</talentlabs>

Web Development Fundamentals

Guide

- The notes and videos are for a brief introduction.
- You are encourage to go through the readings to have full understandings on the topics.
- Some of the **quiz answers are in the readings.**

Computer Network

References/Readings:

- How does the Internet work? | MDN

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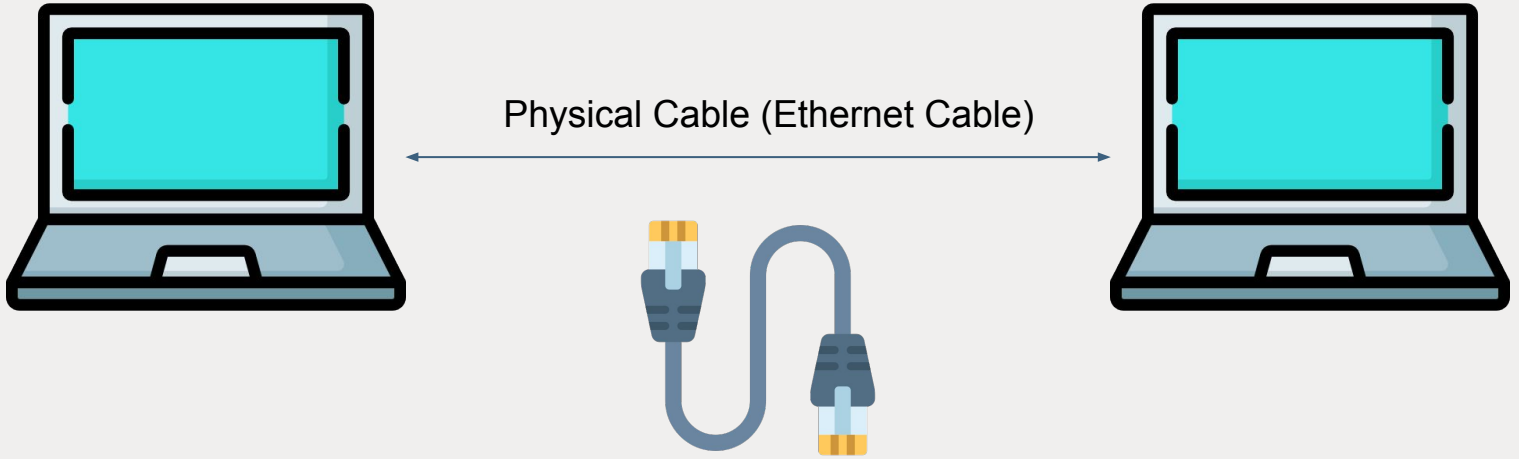
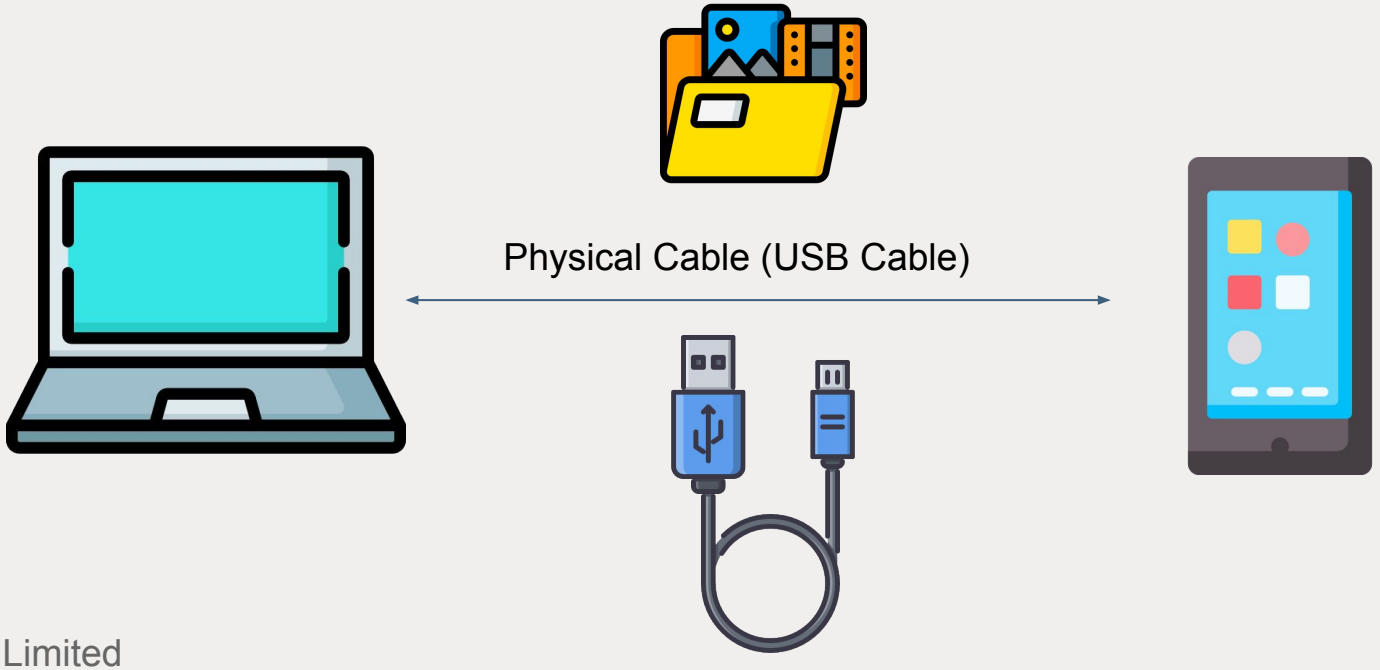
A Simple Network

We have two computers in a room.
How can they talk to each other?



A Simple Network

I haven’t connected two “computers” together before…?
Wait, here is a up to date example.



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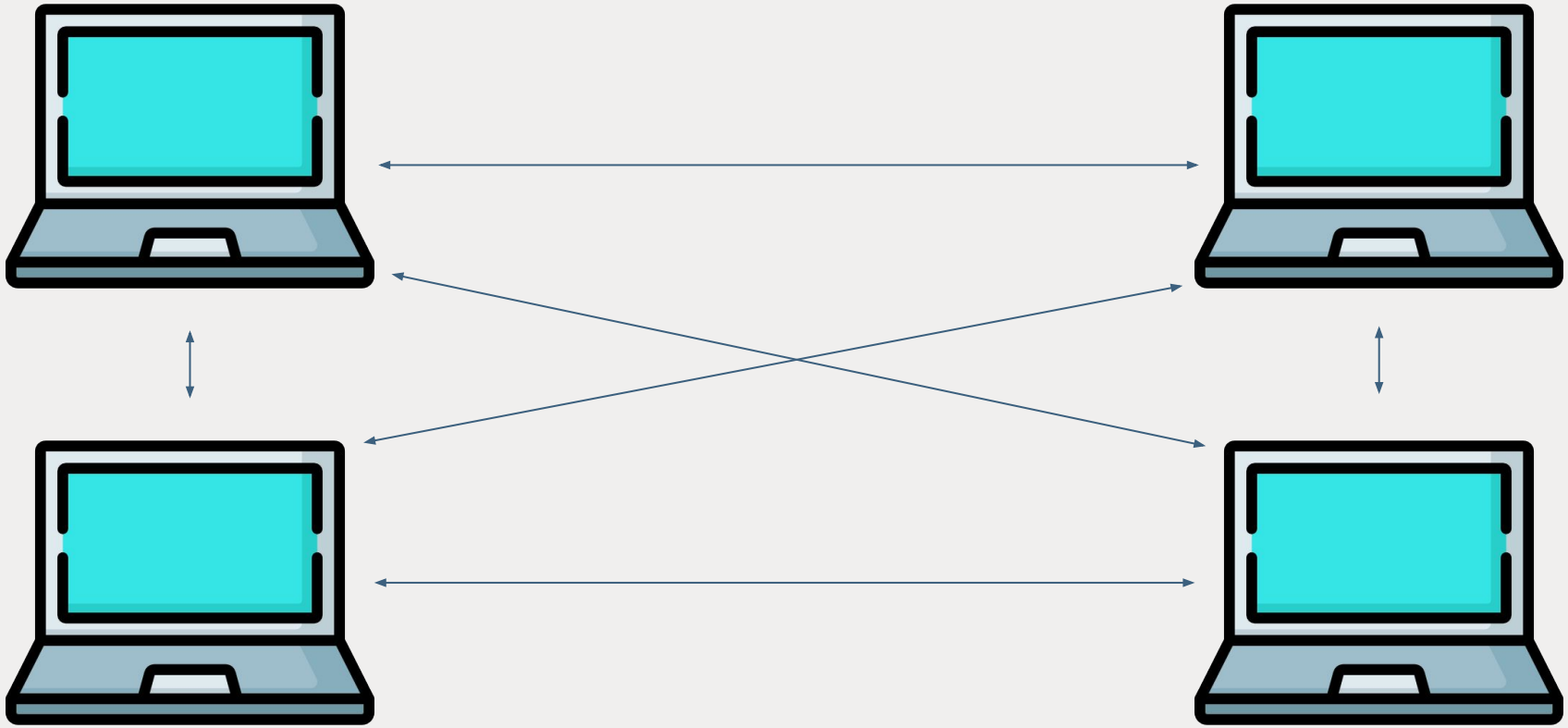
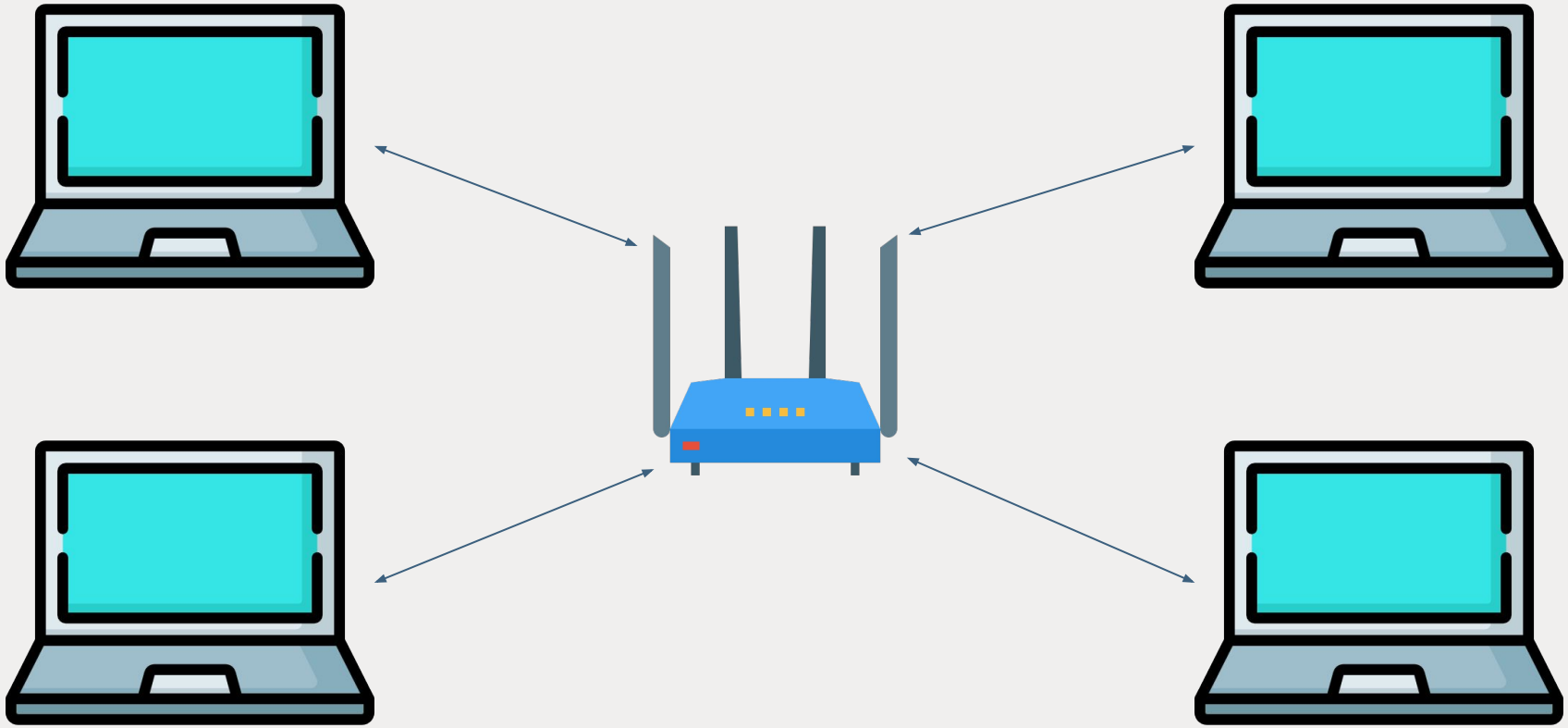
More Computers…

