Introduction to Internet & Web Systems

1

Fundamental Web Programming

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Outline

1. Introduction to World Wide Web

2. Essential Web Protocols

3. Web Development

What is the Internet ?

- **The Internet** is a worldwide system of interconnected networks and computers.

- **The Internet** is a network of networks that connects users in every country in the world. There are currently over one billion Internet users worldwide. It is the largest network in the world that connects hundreds of thousands of individual networks all over the world.

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Introduction to World Wide Web

Use of Internet

- Email
- Social Networking, Chat
- Information sharing
- Getting updates – News around the world
- Entertainment – Games, Videos and Music
- Virtual classrooms
- Remote Access
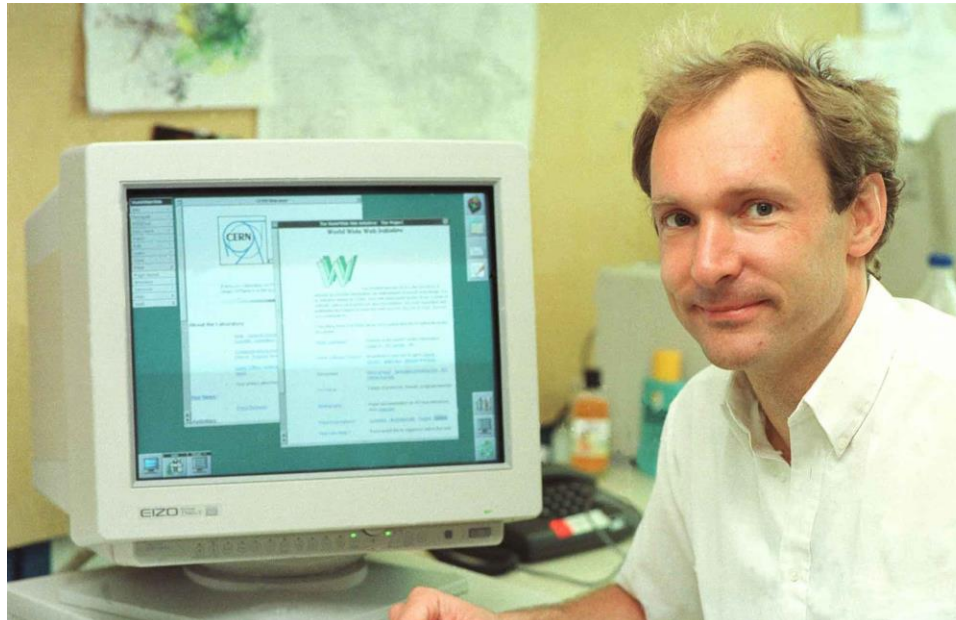- Online Jobs
- Online Meetings

Introduction to World Wide Web

What is the Web?

- The Web (World Wide Web) consists of information organized into Web pages containing text and graphic images.

- It contains hypertext links, or highlighted keywords and images that lead to related information.

- A collection of linked Web pages that has a common theme or focus is called a Web site.

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Introduction to World Wide Web

1990 Tim Berners Lee brought all of this together to form the **World Wide Web**. HTML documents transmitted over the Internet by a web server to web browsers using URIs and HTTP. The first web page online on Aug 6, 1991.

Sir Tim Berners-Lee invented the World Wide Web.

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Introduction to World Wide Web

- **Web pages** are an electronic documents that typically contains several types of information accessible via the World Wide Web

- **Web site** is a collection of related Web pages of a certain individual, group, or organization

- The Web uses a client/server model

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Introduction to World Wide Web

