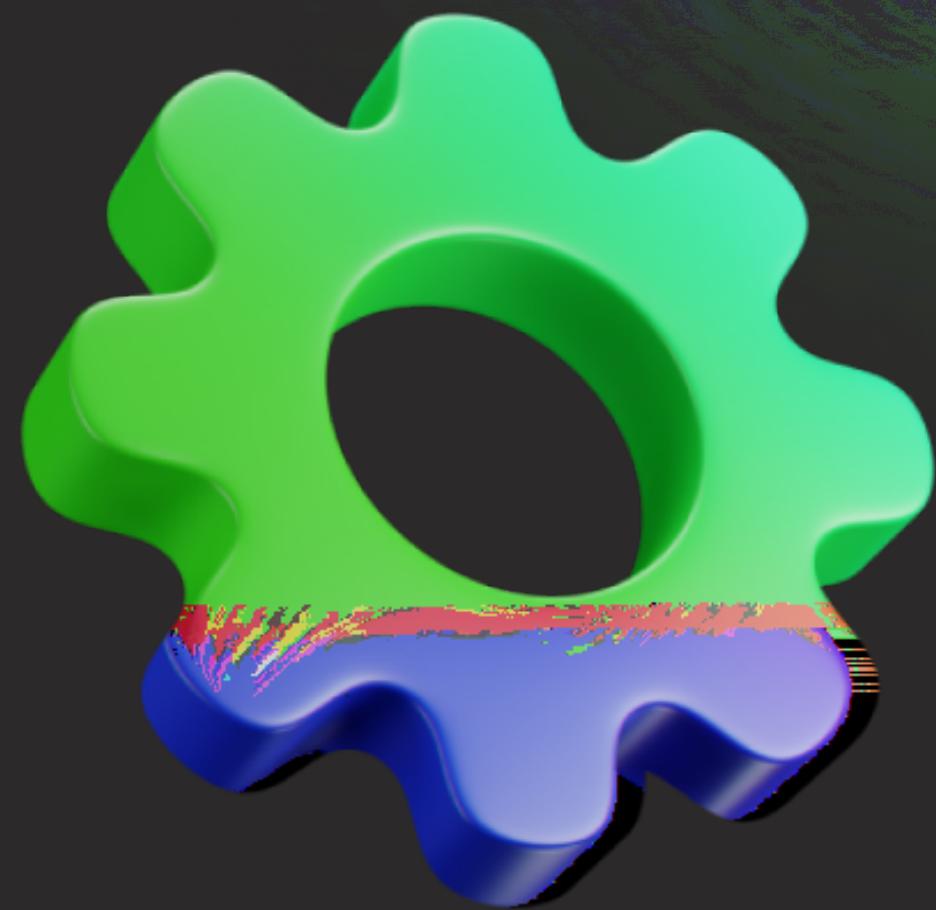


# Exploring Key System Design Concepts In Software Engineering



Saif Eddine Matab

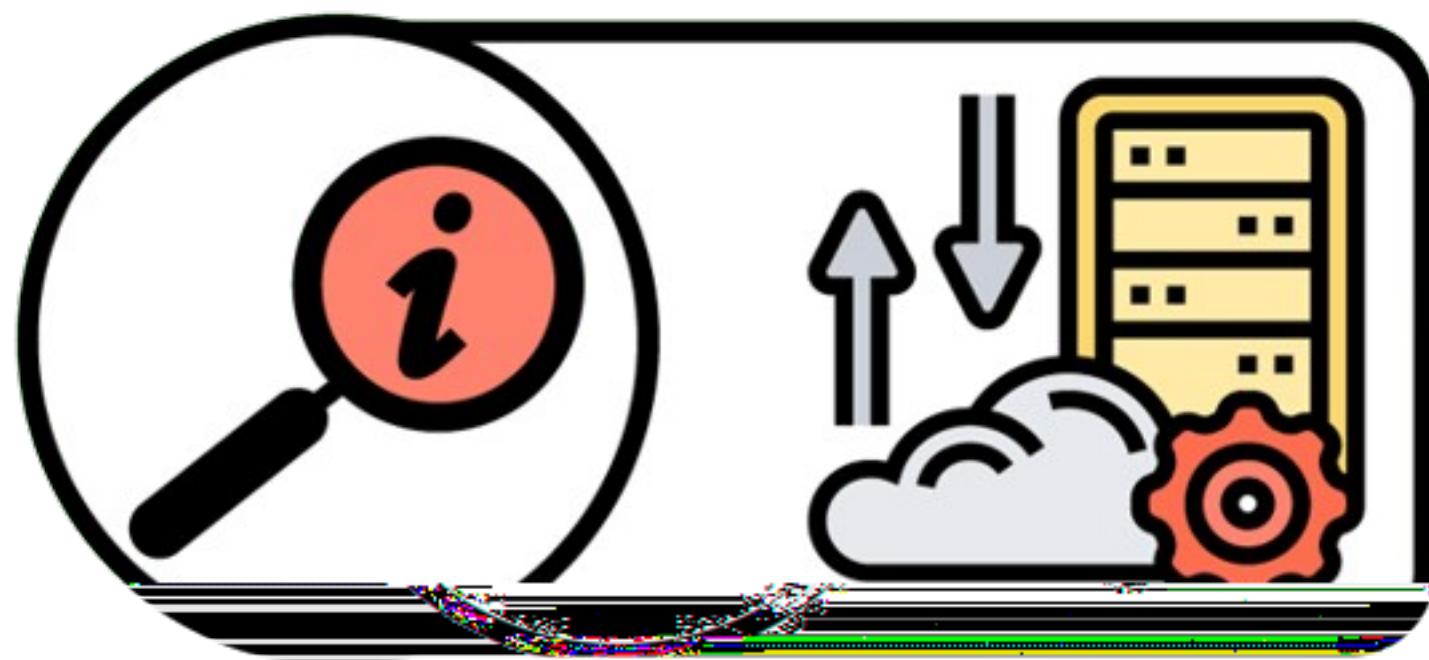
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# 0. System Design