What if there are 4 computers? (6 cables !!!)
Cable Hell...



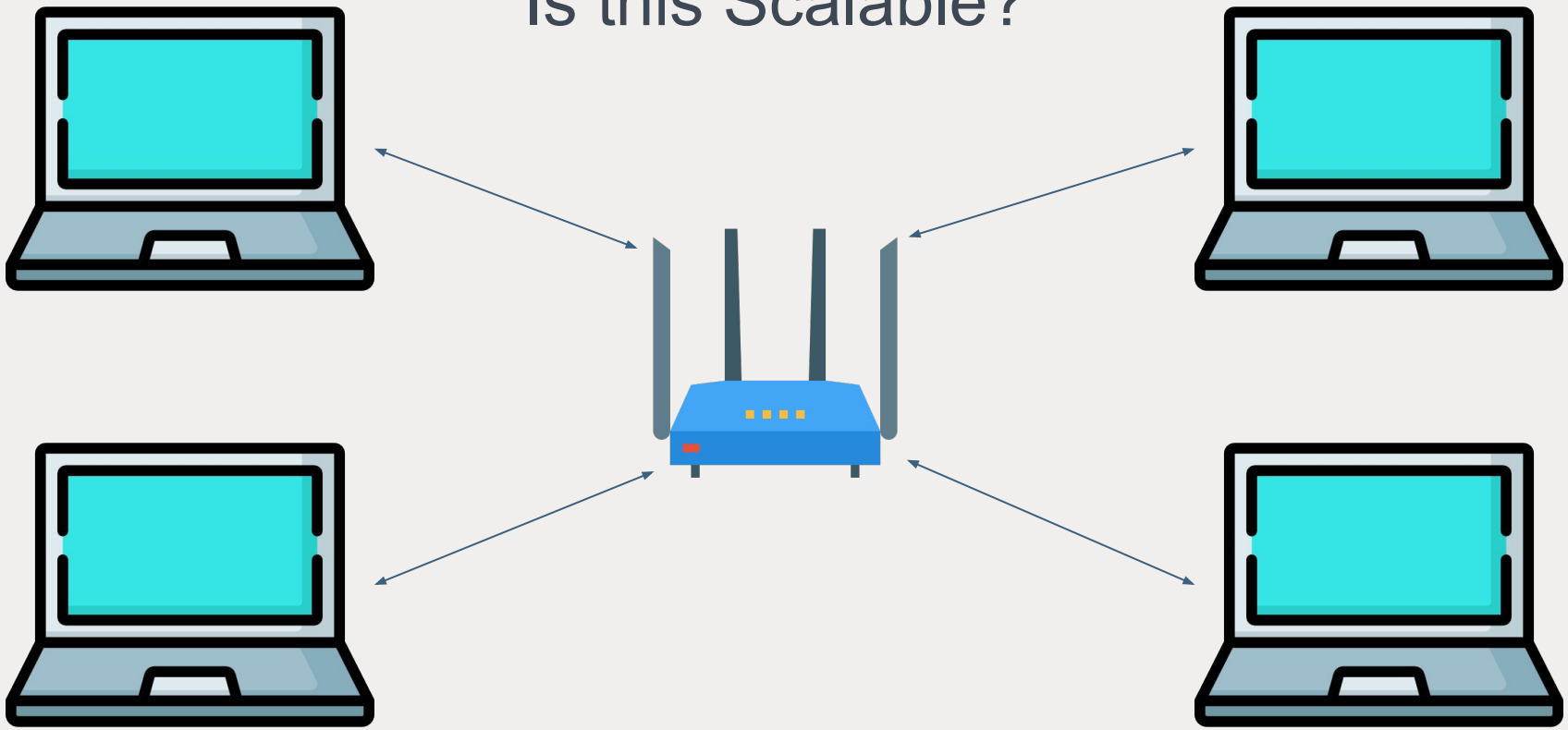
A middleman (Router)

Redesign it with a middleman to save the cable hell.



Local Area Network (LAN)

But why is it “local”?
What if we connect 1000 computers to that router?
Is this Scalable?



LAN-Party

In the good old days, internet was slow and there were no laptops.

People bring their desktop computers to a LAN-Party to play games with each others.

Network of Networks

References/Readings:

- How does the Internet work? | MDN

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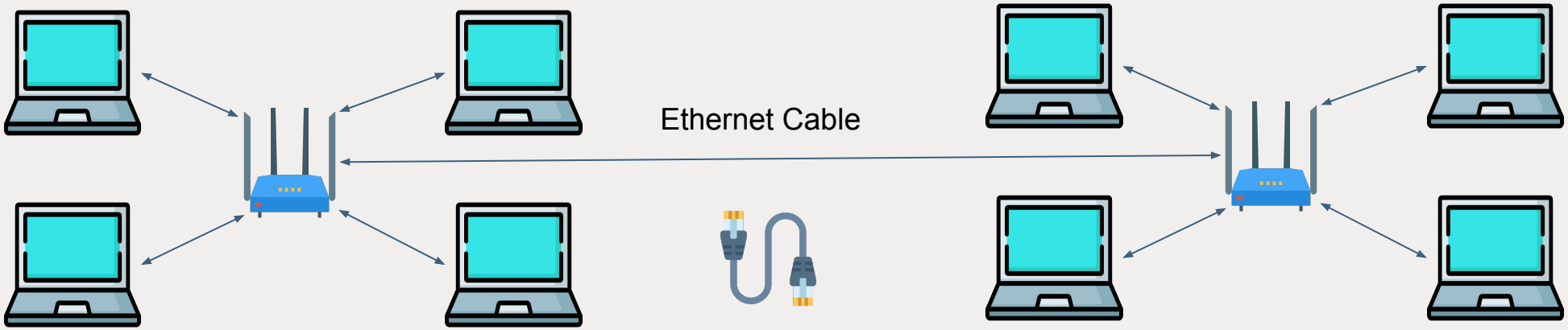
More Routers

Two LANs can be connected via their routers.
Room A LAN connects to Room B LAN.

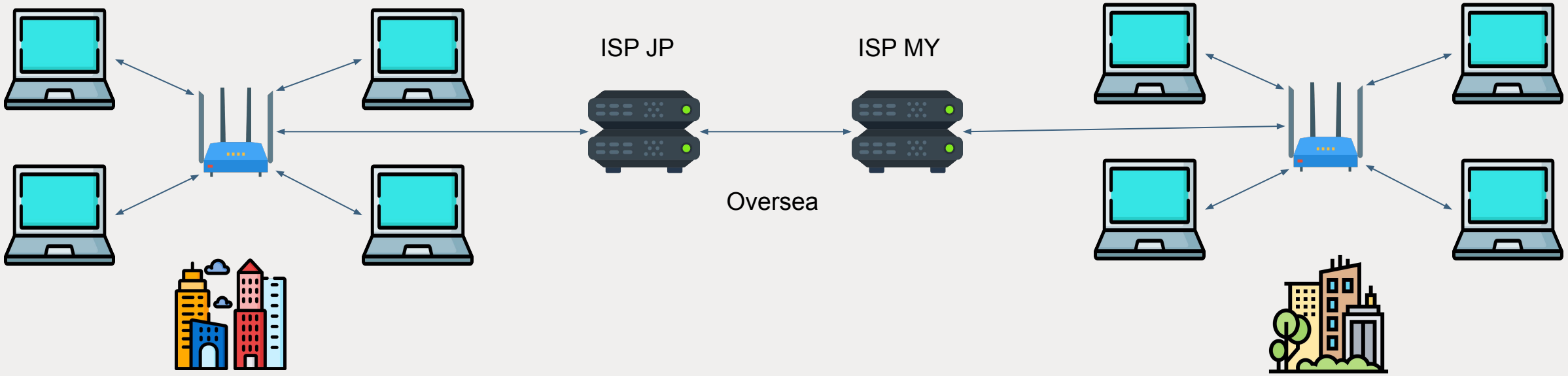


Cross Region Communication

Will you connect an ethernet cable across 2 houses? 2 cities?