A client-server is a popular software design architecture which, at an abstract level, breaks down a software into two parts: client-side and server-side.
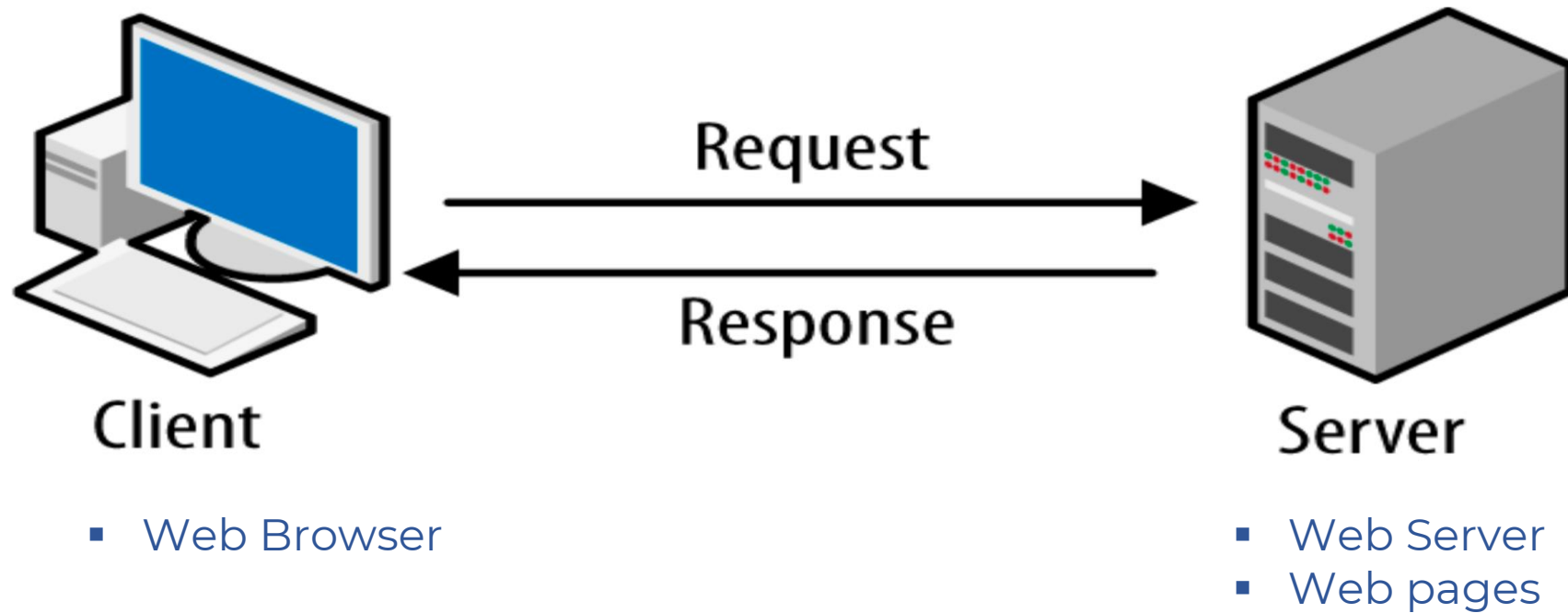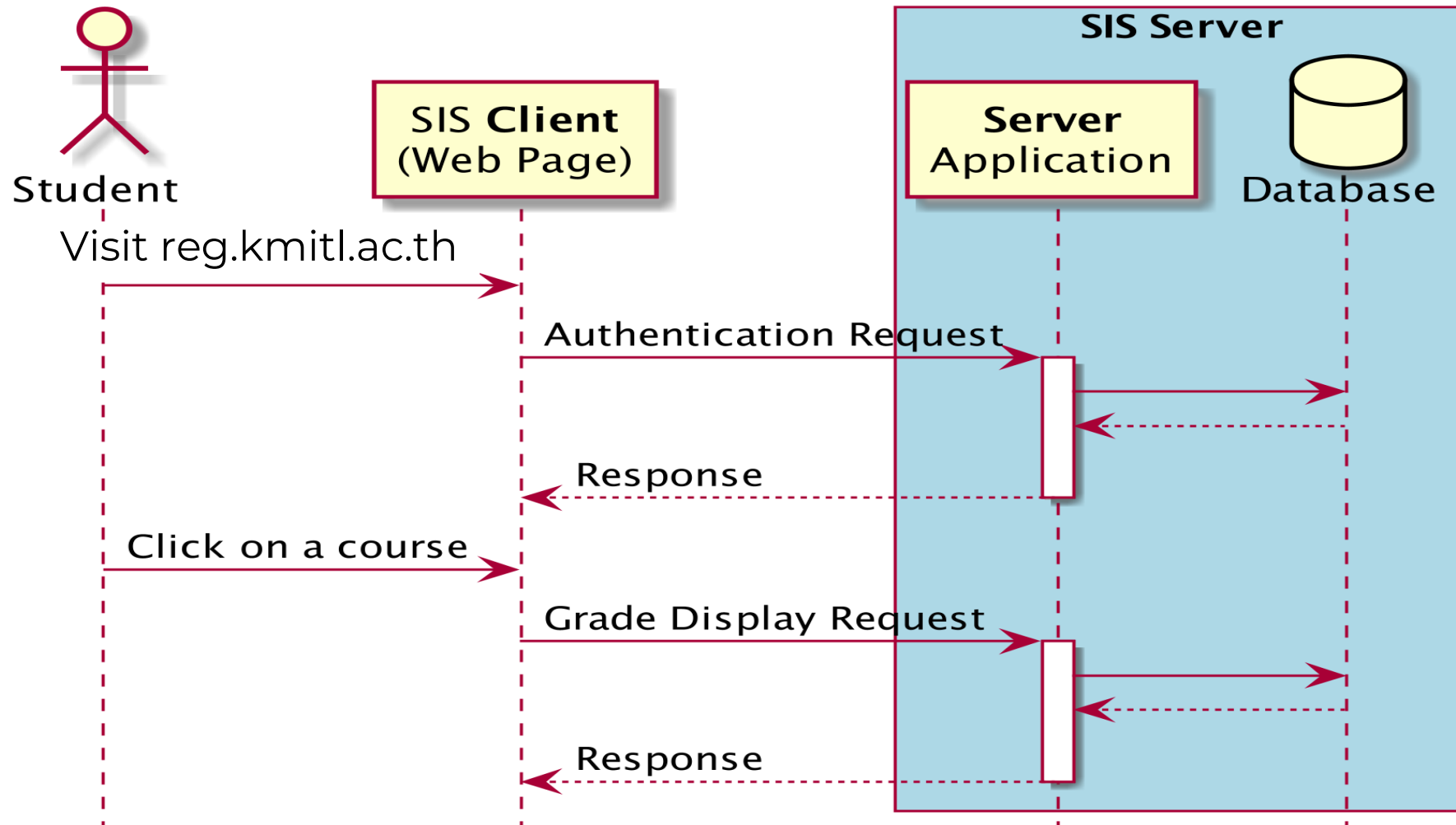
Request