1/10

System design is the process of defining how a software or hardware system will be structured and organized to meet specific goals and requirements. We use system design because it helps ensure that a system functions efficiently, effectively, and reliably by considering its architecture, components, data flow, and other aspects, resulting in a well-organized and maintainable solution that meets user needs.

In FAANG interviews, it's particularly important as it assesses a candidate's ability to architect complex and scalable systems, make design decisions, and evaluate trade-offs.



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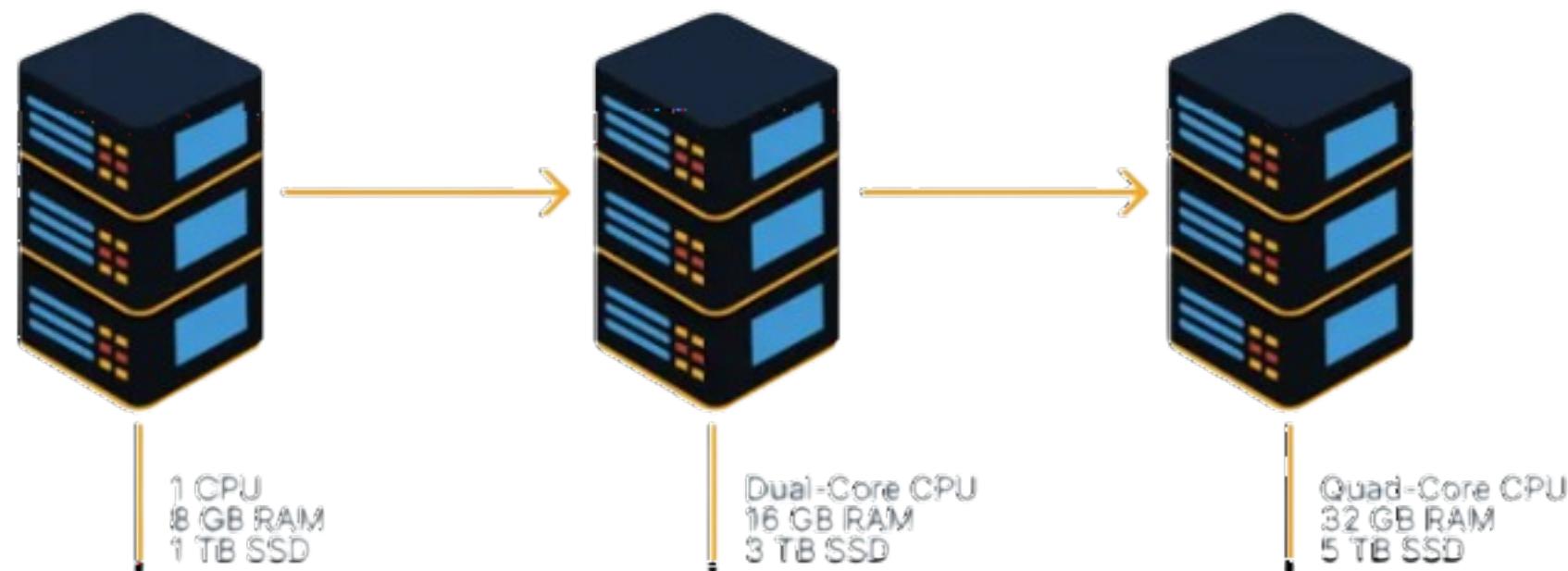
# 1. Vertical Scalling

2/10

Vertical scaling, often referred to as "scaling up," is a method used to enhance a server's capacity by upgrading its existing hardware resources, such as RAM, CPU power, or storage, to improve its ability to handle larger workloads.