Internet Service Provider (ISP)

ISP provides network infrastructure such as underground cables or oversea cables.
LAN A can talk to LAN B via ISP's special routers.



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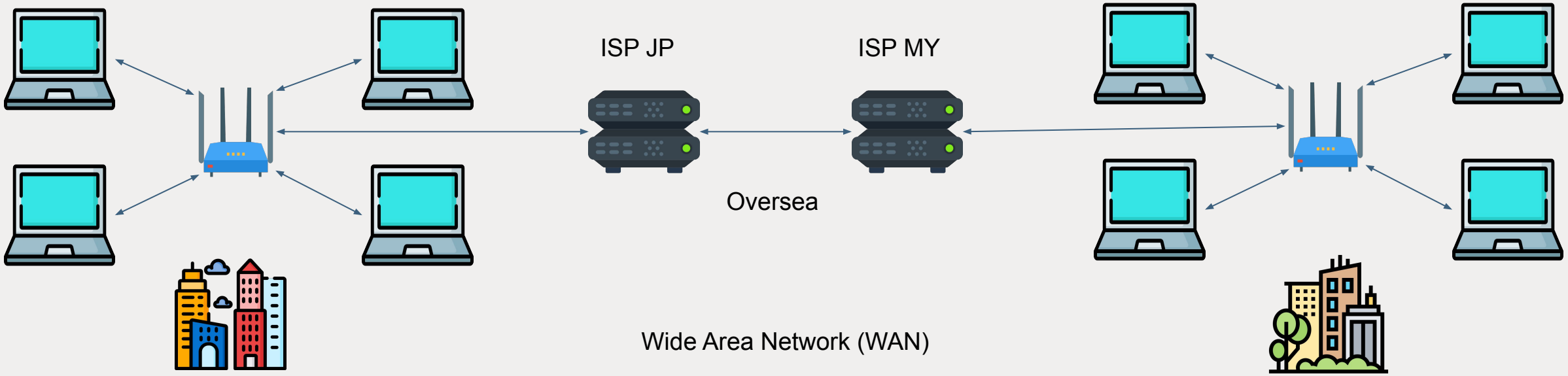
LAN A can talk to LAN B via ISP's special routers.



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Network Address and Domain Name Service

References/Readings:

- Public vs. Private IP Addresses: What's the Difference? | Avast
- What is DNS? | Cloudflare

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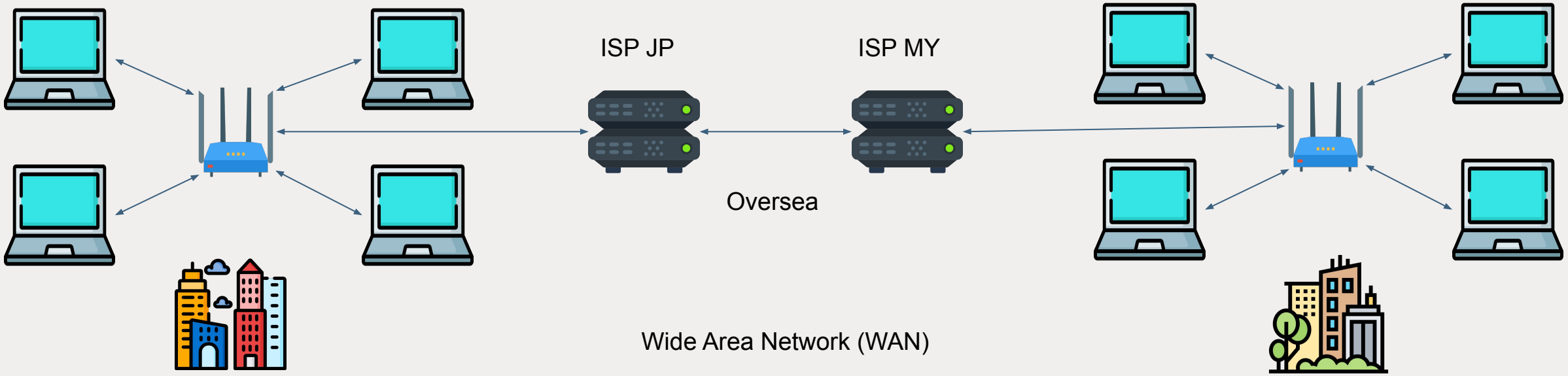
Finding Computers

In the internet we need an address to specify which computer we want to talk to.
The address used here is the IP address.



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IP Address

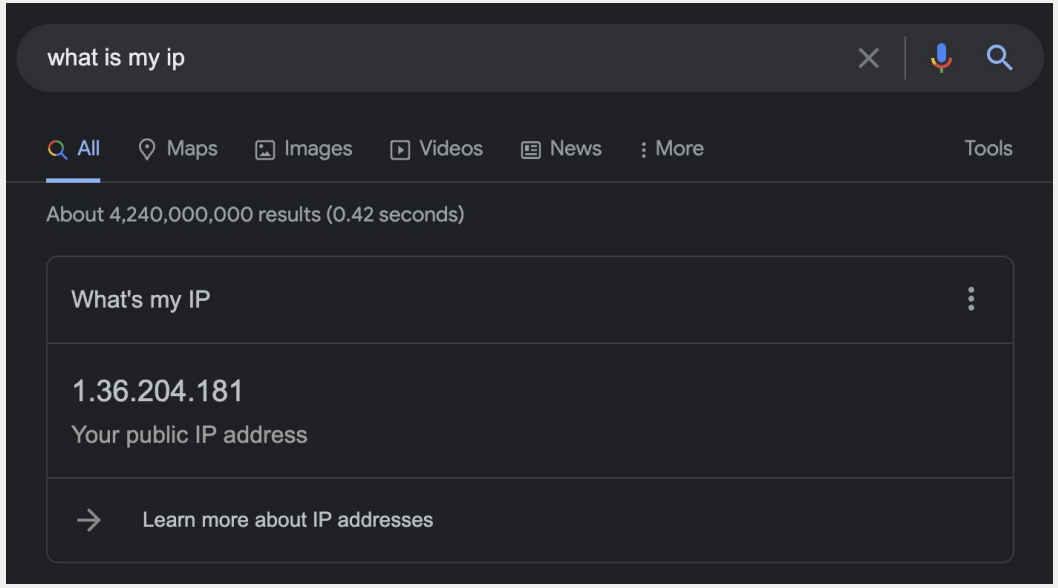
Each computer has

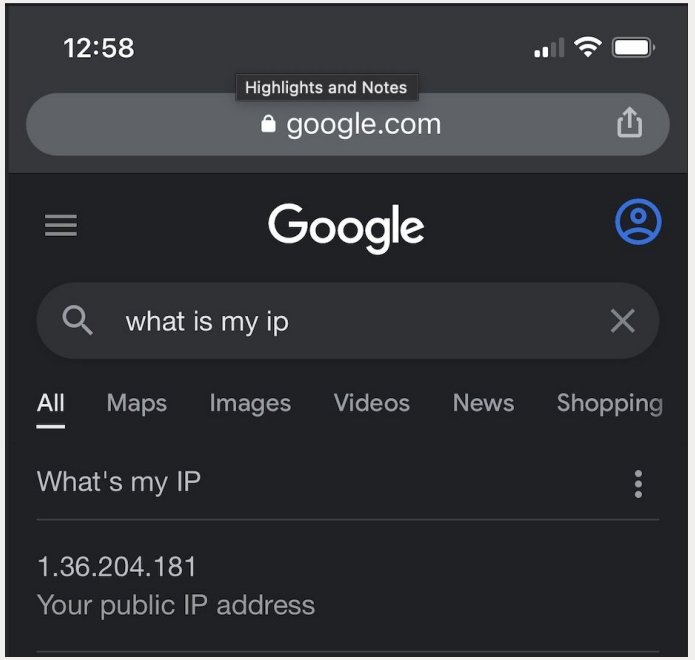
- A Public IP, unique and assigned by your ISP.
- A Private IP, assigned by a router within a LAN.

For home computers, ISP might not give you a unique Public IP, instead a Private IP that is unique within the ISP's router only.
For Servers on a Data Center, you should have a unique Public IP.

Public IP Address

If two devices are connected to the same router to the internet, they have the same public IP address





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Domain Name Service (DNS)

Wait, normally we wouldn't type IP address on browser…
We are actually using a DNS to resolve a domain to an IP.
A Domain Name is more readable.

```
❯ dscacheutil -q host -a name google.com
name: google.com
ipv6_address: 2404:6800:4005:81a::200e

name: google.com
ip_address: 172.217.25.14
```

Domain Name Service (DNS)

You can try, if you type the IP address on Chrome, it brings you to the google.com page.

```
❯ dscacheutil -q host -a name google.com
name: google.com
ipv6_address: 2404:6800:4005:81a::200e

name: google.com
ip_address: 172.217.25.14
```

Client and Server Communication

References/Readings:

- What is a protocol? | Cloudflare
- Client–server model | Wiki

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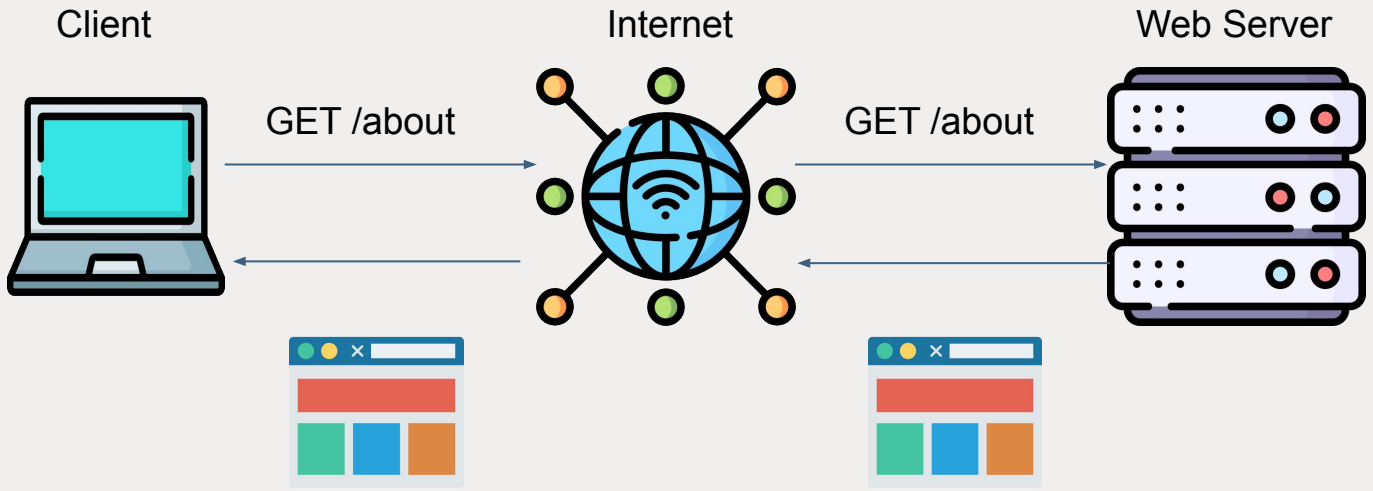
Client-Server Communication

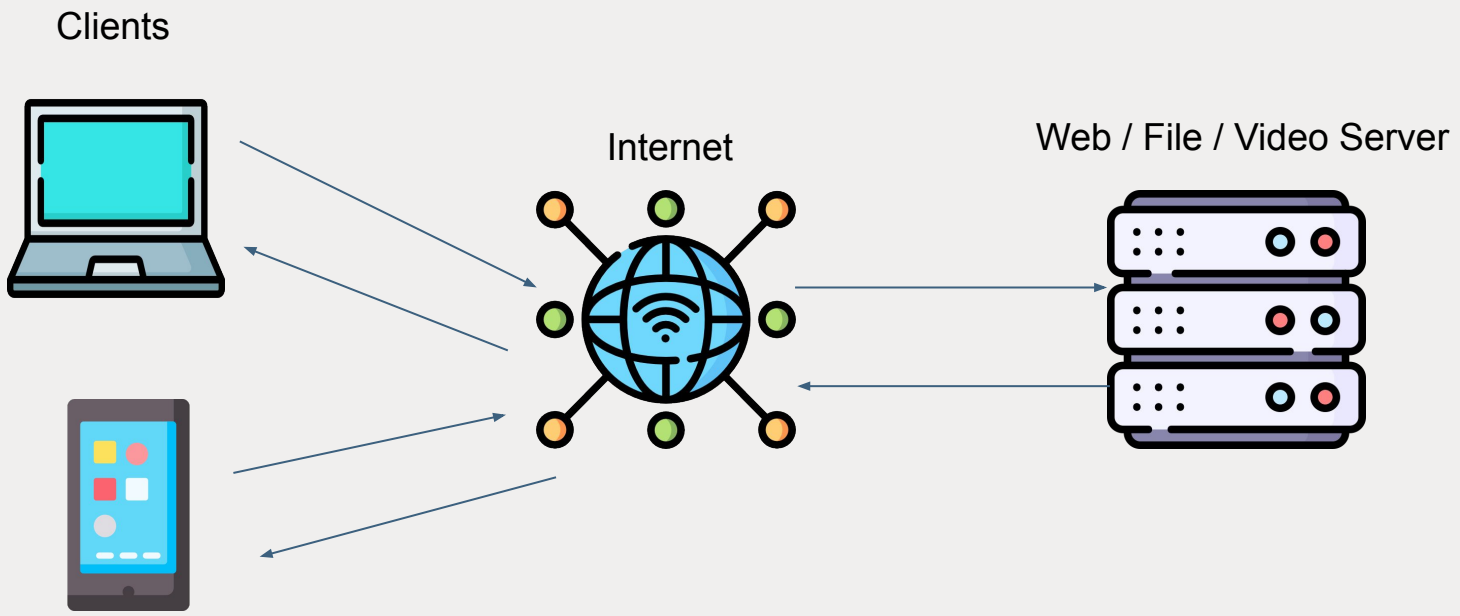
Both Client and Server are computers.

- A Client usually initiates the interaction by sending a request.
- A Server replies the request with a response.



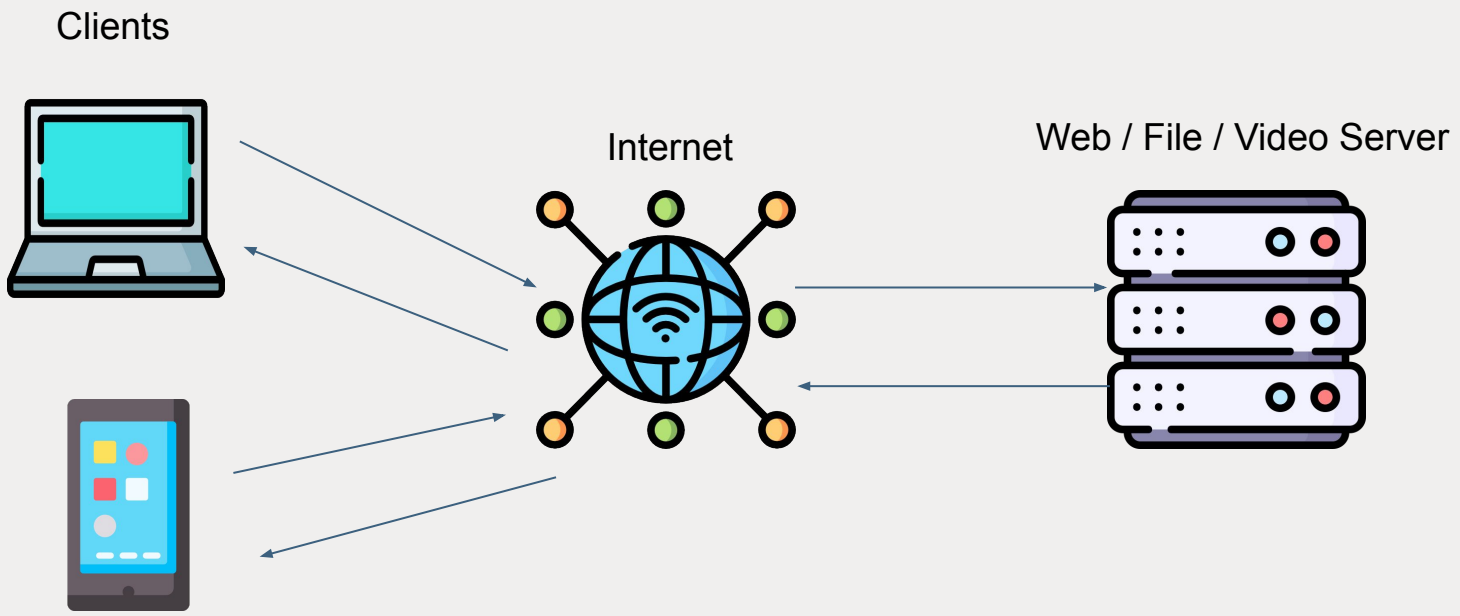
Server

A server provides services for multiple clients. We can classify a server by its functionality, such as a web server, a file server etc.



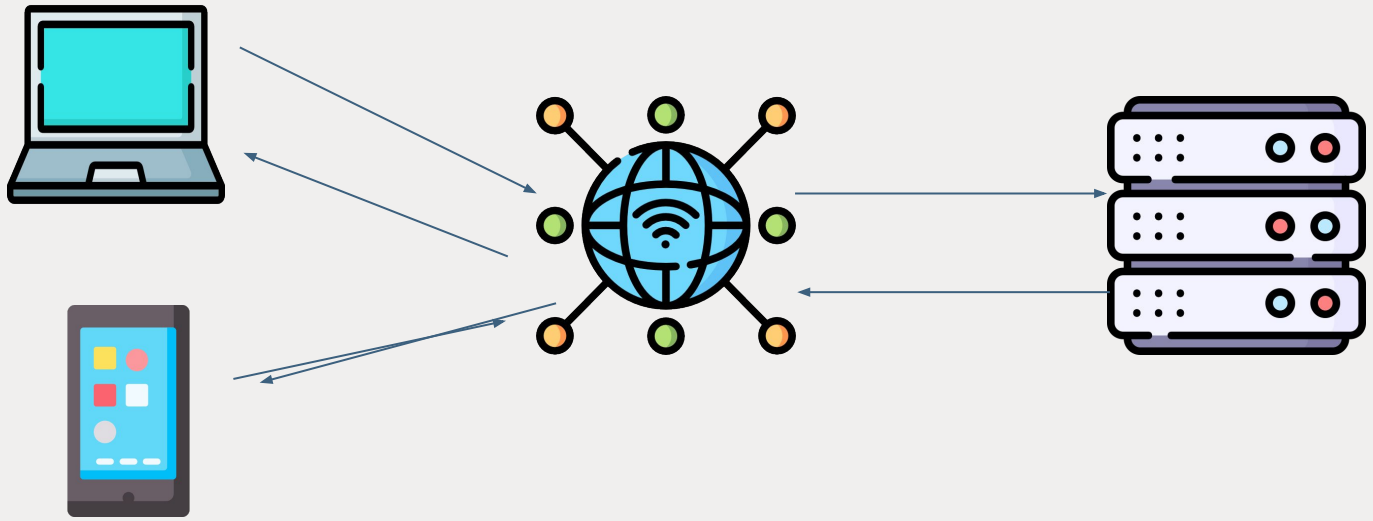
Client

A client uses the service provided by the server. Clients are computers such as phone, laptop or even an ATM machine.



Protocol

A protocol is a set of rules for formatting and processing data. Network protocols are like a common language for computers. The computers within a network are with different software and hardware; however, the use of protocols enables them to communicate with each other regardless.