Response

Client

Server

- Web Browser

- Web Server
- Web pages

Figure : Client-Server model

Introduction to World Wide Web

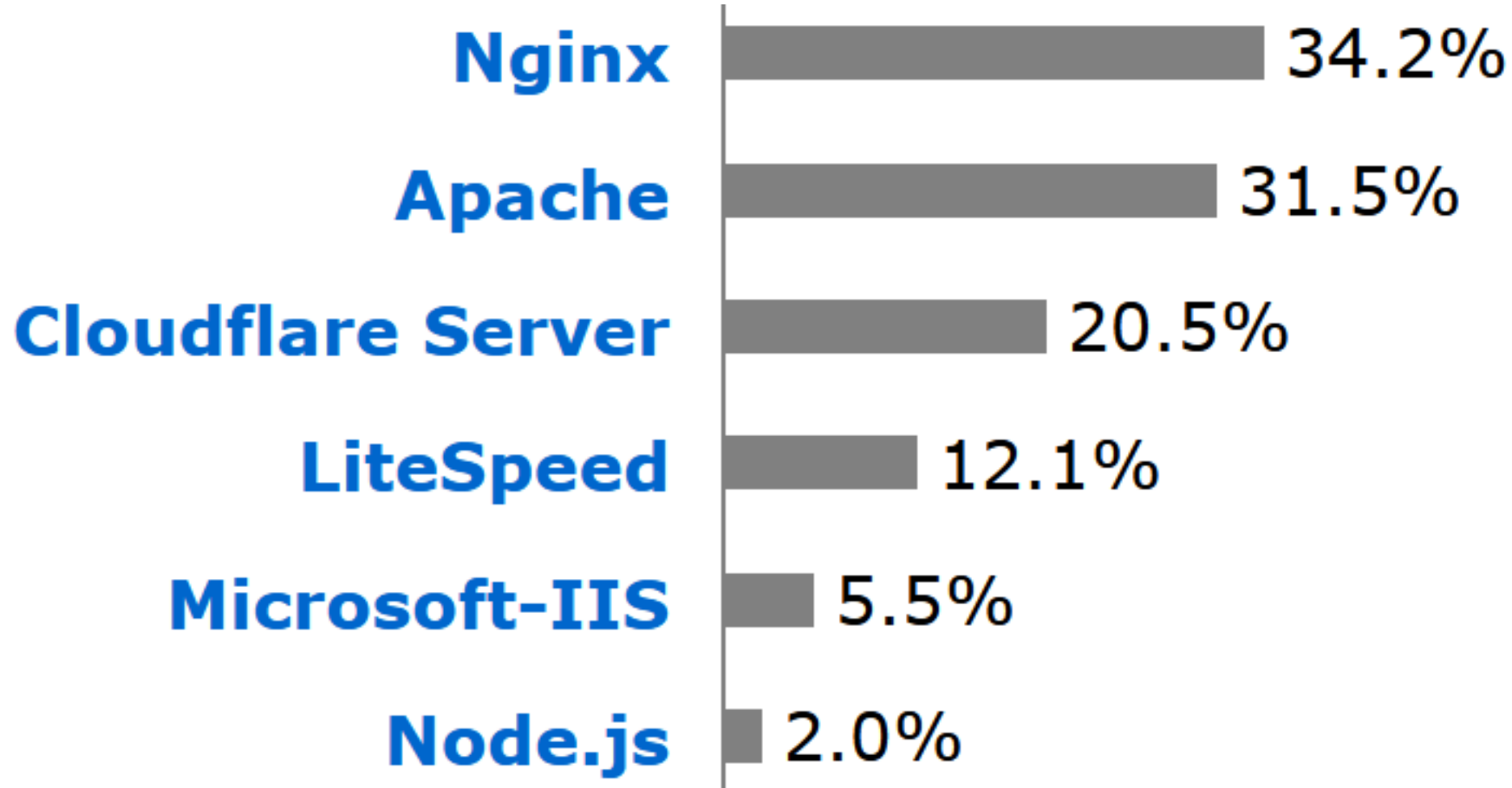**Figure** : An example of student information system(SIS)

Introduction to World Wide Web

A **web server** is server software, or hardware dedicated to running software, that can satisfy World Wide Web client requests.