**When to use vertical scaling:** When you expect more people to use your server, upgrade its parts to handle the extra work.

**When not to use vertical scaling:** If you can't afford the server going down, don't rely on just one upgraded server; it could fail and cause downtime.



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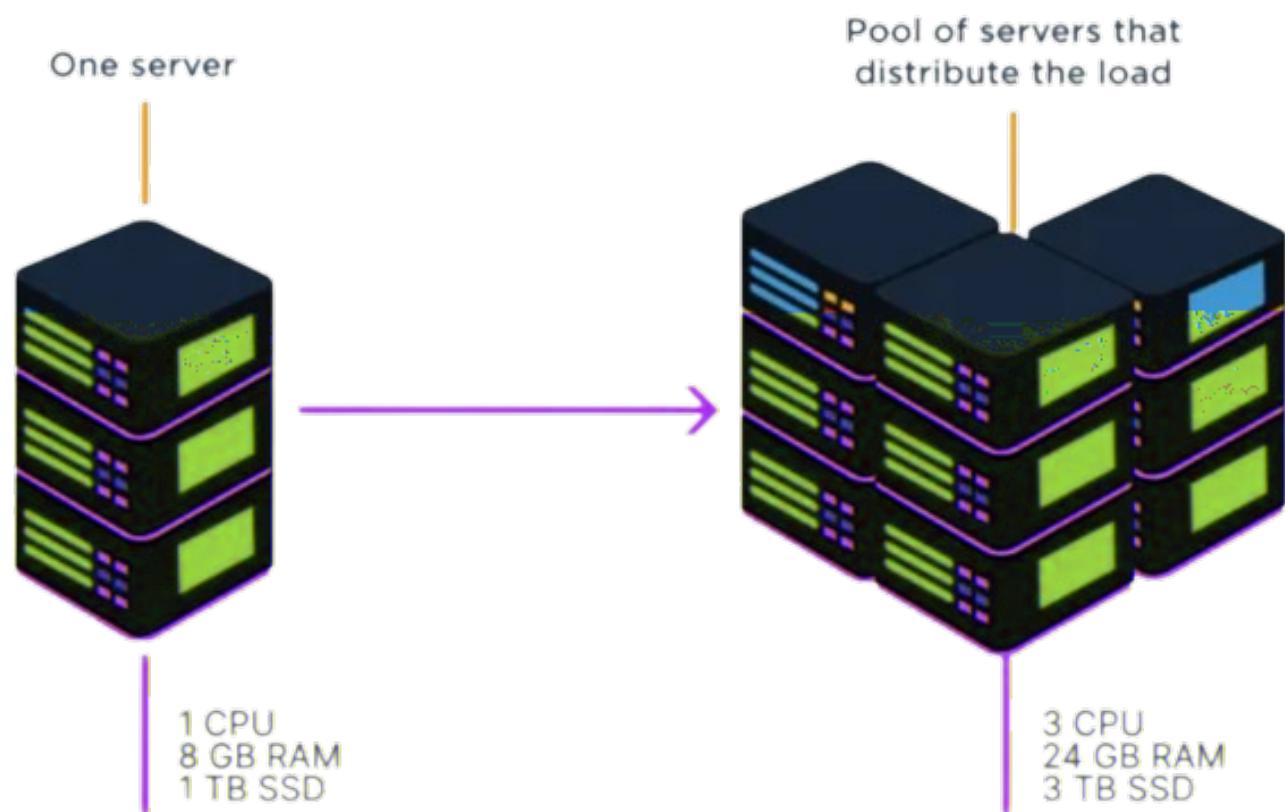
## 2. Horizontal Scalling

3/10

Horizontal scaling, known as "scaling out," expands system capacity by adding more servers to distribute workloads.

**When to use horizontal scaling:** When you expect a large increase in users or traffic, add more servers to share the load and improve performance.

