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**Software Engineering**, Winter 2025
**Practice Assignment 1**

### Exercise 1-1

What is an IP Address ?
State the maximum number of devices connected to IPv4 and IPv6 protocols.

**Solution:**

An Internet Protocol (IP) address is a unique address that identifies a device on the internet or a local network.
IPv4 has $2^{32}$ devices.
IPv6 has $2^{128}$ devices.

### Exercise 1-2

What are pros and cons of client server architecture ?

**Solution:**

Advantages :

- Scalability : easy to scale up by adding more servers this makes it suitable for handling growing workloads and user needs
- Centralized Data Management : Servers can centralize data storage and management, ensuring data consistency and integrity
- Security : more easily enforced on the server-side making it easier to protect sensitive data and control access to resources

Disadvantages :

- Single Point of Failure : Client cannot access web page services and resources when server is down
- Cost : Building and maintaining server infrastructure can be expensive
- Maintenance Overhead : Server maintenance, updates, and security require ongoing attention and resources

**Exercise 1-3**

Farid would like to upload practise assignment on cms.giu-uni.de.
How does Farid device and CMS server exchange data through TCP ?

**Solution:**

The first step is an opening three way handshake between client and server.
Client send data to server in the second step.
The final step is a closing three way handshake between client and server.

The three way handshake opening connection consists of SYN, SYN-ACK, and ACK.
The client send message to server to establish connection (SYN message).
The server acknowledges the client request (SYN-ACK message).
The client sends the acknowledgment (ACK message ) to the server after receiving server acknowledgment.

The three way handshake closing connection consists of FIN, FIN-ACK, and ACK.
The client send message to server to terminate connection (FIN message).
The server acknowledges the client request (FIN-ACK message)
The client sends the acknowledgment (ACK message ) to the server after receiving server acknowledgment.

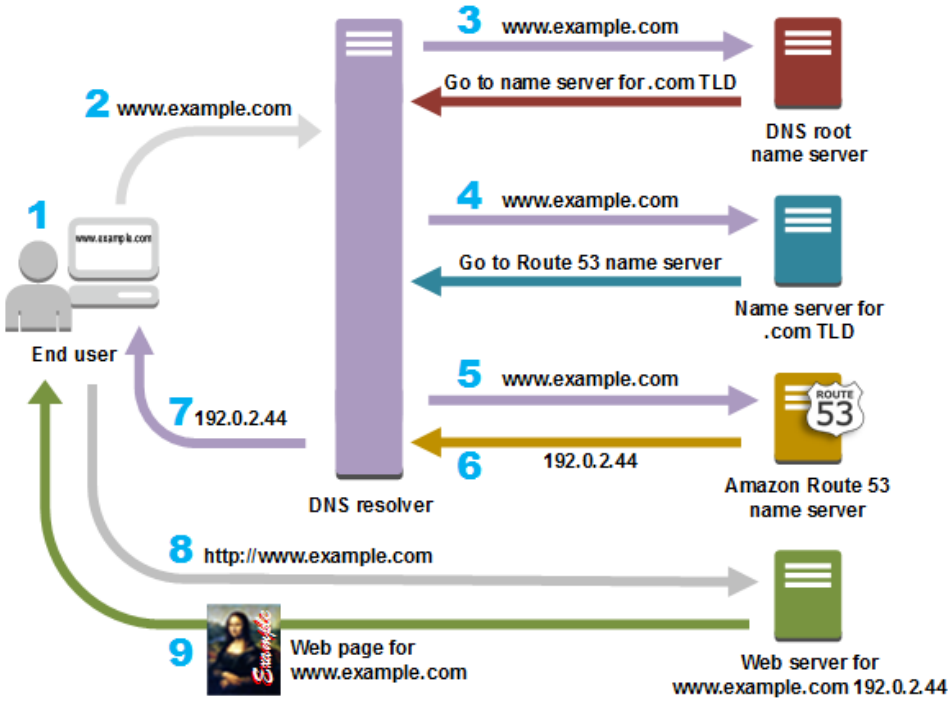
**Exercise 1-4**

What is the differences between UDP and TCP ?

| TCP | UDP |
|---|---|
| Three way handshake connection | Connectionless protocol |
| Extremely reliable | Less reliable |
| Slow | Fast |
| File Transfer Protocol<br>Web Browsing<br>Email | Live Streaming<br>Online Games<br>VoIP |

**Exercise 1-5**

Given the following diagram
Describe the steps of how a webpage is reterived over the internet.
You must include the following terms such as User, Web Server, DNS in your answer.
Note that Amazon Route 53 name server is an Authoritative Nameserver.




Does DNS resolver need to send a query to DNS root server whenever user request a web page ?

**Solution:**

The DNS resolver send a query in case that IP Address of website is not found in the cache

Describe the steps of how a webpage is reterived over the internet.

**Solution:**

1. User types URL of www.example.com in the browser.
2. The Browser sends a website name as query to the DNS resolver.
3. The DNS resolver sends a query to the DNS root server.
The DNS root server replies with name server for .com TLD.
4. The DNS resolver sends a query to .com TLD server.
The .com TLD server replies with Authoritative name server (Amazon Route 53)
5. The DNS resolver sends query to Amazon Route 53.
6. The Amazon Route 53 replies with its corresponding IP Address.
DNS resolver store IP Address in the cache.
7. The DNS resolver forwards IP Address to User.
8. User request webpage from Web server.
9. The Web server sends webpage to User.