- The primary function of a web server is to store, process and deliver web pages to clients.

- The communication between client and server takes place using the HTTP.

- Pages delivered are most frequently HTML documents, which may include images, style sheets and scripts in addition to the text content.

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Introduction to World Wide Web

Nginx	34.2%
Apache	31.5%
Cloudflare Server	20.5%
LiteSpeed	12.1%
Microsoft-IIS	5.5%
Node.js	2.0%

The top web servers on the Internet by W3Techs Usage of Web Servers for Websites in July 2023.

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Introduction to World Wide Web

Web browser is an application software that is used to locate and issue a request for the page on the web server that hosts the document

- It also interpret the page sent back by the web server and display it on the monitor of the client computer

- computer program that lets you view and explore information on the World Wide Web

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Essential Web Protocols

Protocol is a detailed specification of how communication between two computers will be carried out in order to serve some purpose. Also, Protocols specify interactions between the communicating entities.

Internet Protocol is the principal communications protocol for *addressing host interfaces, encapsulating data into datagrams and routing datagrams* from a source host interface to a destination host interface across one or more networks.

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Essential Web Protocols

Internet protocol suite is the conceptual model and set of communications protocols used on the Internet and similar computer networks. It is commonly known as OSI Model.

The Internet relies on a number of protocols in order to function properly. A protocol is simply a standard for enabling the connection, communication, and data transfer between two places on a network. Here are some of the key protocols that are used for transferring data across the Internet.

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Essential Web Protocols

TCP/IP is fundamental to the definition of the Internet, it's natural to begin study of Internet protocols with these protocols.

- TCP and IP are two different protocols.
- TCP(Transmission Control Protocol) defines how computers send packets of data to each other.
- IP (Internet Protocol) is fundamental to the definition of the Internet. A key element of IP is the *IP address*, which is simply a 32-bit number.
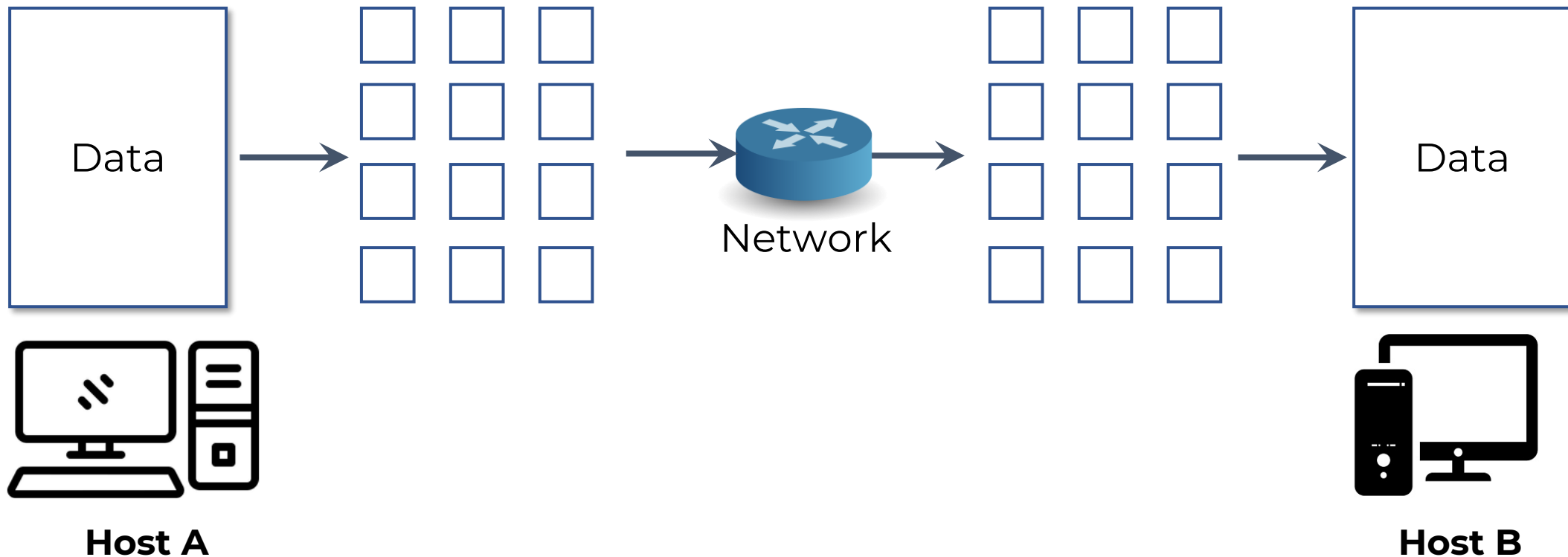
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Essential Web Protocols

TCP (Transmission Control Protocol) is a connection-oriented protocol and offers end-to-end packet delivery. It acts as back bone for connection.