HTTP Protocol and Message

References/Readings:

- An overview of HTTP | MDN
- HTTP request methods | MDN
- HTTP response codes | MDN

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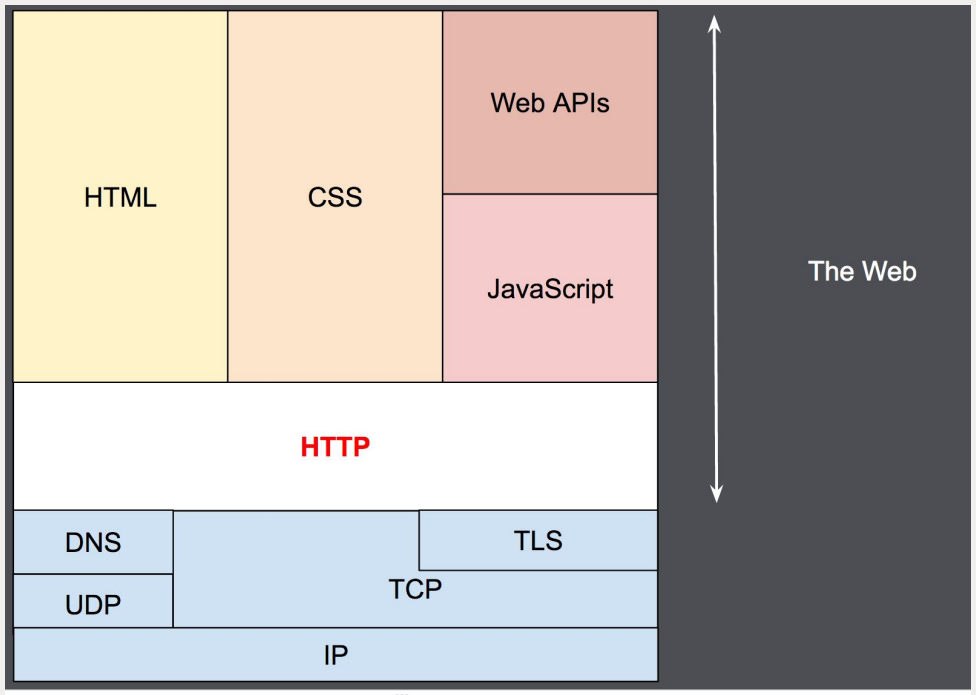
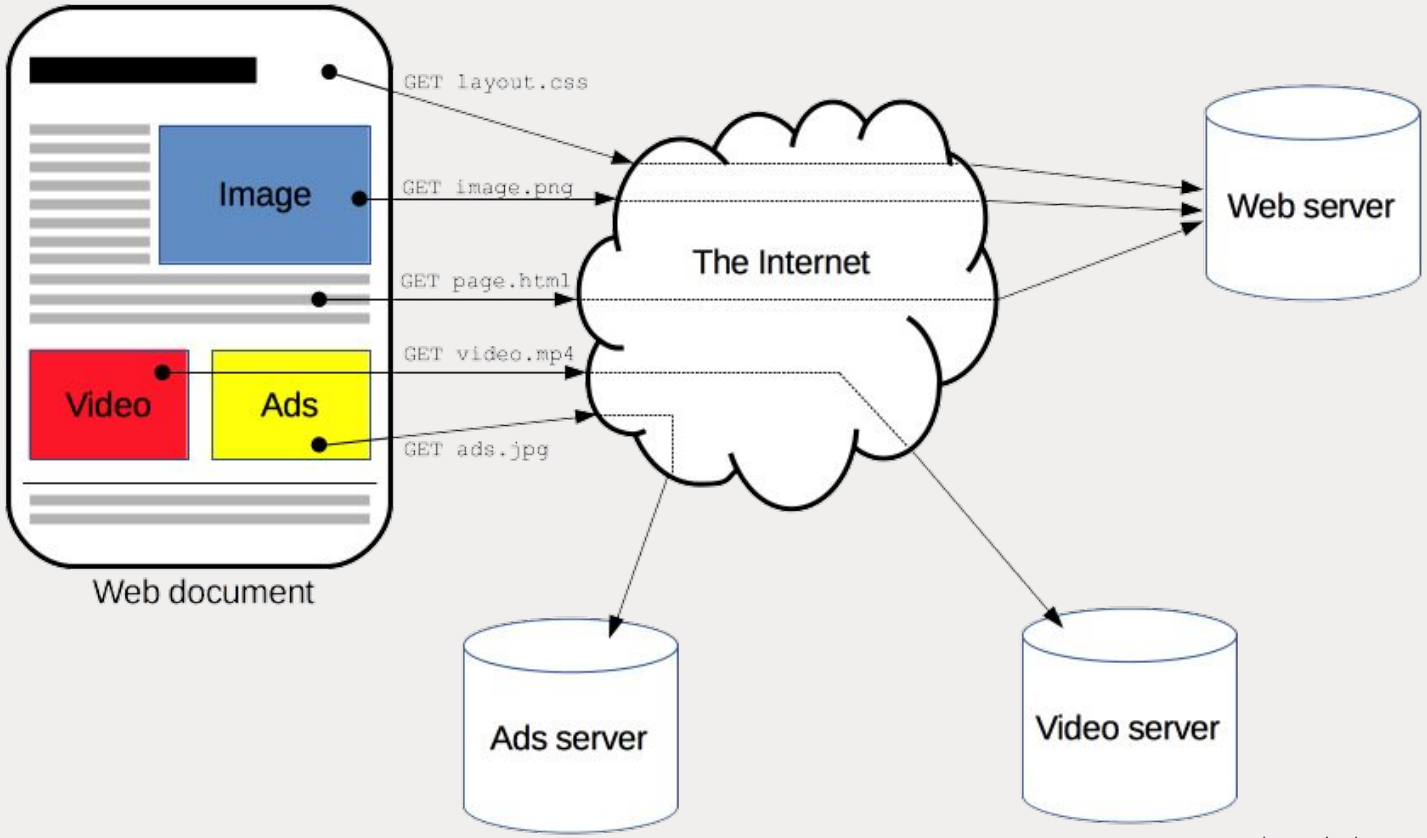
HTTP

HTTP is a protocol for fetching resources such as HTML documents.
It is the foundation of any data exchange.
For example: a HTTP Message wraps/contains an image/HTML.





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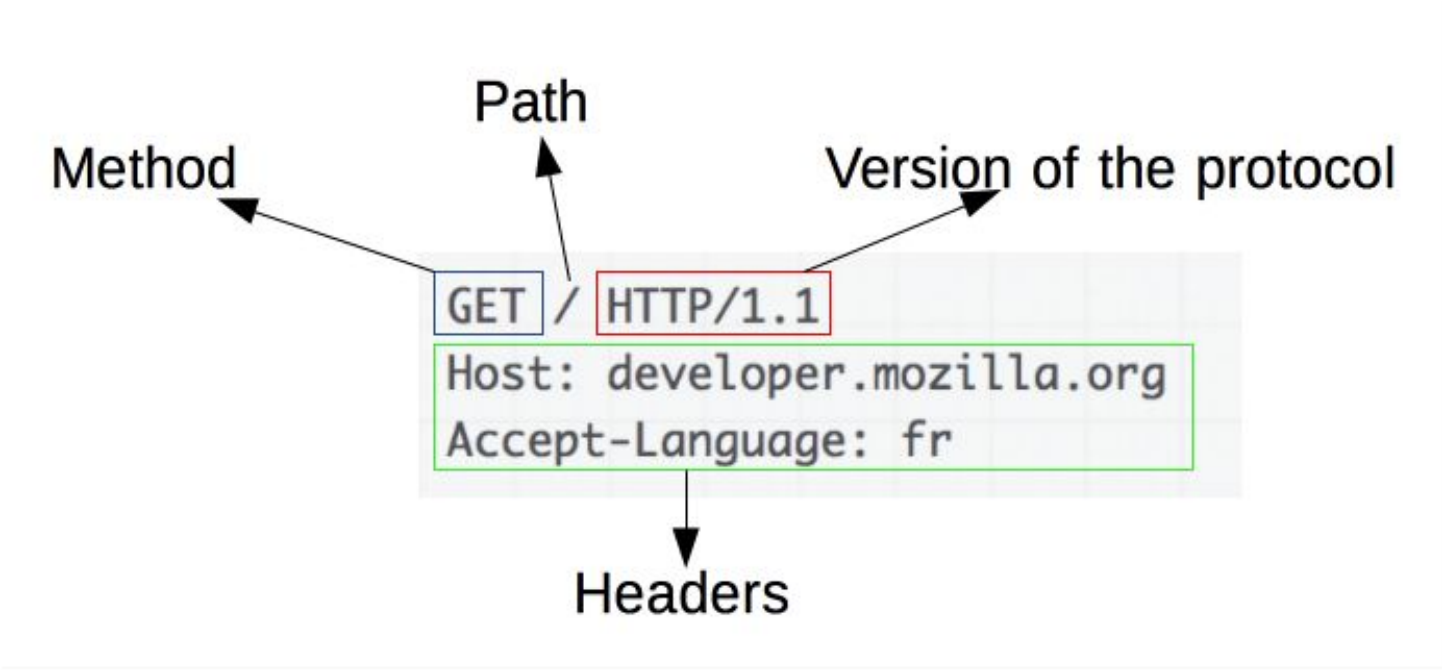
HTTP Request Message

Client sends a request to initiate a communication.

