-side logic, and develop APIs that can interact with the front-end.	PHP, Python, Ruby, Java
Databases	A good understanding of database systems to manage and manipulate data efficiently.	MySQL, MongoDB, Oracle
Web development frameworks	proficient in web development frameworks to build complex web applications more efficiently.	Node.js, React, Angular, Django, Ruby on Rails

Full Stack Developers Skills (2)

Category	Skills	Examples
Version control	Know how to use version control tools to keep track of changes to the codebase and collaborate with other developers.	Git, SVN, and Mercurial
Deployment	Know how to deploy their code to production servers using tools.	Heroku, AWS, Digital Ocean
Testing	Have experience with testing frameworks to write tests that can ensure the code works as intended.	Jest, Mocha, and Selenium

Full Stack Developers Technologies

Common technologies that full stack web developers are expected to know include:

	Technology	Examples
1	Front-end technologies	HTML, CSS, JavaScript, jQuery, React, Angular, Vue.js, Bootstrap
2	Back-end technologies	Node.js, Express, Django, Ruby on Rails, Laravel, Flask
3	Databases	MySQL, PostgreSQL, MongoDB, Oracle
4	Cloud Services	Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform (GCP)
5	Version control systems	Git, SVN, Mercurial
6	Web servers	Apache, Nginx, IIS
7	DevOps tools	Docker, Kubernetes, Jenkins, Ansible, Chef
8	Testing frameworks	Jest, Mocha, Chai, Selenium
9	Security	HTTPS, SSL/TLS, OAuth, JWT
10	API development	REST, GraphQL, SOAP
11	Mobile app development	React Native, Flutter, Ionic
12	Project management	Jira, Trello, Asana, Slack

Thank you