**When not to use horizontal scaling:** If adding more servers is complex or costly, or if your application doesn't support a distributed architecture, horizontal scaling may not be the best choice.



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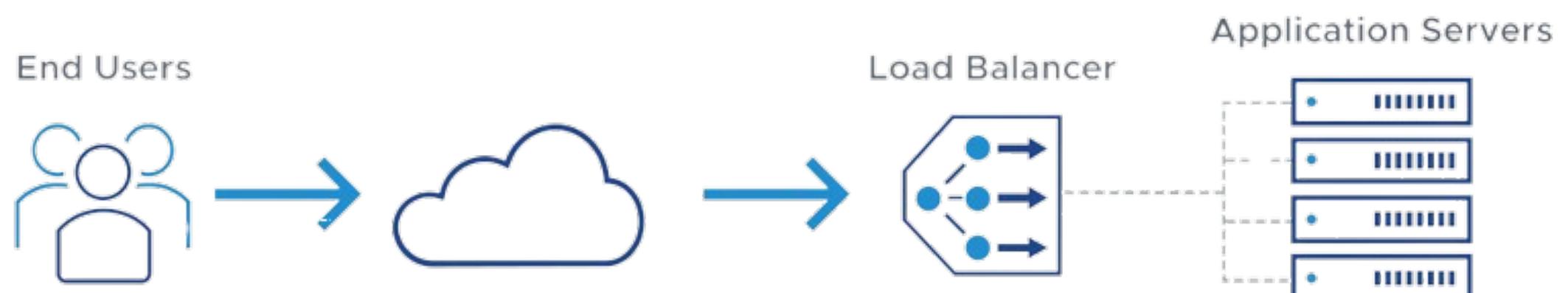
### 3. Load Balancer

4/10

A **load balancer** serves as a pivotal technology that efficiently distributes incoming network or application traffic across multiple servers. By ensuring no single server bears too much load, it optimizes resource use, enhances application responsiveness, and improves overall system reliability.

**Improved Reliability:** Load balancers automatically route traffic to healthy servers, reducing downtime and enhancing system reliability.

**Complexity and Cost:** Load balancers can be complex and expensive to set up and maintain



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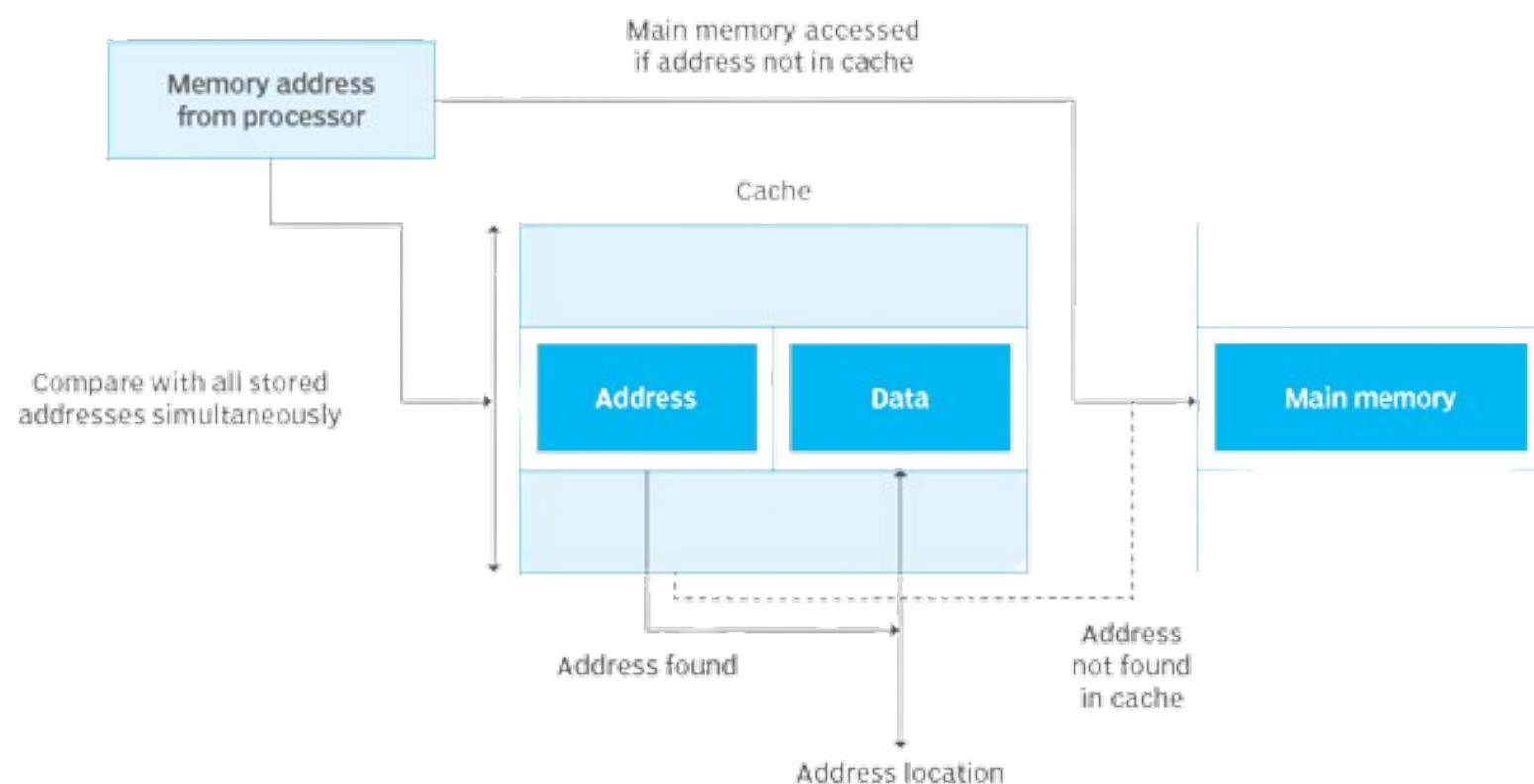
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# 4. Caching