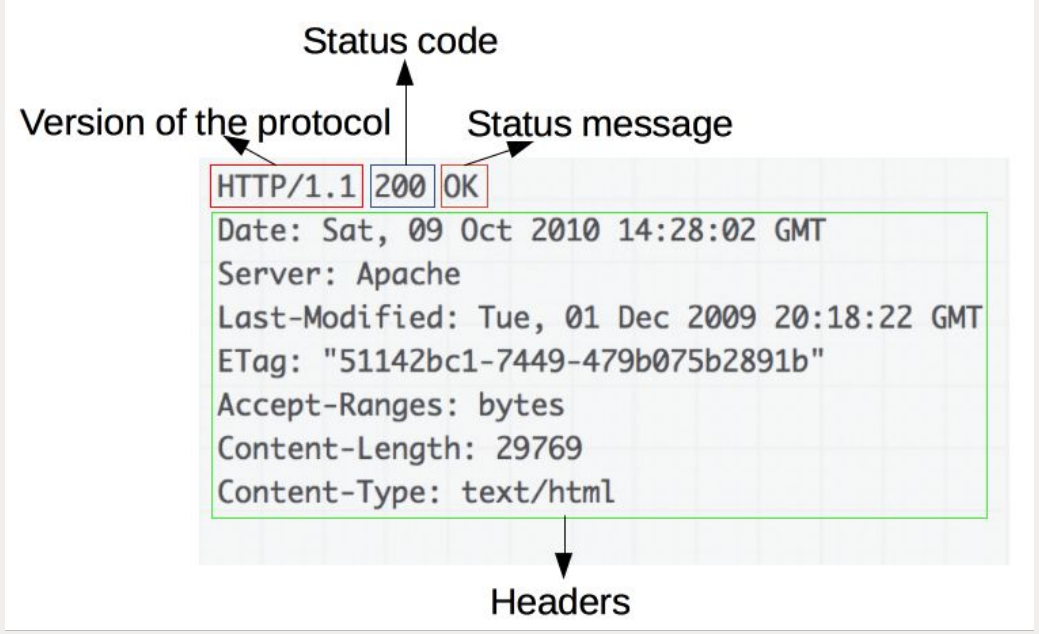
- Method: a Verb describes the operation (GET, POST, PUT, DELETE)
- Host + Path: The location of the resource you want to get.
- Headers: Additional (Meta) Information about the request.
- Body: The actual request data.



HTTP Response Message

Server replies the request with a response.

- Status Code:
  - 2xx: Normal, the request went well
  - 4xx: Client Error, like 404 means the resource not found.
  - 5xx: Server Error, like the server is down.
- Body: Contains the actual data, like the HTML file



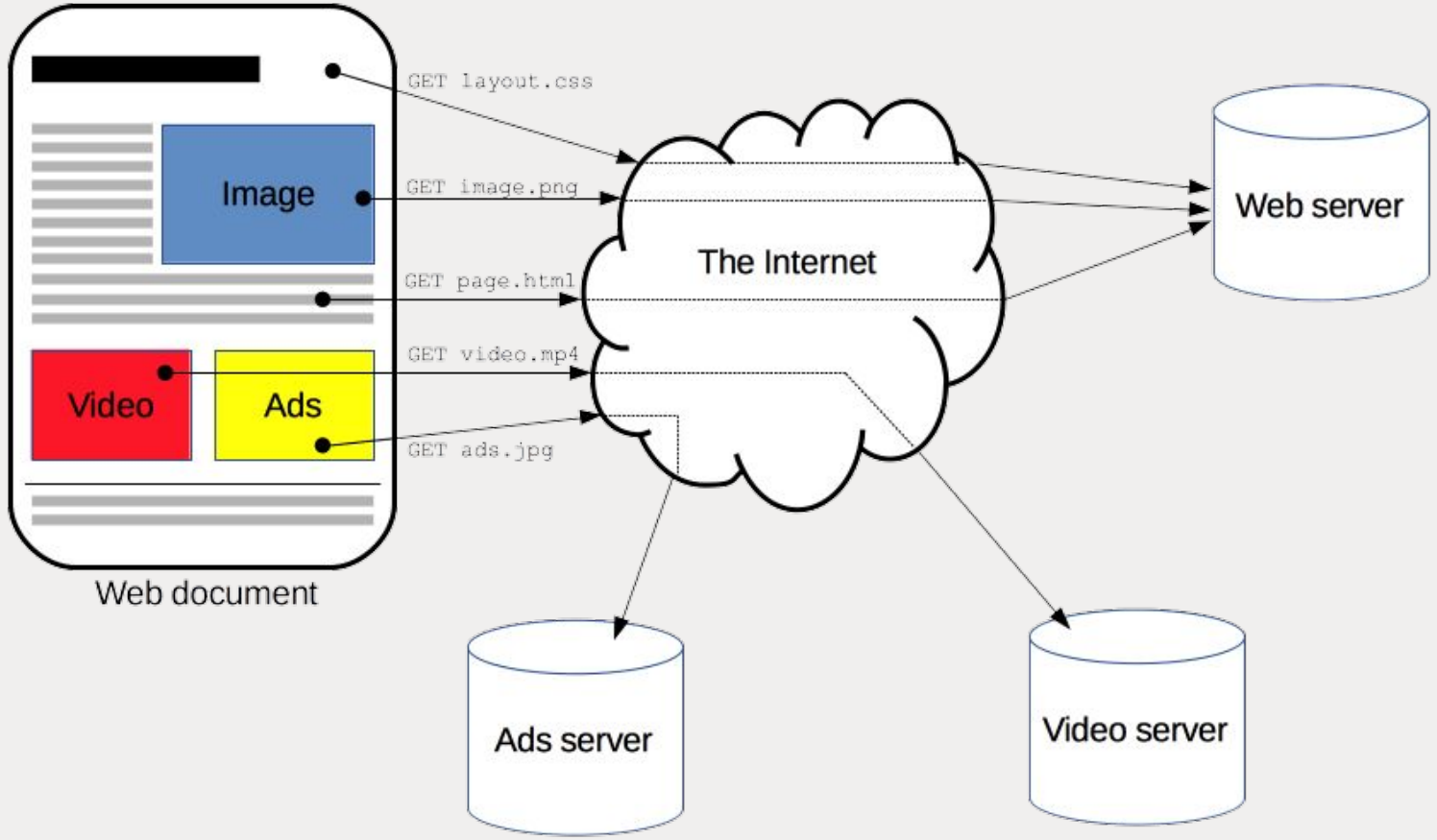
HTTP Response Message

- HTTP is a protocol/format that can be used to transfer different types of data.

HTTP Response Message

```
<html>
</html>
```

HTTP Response Message



Web Server and Backend Application

References/Readings:

- What is a web server? | MDN
- Introduction to the server side | MDN
- Single server setup | ByteByteGo

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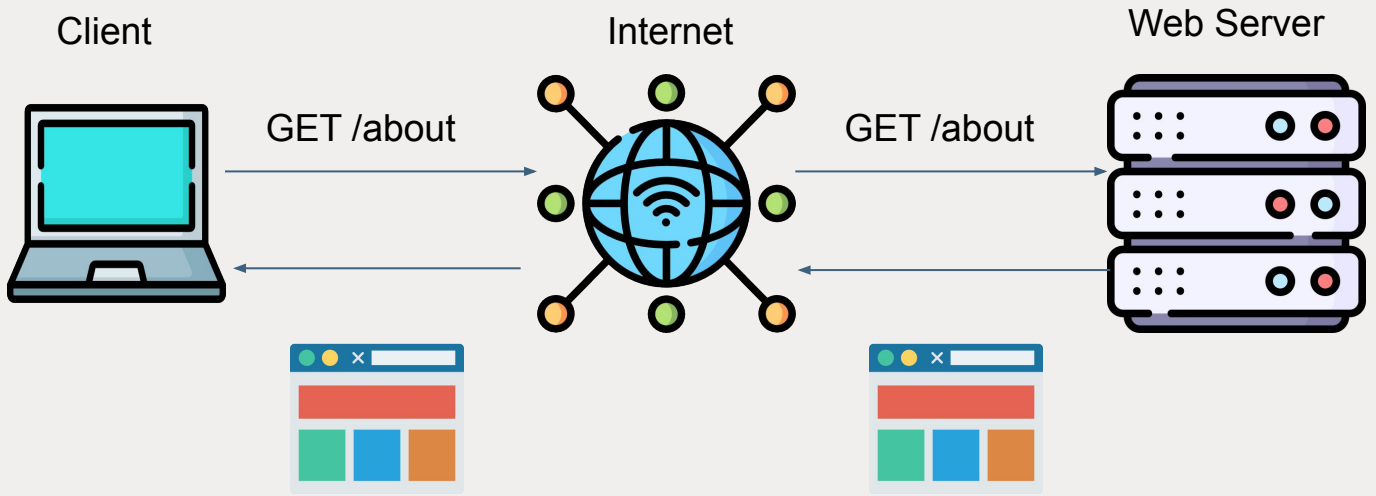
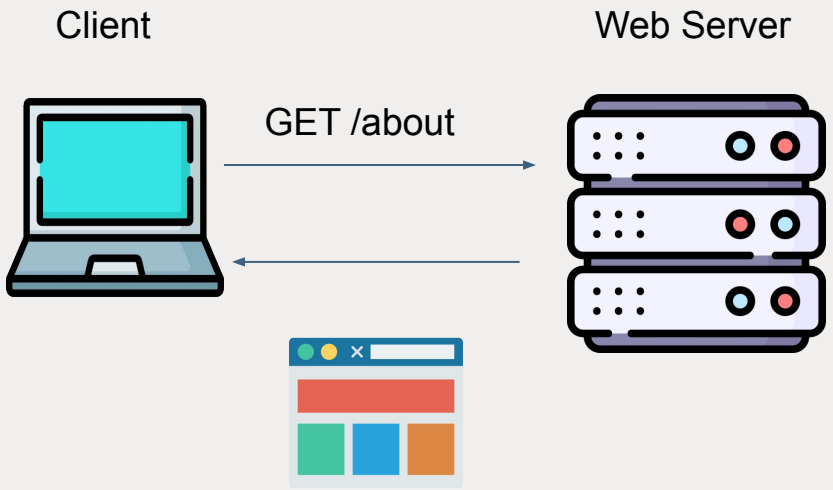
HTTP Web Server

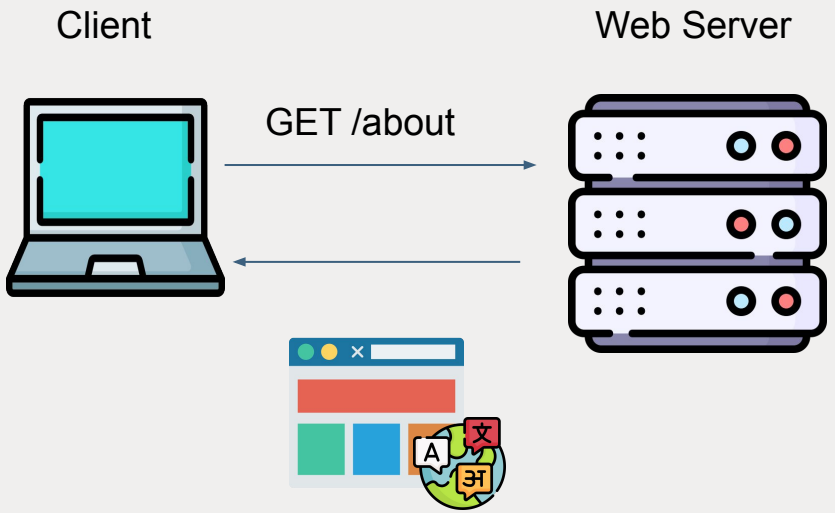
An HTTP server is software that understands URLs (web addresses) and HTTP (the protocol your browser uses to view webpages). An HTTP server delivers the content of these hosted websites to the end user's device.