- ✓ TCP corresponds to the Transport Layer of OSI Model.
- ✓ TCP offers features:
  - ▪ Stream Data Transfer.
  - ▪ Reliability.
  - ▪ Efficient Flow Control
  - ▪ Full-duplex operation.
  - ▪ Multiplexing.

Essential Web Protocols

Figure: TCP data packages

Host A

Network

Host B

Essential Web Protocols

Internet Protocol (IP) is connectionless and unreliable protocol. It ensures no guarantee of successfully transmission of data. In order to make it reliable, it must be paired with reliable protocol such as TCP at the transport layer.

- Each device on the Internet has one or more **IP addresses** associated with it.

- **IP addresses** are normally written as a sequence of four decimal numbers separated by periods, as in **192.0.34.166**. Each decimal number represents one byte of the **IP address**.

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Essential Web Protocols

UDP (User Datagram Protocol) is an alternative protocol to TCP that also builds on IP. The main feature that UDP adds to IP is the port concept that we have just seen in TCP.
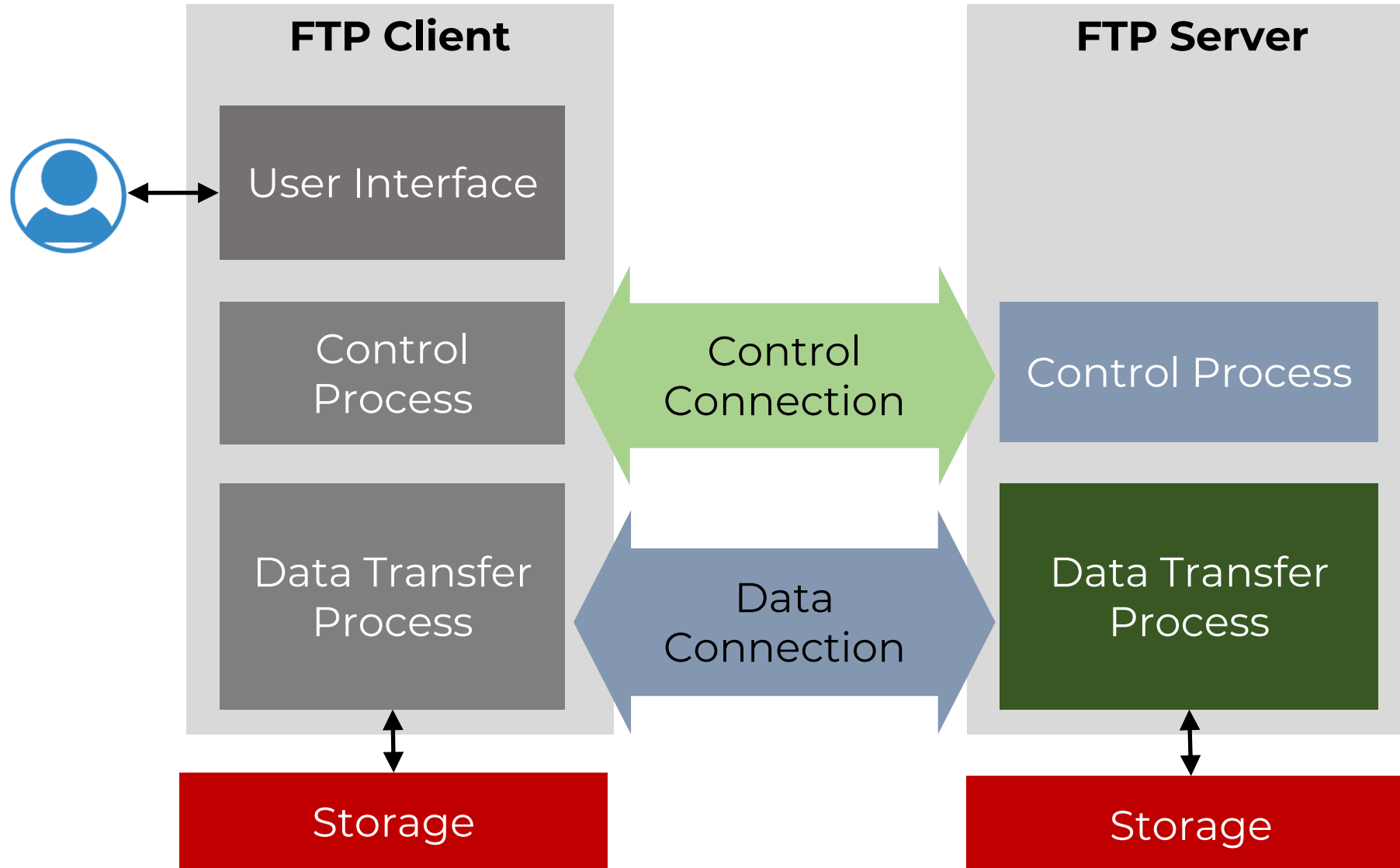
- It does not provide the two-way connection or guaranteed delivery of TCP.
- Its advantage over TCP is speed for simple tasks.
- One Internet application that is often run using UDP rather than TCP is the DNS.

