Q. Research and document how a basic networking system works [Read about reverse tunneling, UDP/TCP, ports on a machine, what setting up a server means etc]. Example IITD proxy system.

🡪 **Computer Network:**  
It is the interconnection of multiple devices, generally termed as Hosts connected using multiple paths for the purpose of sending/receiving data or media.  
There are also multiple devices or mediums which helps in the communication between two different devices which are known as **Network devices**. Ex: Router, Switch, Hub, Bridge.

The layout pattern using which devices are interconnected is called as network topology. Such as Bus, Star, Mesh, Ring, Daisy chain.

**Protocol:**  
A protocol is the set of rules or algorithms which define the way how two entities can communicate across the network and there exists different protocol defined at each layer of the OSI model. Few of such protocols are TCP, IP, UDP, ARP, DHCP, FTP and so on.

[**TCP (Transmission Control Protocol)**](https://www.geeksforgeeks.org/tcp-services-and-segment-structure/)**:**  
TCP is a layer 4 protocol which provides acknowledgement of the received packets and is also reliable as it resends the lost packets. It is better than UDP but due to these features it has an additional overhead. It is used by application protocols like HTTP and FTP.

[**UDP (User Datagram Protocol)**](https://www.geeksforgeeks.org/computer-network-user-datagram-protocol-udp/)**:**  
UDP is also a layer 4 protocol but unlike TCP it doesn’t provide acknowledgement of the sent packets. Therefore, it isn’t reliable and depends on the higher layer protocols for the same. But on the other hand it is simple, scalable and comes with lesser overhead as compared to TCP. It is used in video and voice streaming.

**Port:**

In [computer networking](https://en.wikipedia.org/wiki/Computer_networking), a **port** is a communication endpoint. At the software level, within an [operating system](https://en.wikipedia.org/wiki/Operating_system), a port is a logical construct that identifies a specific [process](https://en.wikipedia.org/wiki/Process_(computing)) or a type of [network service](https://en.wikipedia.org/wiki/Network_service). Ports are identified for each protocol and address combination by 16-bit unsigned numbers, commonly known as the **port number**. The most common protocols that use port numbers are the [Transmission Control Protocol](https://en.wikipedia.org/wiki/Transmission_Control_Protocol) (TCP) and the [User Datagram Protocol](https://en.wikipedia.org/wiki/User_Datagram_Protocol) (UDP).

A port number is always associated with an [IP address](https://en.wikipedia.org/wiki/IP_address) of a host and the [protocol](https://en.wikipedia.org/wiki/Network_protocol) type of the communication. It completes the destination or origination [network address](https://en.wikipedia.org/wiki/Network_address) of a message. Specific port numbers are commonly reserved to identify specific services, so that an arriving packet can be easily forwarded to a running application. For this purpose, the lowest numbered 1024 port numbers identify the historically most commonly used services, and are called the [well-known port numbers](https://en.wikipedia.org/wiki/Well-known_port_numbers). Higher-numbered ports are available for general use by applications and are known as [ephemeral ports](https://en.wikipedia.org/wiki/Ephemeral_port).

**Reverse tunneling** is a **tunneling** from mobile host to home agent, and makes it possible for the mobile host from foreign **network** to communication in the **network** whose router has access filters.

**Servers** are used to manage **network** resources. For example, a user may **set up a server** to control access to a **network**, send/receive e-mail, manage print jobs, or host a website. They are also proficient at performing intense calculations. Some **servers** are committed to a specific task, often referred to as dedicated.

🡺 Write about how does a website work? What process is followed when you type in the URL of a website?

1. You enter a URL into a web browser
2. The browser looks up the IP address for the domain name via DNS
3. The browser sends a HTTP *request* to the server
4. The server sends back a HTTP *response*
5. The browser begins rendering the HTML
6. The browser sends requests for additional objects embedded in HTML (images, css, JavaScript) and repeats steps 3-5.
7. Once the page is loaded, the browser sends further async requests as needed.

🡺Suppose you created an HTML page and wanted to show this to a person using the same WiFi network. How would you accomplish this if you are neither allowed to upload your site nor give the source code through external storage? [Hint: Google setting up a local server using python]

* We will setup a local server using softwares such as node js, pthon, etc. & host it on the local machine on the same network IP as the person’s IP.

🡺Get an overall idea of what is NginX and Apache (no need to dive too deep) and what role do they play in websites.