Static vs Dynamic Web Server



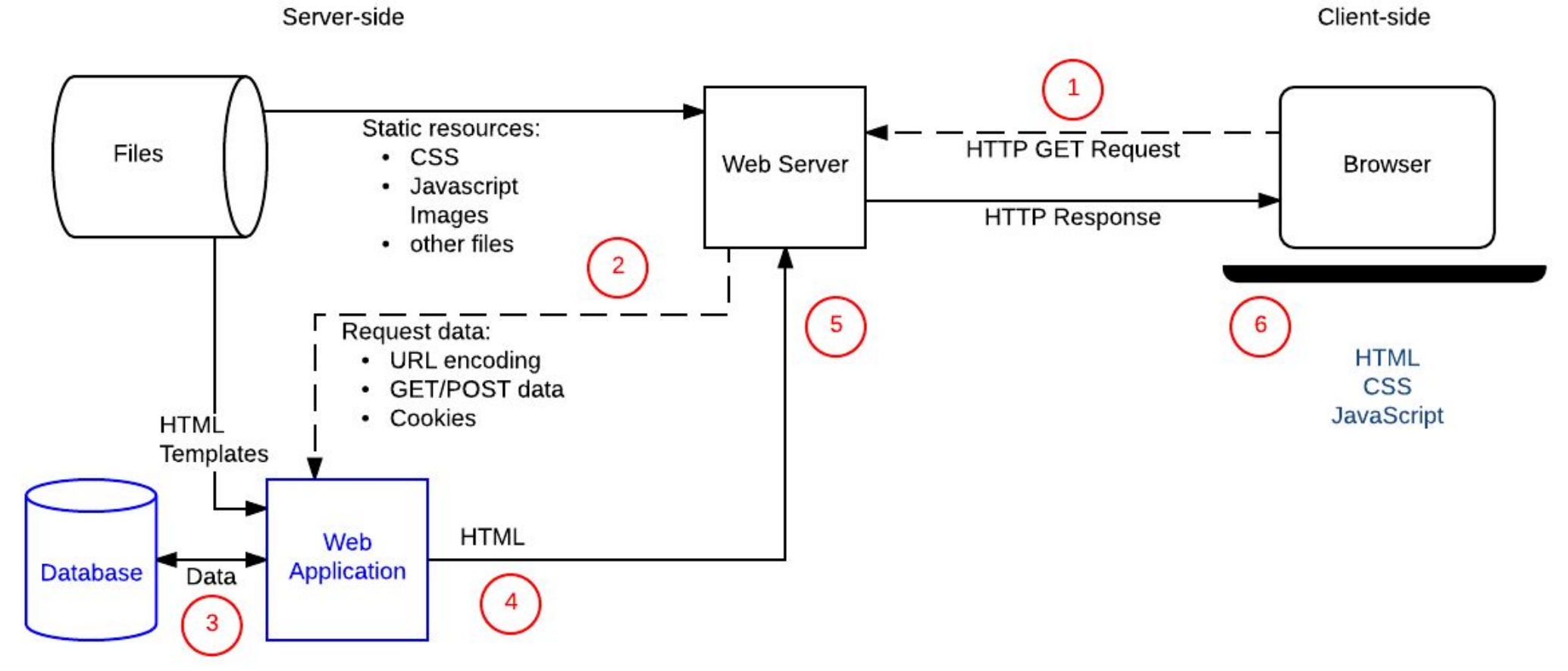
Static server gives same responses each time for a HTTP path. Such as this About page HTML is always the same.



Dynamic server can adjust the responses based on different situation. For example, adjusting the display language or adding user information.

This usually requires server-side programming language such as Python, JavaScript or PHP.

Dynamic Server-side Web Application



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Persisting Data and Database

References/Readings:

- Database | MDN

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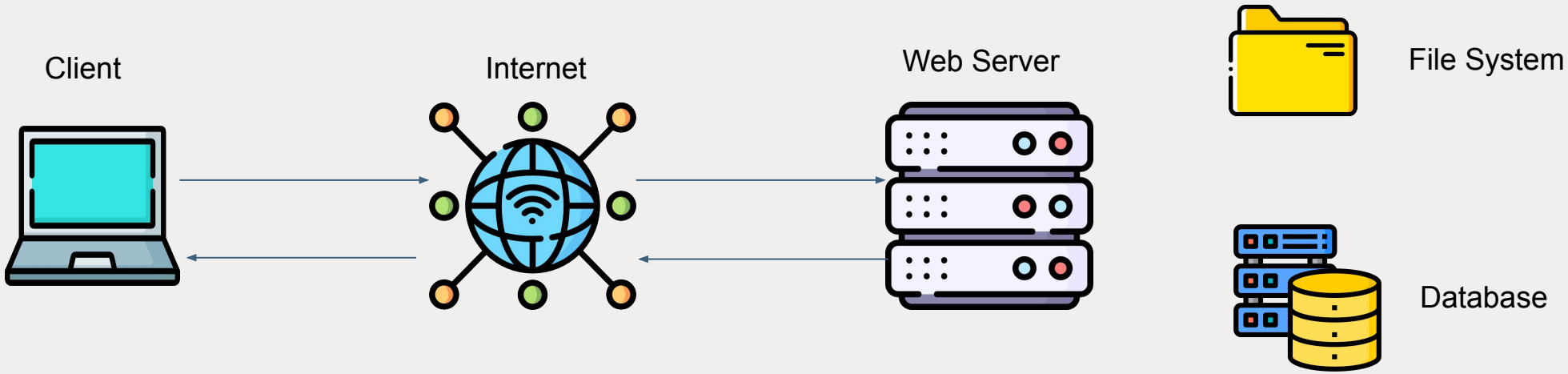
Web Server Storage

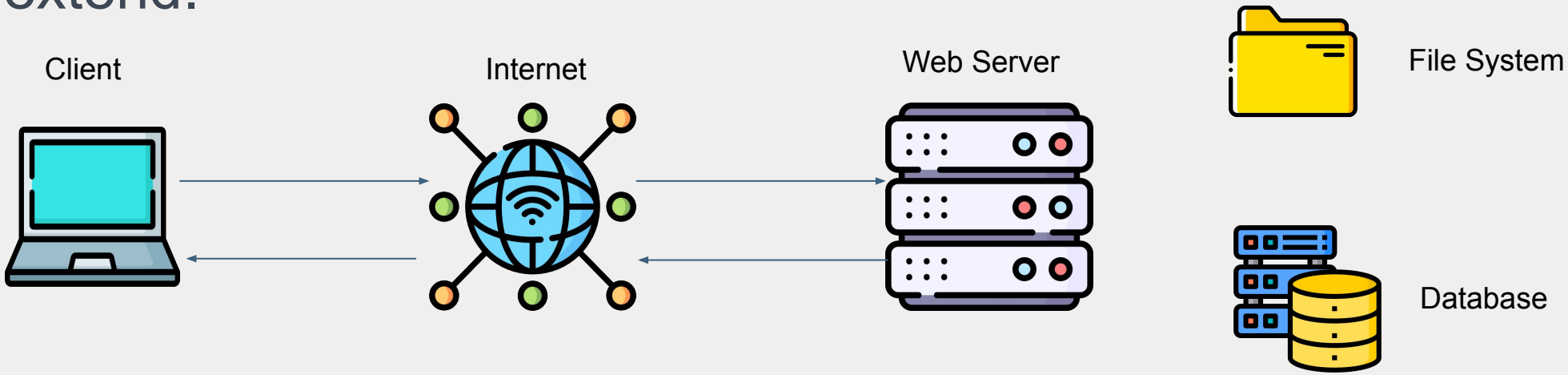
In order to serve resources, we need to store them.

- File System
- Database



Different Use cases

GET /sun.jpg: Can be get from the file system directly.
GET /peter-bank-account: We need to search and compute the values via the database.
Database: Faster & easier like searching, structure, and extend.



JSON and Fetching Data from the server

References/Readings:

- JSON | MDN
- Fetching data from the server | MDN
- Frontend vs Backend

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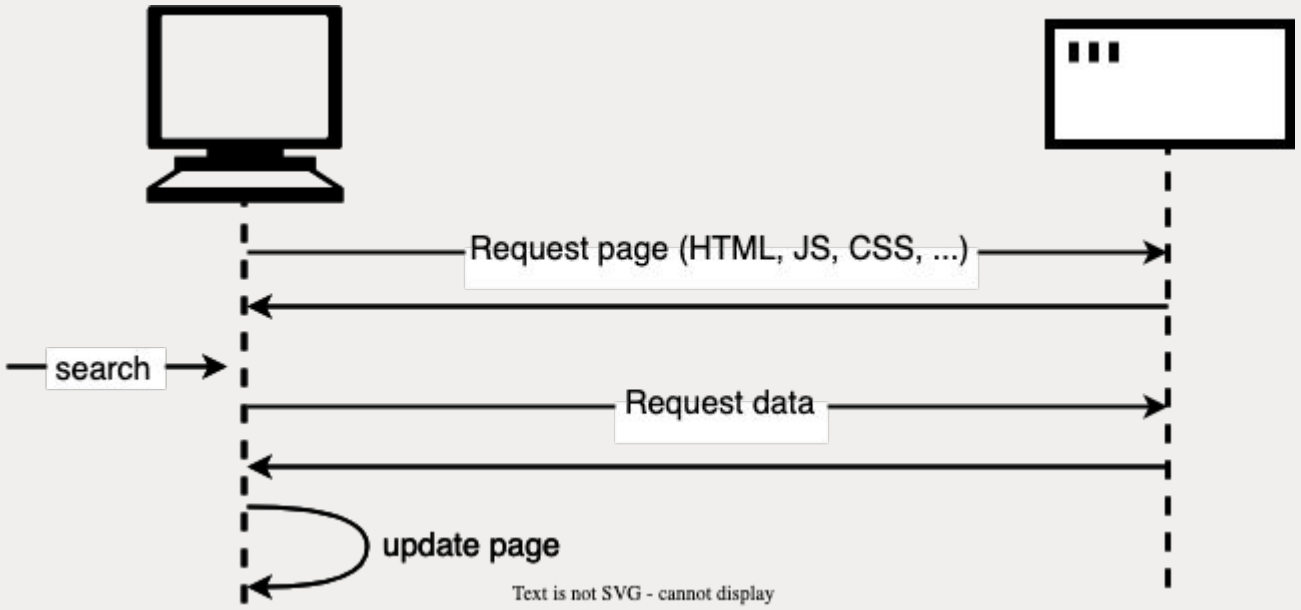
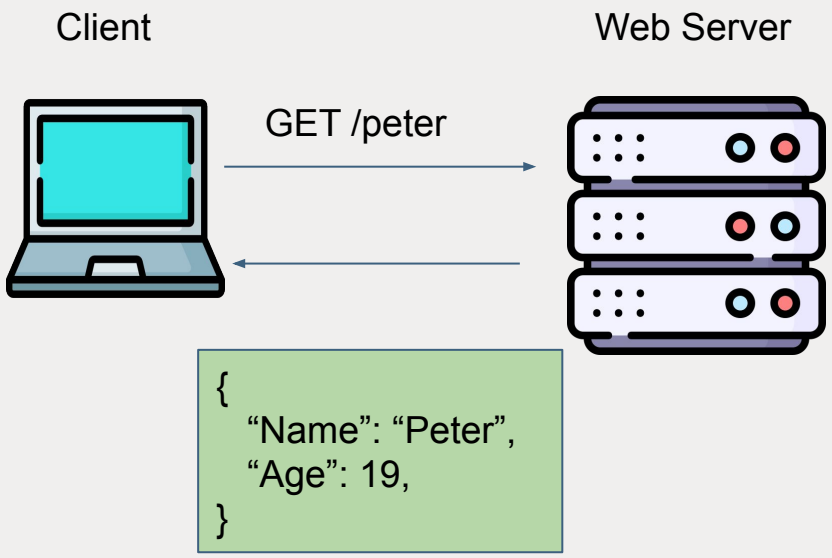
Requesting Files vs Data

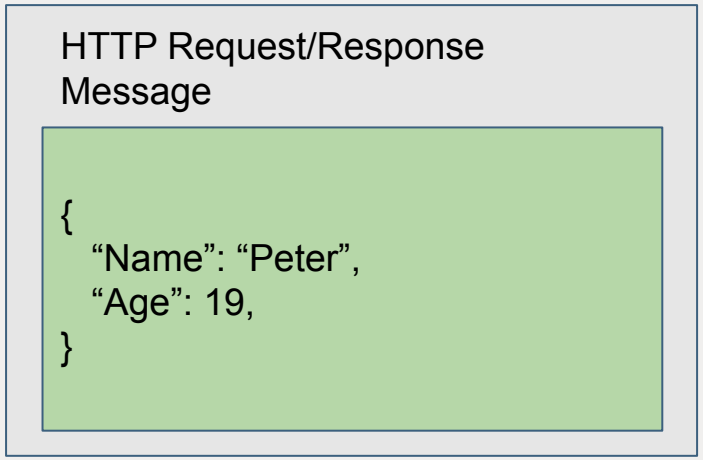
- We only discussed about Files response like HTML, Images.
- What if the client only want the data? JSON response.
- It enables partial update on the client-side. (avoiding full page reload)



JSON in HTTP Message

- JSON is like the JavaScript Object.
  - It stores key-value pairs.
  - It supports nested structure.
- Apart from requesting for a file, a client can request for data in JSON format.





Frontend Application

References/Readings:

- Client-Side v/s Server-Side Rendering: What to Choose When?

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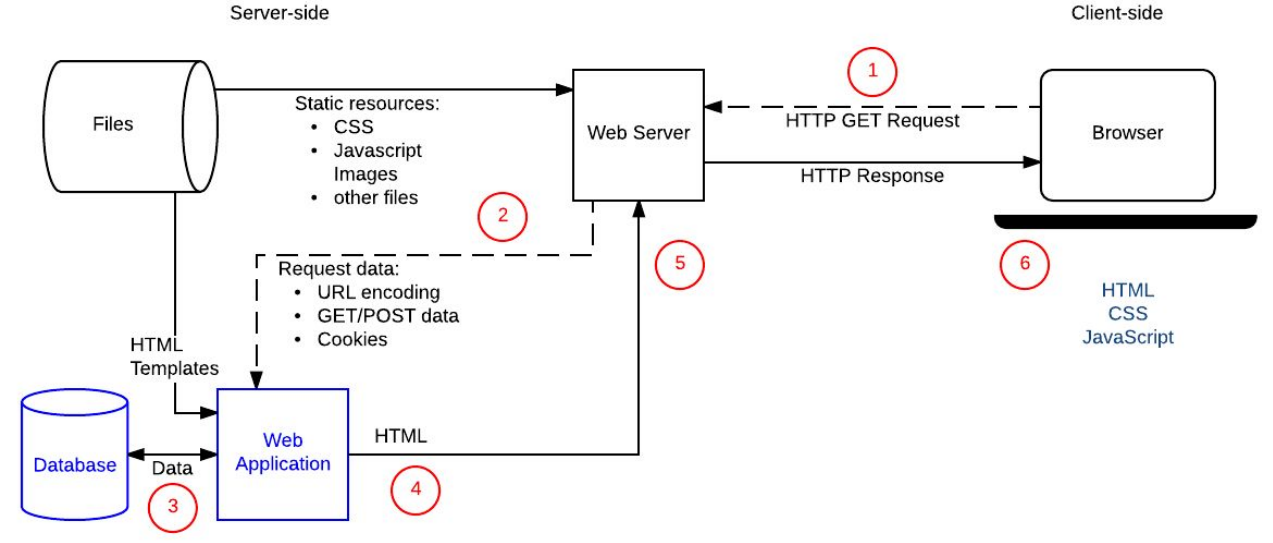
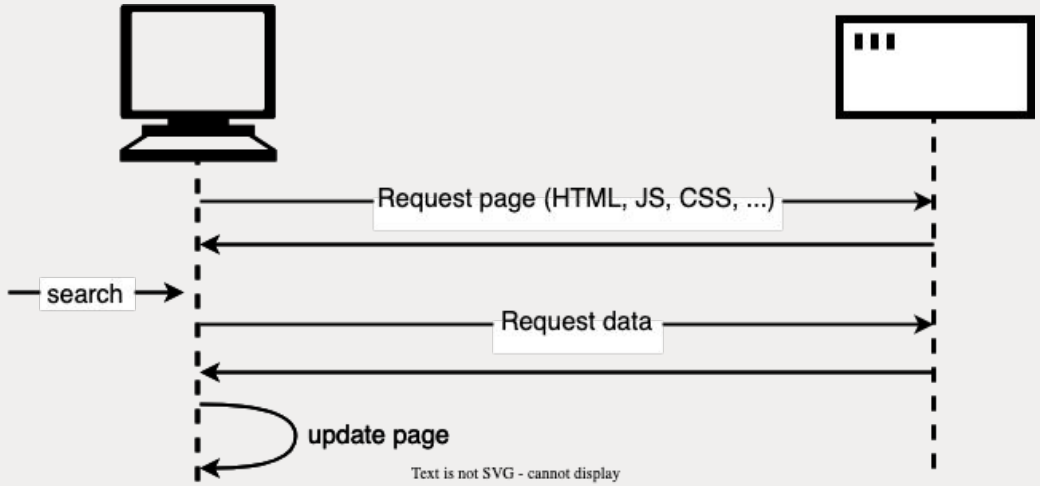
Client-side vs Server-side Rendering

- Similar to Server-side programming, we are using Client-side programing to create dynamic content.





A backend application is using server-side programming to create server-side dynamic content. (Server-side Rendering)

A frontend application is using client-side programming to create client-side dynamic content. (Client-side Rendering)

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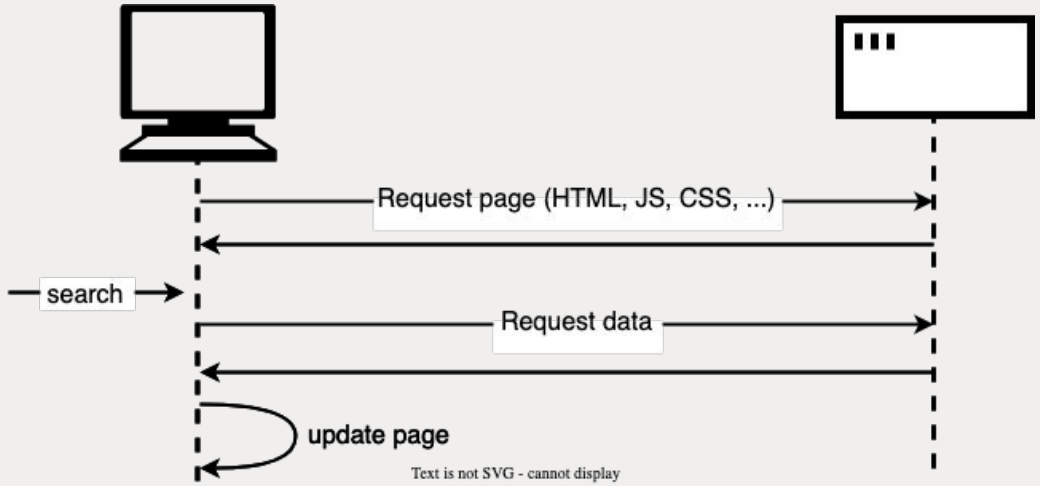
Client-side Programming

- Similar to Server-side programming, we are using Client-side programing to create dynamic content.
- A very common use of JavaScript is to dynamically modify HTML and CSS to update a user interface, based on
  - User interaction like clicking a button
  - JSON data returned from the server.



A frontend application is using client-side programming to create client-side dynamic content. (Client-side Rendering)

Chrome Development Tool

References/Readings:

- The Beginner’s Guide to Chrome Developer Tools

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THANK YOU!

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