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Essential Web Protocols

FTP (File Transfer Protocol) is used to copy files from one host to another. FTP offers the mechanism for the same in following manner:

- FTP creates two processes such as Control Process and Data Transfer Process at both ends i.e. at client as well as at server.

- FTP establishes two different connections: one is for data transfer and other is for control information.

- Control connection is made between control processes while Data Connection is made between data transfer processes.

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Essential Protocols – FTP

FTP Client

FTP Server

User Interface

Control Process

Control Connection

Control Process

Data Transfer Process

Data Connection

Data Transfer Process

Storage

Storage

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Essential Web Protocols

How to use FTP ?

- **Graphical FTP clients**: A graphical FTP clients simplify file transfers by allowing you to drag and drop file icons between windows.

- **Web browser**: You can use a web browser to connect to FTP addresses exactly as you would to connect to HTTP addresses.

- **Command-line FTP**: Windows, macOS, and Linux have built-in command-line clients.

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Essential Web Protocols

HTTP (Hypertext Transfer Protocol) is a form of communication protocol, in particular a detailed specification of *how web clients and servers should communicate*. The basic structure of HTTP communication follows what is known as a "request–response model".

HTTP is the primary TCP-based protocol used for communication between web servers and browsers.

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Essential Web Protocols

A nice feature of **HTTP** is that these request and response messages often consist entirely of plain text in a readable form.

```
Server: Apache/1.3.27 (Unix)  (Red-Hat/Linux)
Last-Modified: Wed, 08 Jan 2003 23:11:55 GMT
ETag: "3f80f-1b6-3e1cb03b"
Accept-Ranges: bytes
Content-Length: 438
Connection: close
Content-Type: text/html

<HTML>
<HEAD>
<TITLE>Example Web Page</TITLE>
</HEAD>
<body>
```

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Essential Web Protocols

HTTP Secure (HTTPS) is an extension of the HTTP for secure communication over a computer network and is widely used on the Internet.

- The communication protocol is encrypted using Transport Layer Security (TLS), or formerly, its predecessor, Secure Sockets Layer (SSL).
- The protocol is therefore also often referred to as HTTP over TLS, or HTTP over SSL.

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Web Development

Web System can be classified into the following sections:

- **World Wide Web** (WWW) is based on several different technologies : Web browsers, Hypertext Markup Language (HTML) and Hypertext Transfer Protocol (HTTP).

- **Web browser** is an application software to explore www. It provides an interface between the server and the client and requests to the server for web documents and services.

- **Web Server** is a program which processes the network requests of the users and serves them with files that create web pages. This exchange takes place using HTTP.

Web Development

Web System can be classified into the following sections: (cont.)

- **Web Page** is a digital document that is linked to the World Wide Web and viewable by anyone connected to the internet has a web browser.

- **Web Development** refers to the building, creating, and maintaining of websites. It includes aspects such as web design, web publishing, web programming, and database management. It is the creation of an application that works over the internet i.e. websites.

Web Development

The three basic types of Web System Development are as follows:

1. **Front-end Development**: The part of a website that the user interacts directly is termed as front end. It is also referred to as the client-side of the application.

2. **Back-end Development**: Back-end is the server-side of a website. It is the part of the website that users cannot see and interact. It is the portion of software that does not come in direct contact with the users. It is used to store and arrange data.

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Web Development

The three basic types of Web System Development are as follows: (cont.)

3. **Full-stack Development**: Front-end and back-end tasks are covered by full-stack web system development. Many full-stack developers specialize in one part of development, but their breadth of knowledge helps troubleshoot and speed up a construction or redesign.