5/10

Caching is a technique used to temporarily store copies of files, data, or requests in a computing environment to speed up retrieval times on subsequent access. By storing frequently accessed information in a cache, a system can reduce the need to repeatedly fetch the same data from the original source, which might be time-consuming or resource-intensive.

## Cache memory



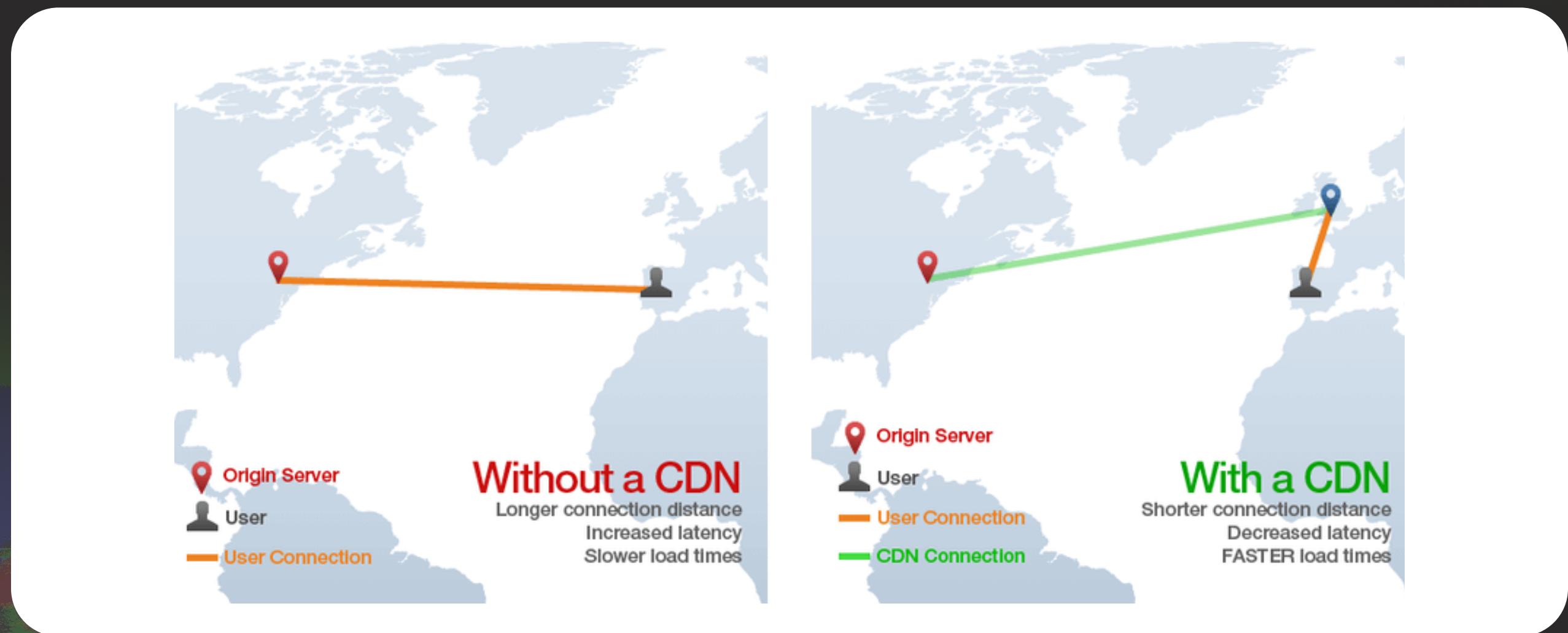
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# 5. Content Delivery Network (CDN)