* **Apache** is an open-source and free web server software that powers around 46% of websites around the world. The official name is **Apache** HTTP Server, and it's maintained and developed by the **Apache** Software Foundation. It allows website owners to **serve** content on the web — hence the name “web server”
* **NGINX** is a web server that also acts as an email proxy, reverse proxy, and load balancer. The software's structure is asynchronous and event-driven; which enables the processing of many requests at the same time. **NGINX** is highly scalable as well, meaning that its service grows along with its clients' traffic.

🡺Would the above method work if the person was using his mobile data and you were using IITD WiFi ? Why/Why not ?

* You go into your router configuration and forward port 80 to the LAN IP of the computer running the web server.Then anyone outside your network (but not you inside the network) can access your site using your WAN IP address ([whatismyipcom](http://www.whatismyip.com/)).

Q. Do you know about database systems? What are they used for? Consider you are recruited at DevClub and you are said to make a website for managing the database of all IIT Delhi professors. The database includes all the necessary information of the professor including his personal information, all his projects, all his research data. How would you deal with the situation. What amongst SQL type databases or NoSql type databases will be better to model the situation and why? Briefly pen down the design of your database in terms of models/tables you’ll have along with what attributes you’ll store. Mention points for both why and why not did you use a particular type of the database.

* A **database** is an organized collection of [data](https://en.wikipedia.org/wiki/Data_(computing)), generally stored and accessed electronically from a computer system. Where databases are more complex they are often developed using formal [design and modeling](https://en.wikipedia.org/wiki/Database#Design_and_modeling) techniques.
* The [database management system](https://en.wikipedia.org/wiki/Database#Database_management_system) (DBMS) is the [software](https://en.wikipedia.org/wiki/Software) that interacts with [end users](https://en.wikipedia.org/wiki/End_user), applications, and the database itself to capture and analyze the data. The DBMS software additionally encompasses the core facilities provided to administer the database. The sum total of the database, the DBMS and the associated applications can be referred to as a "database system". Often the term "database" is also used to loosely refer to any of the DBMS, the database system or an application associated with the database.
* NoSQL type database will be better to model the situation as the data has no fixed structure (suppose someone can add some more personal info about a particular professor data or we can add some more field in an particular research).
* Basic Schema(can be modified)
* {
* Name:String,
* \_id:String,
* Department:String,
* Projects:[{
  + Name:String,
  + Date:Date
* }],
* Research:[{
  + Topic:String,
  + Date:Date
* }]
* }

Basic Design

Name: (Name Of Professor)

\_id: (Unique Id)

Department: (Name of department)

Project : (Array containing Info about project of professor)

Research: (Array containing info about research work of professor)

Q. Many times in JavaScript, you would need to use the clock for timing difference or, more specifically, a timer. The applications may be to send out an alert, maybe a countdown, testing the performance of your website, setting an animation, or any other crucial time-based action. The simplest way to implement that would be using setTimeout() and setInterval(). Are these a good choice for all the applications? Find out about them and also explore what other options are available to achieve better results. You may also look into why JS timer’s performance is intentionally degraded sometimes for security purposes.

🡪 setTimeout(expression, timeout); runs the code/function once after the timeout.

setInterval(expression, timeout); runs the code/function in intervals, with the length of the timeout between them.

For other options:

<https://www.geeksforgeeks.org/create-countdown-timer-using-javascript/>

For why JS timer’s performance is intentionally degraded sometimes for security purposes

* The computer security vulnerabilities Meltdown and Spectre can infer protected information based on subtle differences in hardware behavior. It takes less time to access data that has been cached versus data that needs to be retrieved from memory, and precisely measuring time difference is a critical part of these attacks.
* Our web browsers present a huge potential surface for attack as JavaScript is ubiquitous on the modern web. Executing JavaScript code will definitely involve the processor cache and a high-resolution timer is accessible via browser performance API.
* Web browsers can’t change processor cache behavior, but they could take away malicious code’s ability to exploit them. Browser makers are intentionally degrading time measurement capability in the API to make attacks more difficult. These changes are being rolled out for [Google Chrome](https://www.chromium.org/Home/chromium-security/ssca), [Mozilla Firefox](https://blog.mozilla.org/security/2018/01/03/mitigations-landing-new-class-timing-attack/), Microsoft [Edge and Internet Explorer](https://blogs.windows.com/msedgedev/2018/01/03/speculative-execution-mitigations-microsoft-edge-internet-explorer/). Apple has [announced Safari updates](https://support.apple.com/en-us/HT208394) in the near future that is likely to follow suit.