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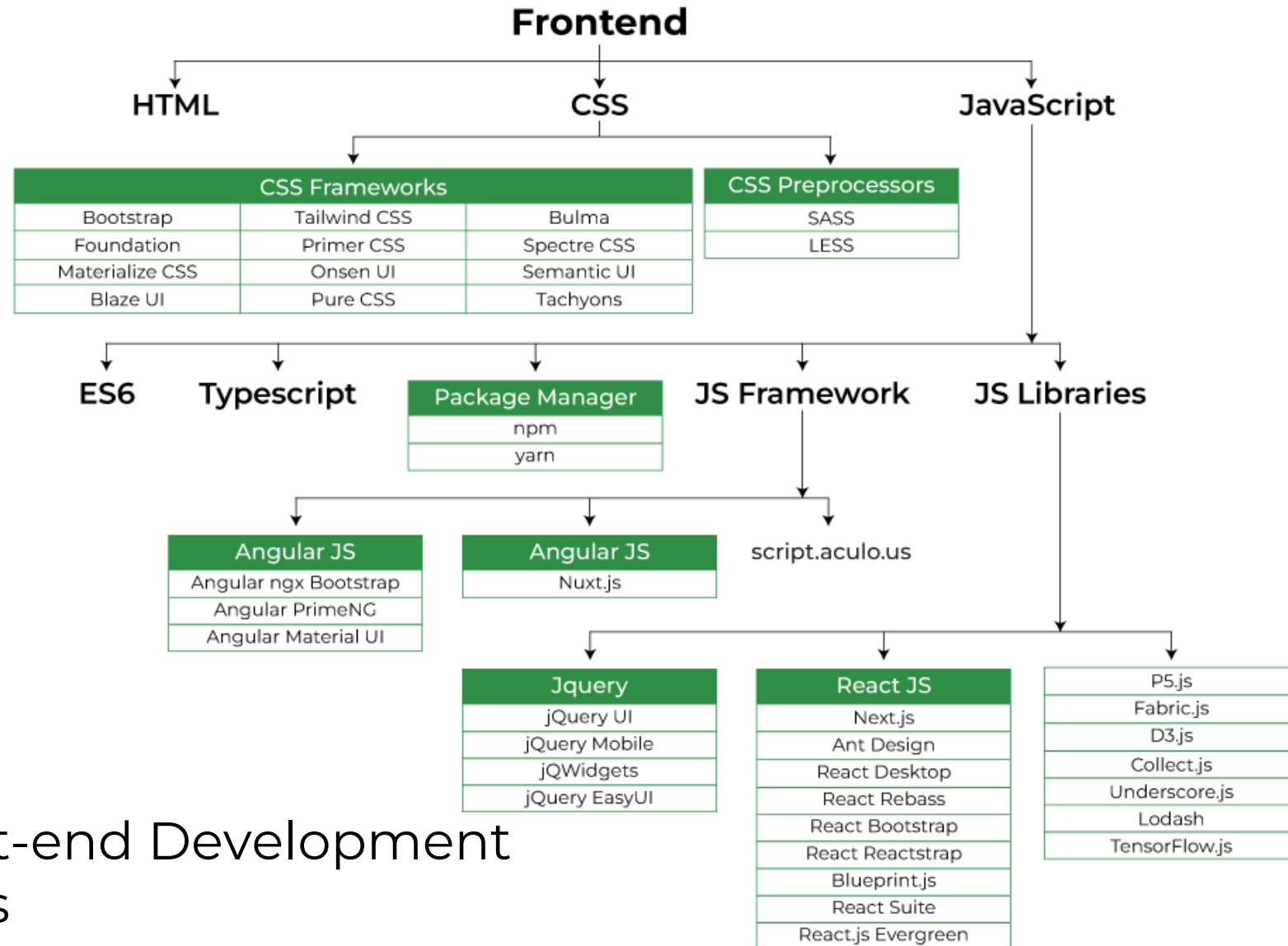# Web Development: Front-end Technologies

Figure: Front-end Development Technologies

Web Development: Front-end Technologies

The front-end portion is built by using some languages which are discussed below:

- **HTML** (Hypertext Markup Language) is used to design the front-end portion of web pages using a markup language.

- **CSS**(Cascading Style Sheets) is a simply designed language intended to simplify the process of making web pages presentable. CSS allows you to apply styles to web pages. More importantly, CSS enables you to do this independent of the HTML that makes up each web page.

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Web Development: Front-end Technologies

The front-end portion is built by using some languages which are discussed below: (cont.)

- **JavaScript** is a scripting language used to create magic on the sites to make the site interactive for the user. It is used to enhancing the functionality of a website to running cool games and web-based software.