6/10

A Content Delivery Network (CDN) is a network of distributed servers that deliver web content and services to users based on their geographic locations. By caching content at multiple locations around the world, CDNs reduce latency, ensure faster load times, and enhance the user experience by serving content from the server closest to the user.



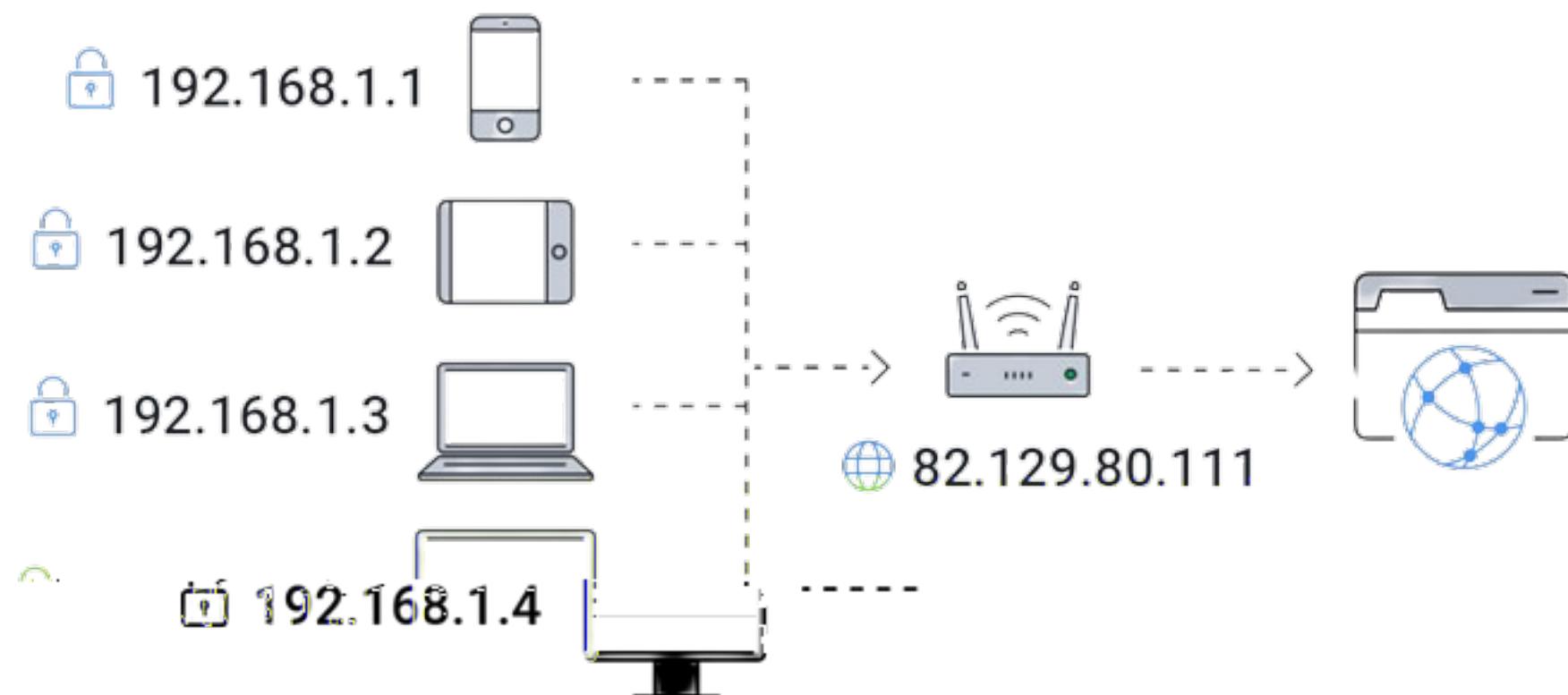
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## 6. IP Adress

7/10

An **IP address**, short for **Internet Protocol address**, is a unique identifier assigned to each device connected to a computer network that uses the Internet Protocol for communication



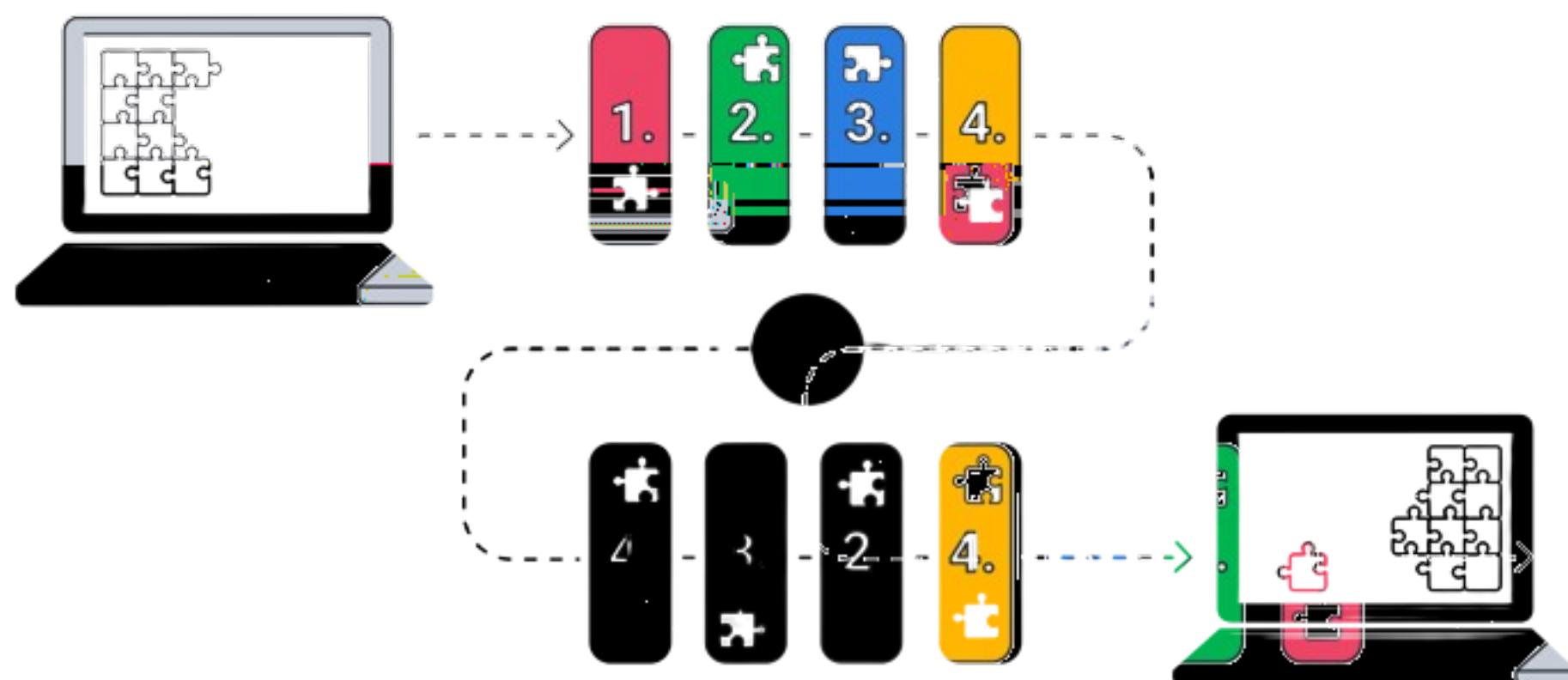
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## 7. TCP/IP

8/10

TCP/IP, which stands for Transmission Control Protocol/Internet Protocol, is the fundamental suite of communication protocols used to connect network devices on the internet and on most other computer networks