- **AJAX** (Asynchronous JavaScript and XML) is used to communicate with the server without refreshing the web page and thus increasing the user experience and better performance.
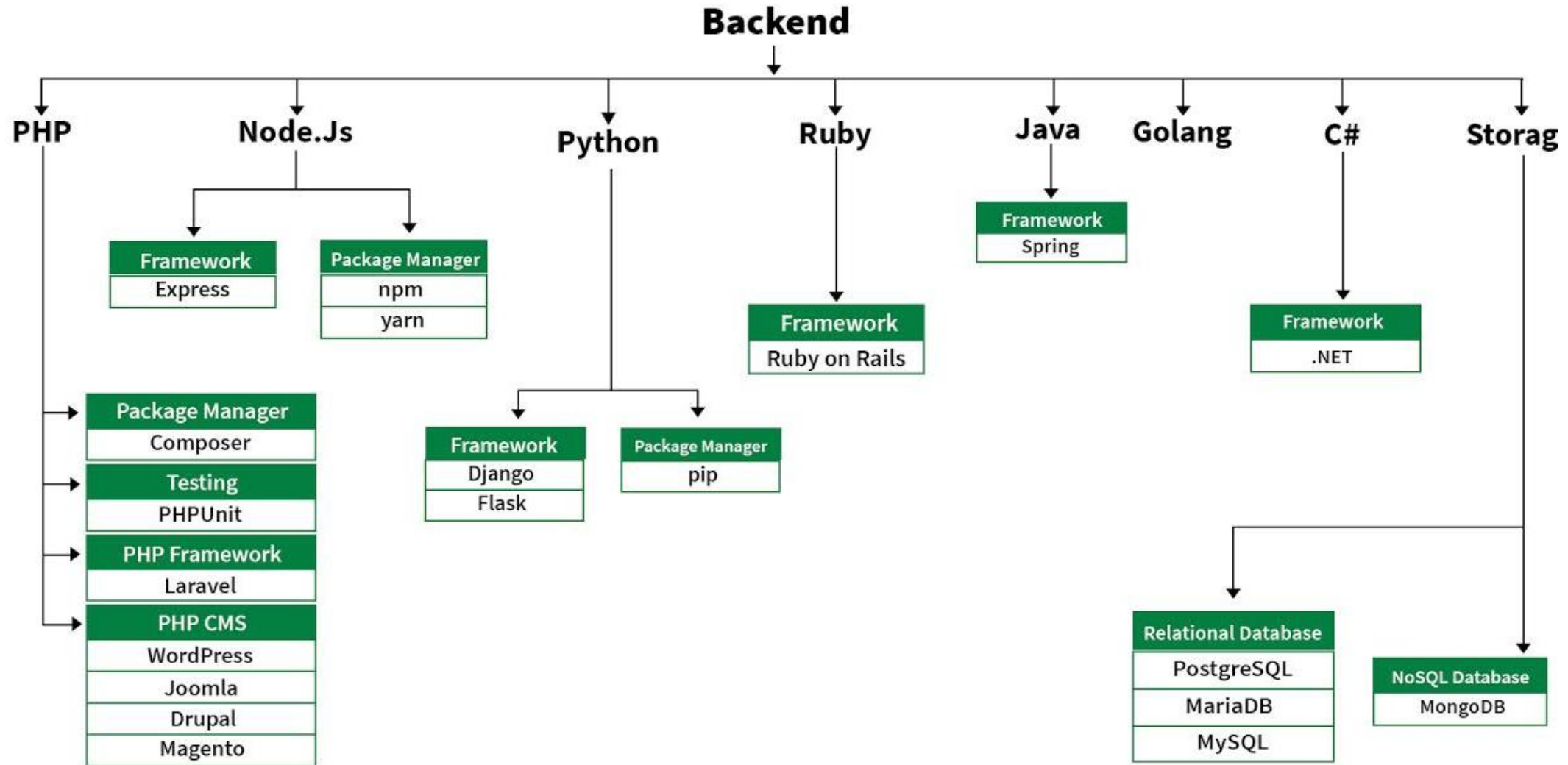
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Web Development: Back-end Technologies

Figure: Back-end Development Technologies

Web Development: Back-end Technologies

The back-end portion is built by using some languages which are discussed below:

- **PHP** is a server-side scripting language designed specifically for web development. Since PHP code executed on the server-side, so it is called a server-side scripting language.

- **Node.js** is a cross-platform runtime environment for executing JavaScript code outside a browser. Node.js is used for building back-end services like APIs like Web App or Mobile App.

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Web Development: Back-end Technologies

The back-end portion is built by using some languages which are discussed below: (cont.)

- **Python** is a programming language that lets you work quickly and integrate systems more efficiently.

- **Ruby** is a dynamic, reflective, object-oriented, general-purpose programming language. Ruby is a pure Object-Oriented language.

- **Java** is one of the most popular and widely used programming languages and platforms. It is highly scalable. Java components are easily available.

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Web Development: Back-end Technologies

The back-end portion is built by using some languages which are discussed below: (cont.)

- **JavaScript** can be used as both (front end and back end) programming.

- **Golang** is a procedural and statically typed programming language having the syntax similar to C programming language.

- **C#** is a general-purpose, modern and object-oriented programming language.

- **DBMS** (Database Management System) is a software which is used to manage database.

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Format of data is used by web applications to communicate with each other. It is light weight text-based data interchange format which means, it is simpler to read and write. Two common data formats used in web development.

- **XML**(Extensible Markup Language) is a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable.

- **JSON** (JavaScript Object Notation) is a format for structuring data.

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Web Development: Back-end Technologies

- **API** (Application Programming Interface) is a collection of communication protocols and subroutines used by various programs to communicate between them.

- **Web Protocols** are set of rules followed by everyone communicating over the web. Such as HTTP, TCP/IP Model, UDP, FTP, SMTP, SOAP, and so on.

- **Graphical elements and Fonts** are the key feature of any webpage. They can be used to convey important points better than simple text does and beautify the webpage.

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Web Development

Type of Web application

- E-commerce

- Content management

- Customer relationship management systems

- Mobile web technologies

- Web-enabled applications

- Social media and Computing

- Web Analytics and Search Engine

- etc.

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Web Development

Online Application

- No need to install

- Just login and use

- Available from anywhere where Internet connection is available

- Operating system independent

- No piracy issues

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