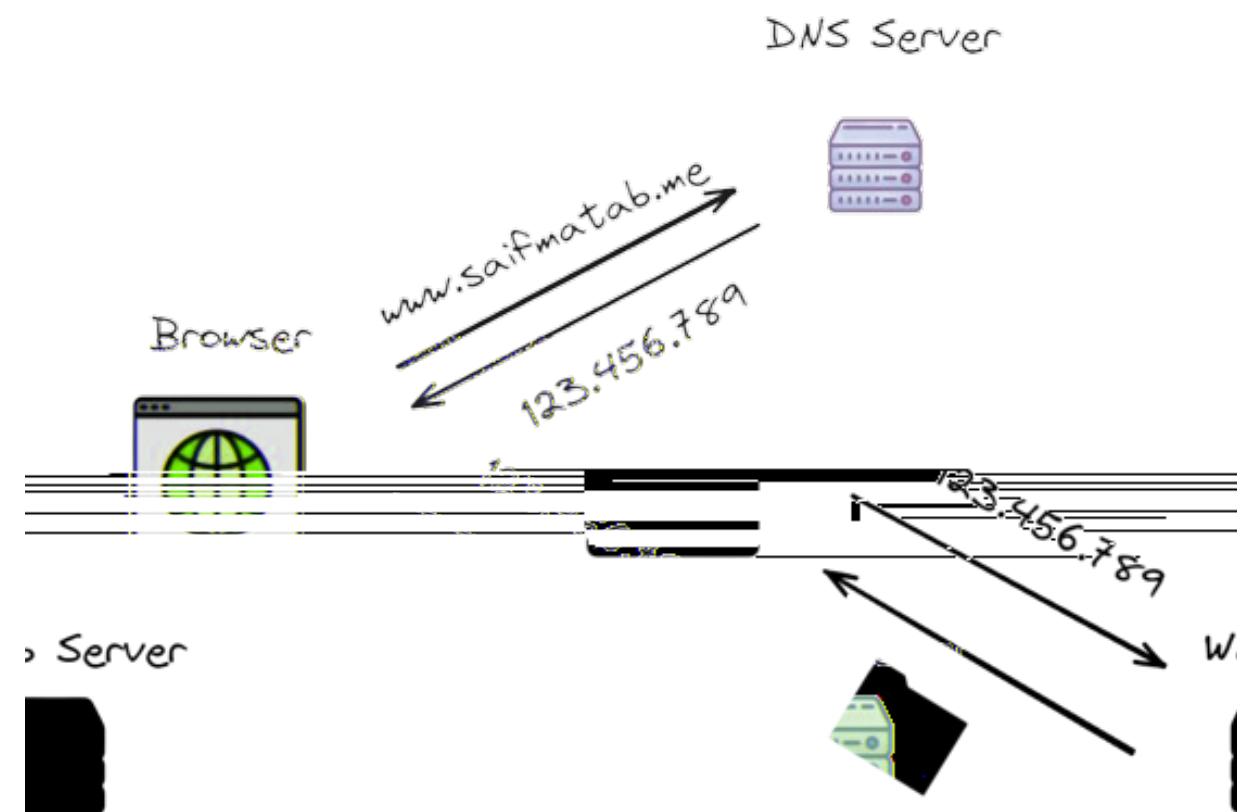
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# 8. Domain Name Service (DNS)

9/10

The Domain Name System (DNS) is a hierarchical naming system for computers, services, or any resource connected to the Internet or a private network. It translates more readily memorized domain names to the numerical IP addresses needed for locating and identifying computer services and devices with the underlying network protocols.



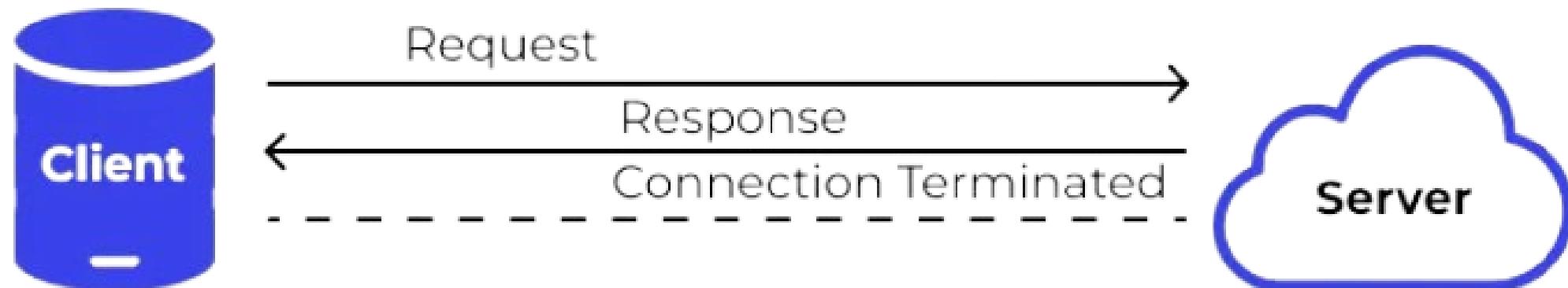
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# 9. Hypertext Transfer Protocol (HTTP)

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HTTP, short for HyperText Transfer Protocol, is the foundational protocol used for transmitting web pages on the internet. It defines how messages are formatted and transmitted, and how web servers and browsers should respond to various commands.



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