

Introduction To Web Development + MERN Stack

1/9/2025

Introduction to Web Development | Internet Working | MERN Stack | Spring Boot | AI

Internet → main purpose to communicate

COMPUTER - Common Operating Machine Purposely used
for Technological and Educational Research.

derived / originates from Latin word 'computare', meaning
"to calculate" or "to count"

* Networking works Similar to Post office working

• IP Addressing (Internet Protocol)

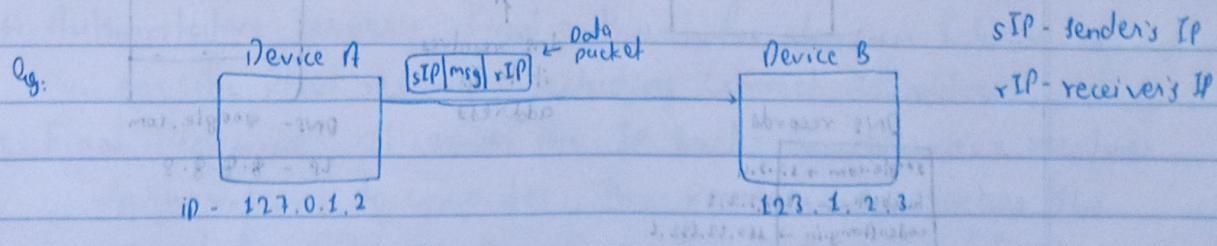
A unique numerical identifier for devices on the network
enabling communication by specifying the device's
location & identity

- There are two main versions IPv4 & IPv6, these

- can be public (globally unique, assigned by ISPs) or
private (used within local networks).

(expt pt.) - IP address can also be static (fixed, good for servers)
or dynamic (temporary, assigned by DHCP)

- It is the logical / digital address to identify a device
on the network, it allows data packets to be routed
to correct destination.

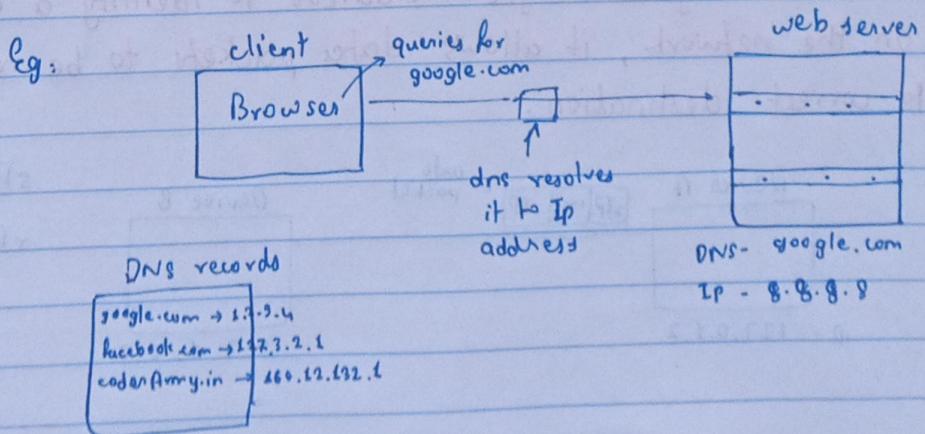


nslookup.io

ipconfig /all

Types of IP Addresses:

- IPv4 : represented by four sets of numbers separated by periods (e.g., 192.168.1.1)
- IPv6 : uses hexadecimal characters separated by colons (e.g., 2001:0db8:85a3:0000:8a2e:0370:7334) to support a vast number of devices.
- Public IP : assigned by ISP makes device directly accessible from anywhere on the internet.
- Private IP : used within private network and not accessible from public internet.
- Static IP : fixed IP that does not change overtime, often used for servers that need a constant & reliable addr.
- Dynamic IP : temporary IP assigned by DHCP server that can change over-time.
- DNS (Domain Name System)
 - ↳ It is the Internet's directory, translating human-friendly domain names (like www.google.com) into a machine-readable IP address (like 142.250.191.132)
 - This process is called DNS resolution



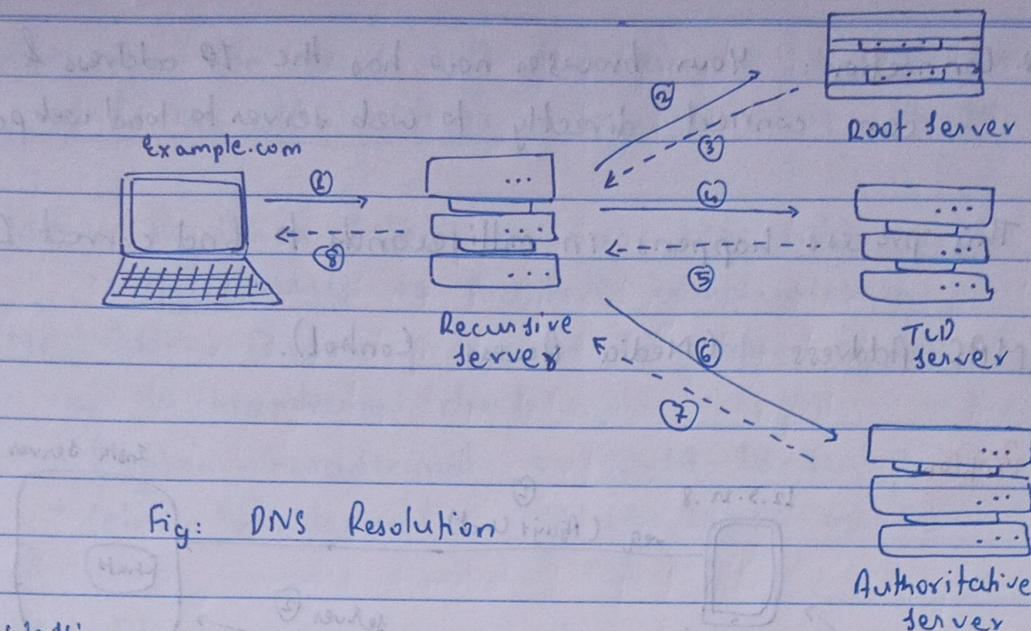


Fig: DNS Resolution

Working:

1. Browser Cache - checks the browser if it has recently looked up.
2. OS cache - computers OS cache also stores recent DNS lookups
3. Recursive DNS query : If IP not found locally, it is sent to Recursive server. - Acts as an intermediary, fetching the correct IP address on behalf of the client.
4. Root server: (There are 13 root servers located around world) The root server doesn't know IP address but it directs to the correct TLD nameserver.
5. TLD server (Top-level-domain) : manages extensions like .com, .org, .edu. The TLD server provides the IP address of authoritative nameserver for the specific domain.
6. Authoritative server: Final authority for domain & holds the specific DNS records, including correct IP address.
7. Final Response : It sends the IP back to recursive resolver which returns to computer. The resolver also caches the record for a period known as Time - To - Live (TTL).

- * Now when the server will send response it will also verify the MAC address of receiver along with IP address.

Address Resolution Protocol \rightarrow maps MAC addresses to IP addresses to facilitate communication.

MAC Address Format : is a 48-bit value, typically expressed as 12 hexadecimal digits.

- Hyphen - hexadecimal : 00-1A-2B-3C-4D-5E
- Colon - hexadecimal : 00:1A:2B:3C:4D:5E

• Port Number

- Numerical Identifiers (0 - 65535) in computer Networking to identify specific applications or services on a device
- They work with IP addresses to direct network traffic to the correct service on a machine, with common ports assigned to standard applications like HTTP (80) & HTTPS (443)
- A Port number is a 16-bit unsigned integer.

no stored using 16 binary digits (0's & 1's) \rightarrow numbers cannot be negative values are all positive

$$16\text{-bit number} \Rightarrow b^{2^6} = 65536$$

Categories:

1. Well-known Ports (0 - 1023)

strictly managed by IANA

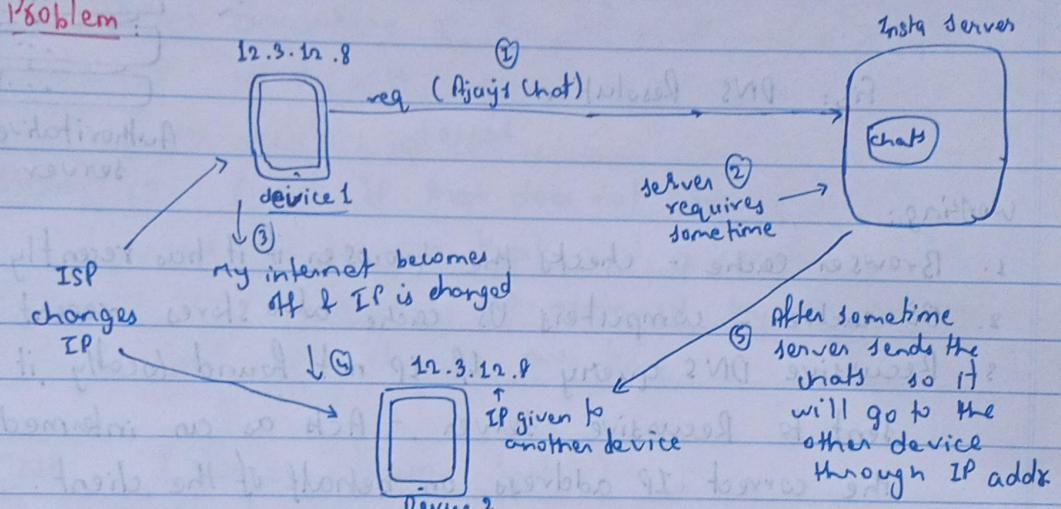
Eg., 21: FTP, 22: SSH, 25: SMTP, 53: DNS
80: HTTP, 443: HTTPS.

8. Connection: Your browser now has the IP address & can connect directly to web server to load web page.

This process happens in milliseconds to find correct IP Address.

- MAC Address (Media Access Control).

Problem:



This problem is resolved by MAC Address.

- MAC address is a unique, permanent hardware identifier assigned to a network interface controller (NIC) by the manufacturer. Operated at Data Link layer of OSI model.
- It acts a physical Address, used to route data packets to correct device, it is often addressed as hardware address.
- Unlike IP address, a mac Address is hardcoded into the device's chip & does not change, serving as a unique identifier for devices within local segment.

Data packet now has:

s IP	sMAC	msg Ajay's chat's	r IP	r MAC
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2. Registered Ports (1024 - 49151)

- These ports are for specific applications or services that are not universal. Companies & developers can register a port for their software to avoid conflicts with other applications.
- Less strict you can request a port from IANA.
- You do not need administrator privileges to use these ports. This is the "user space" for applications.

Eg., for MERN Developer.

3000 : unofficial but extremely common default for running React & Node.js development servers,

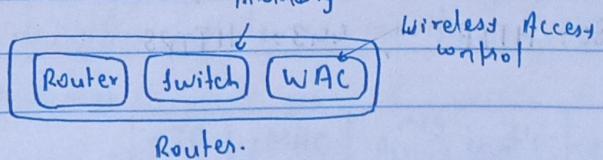
3306 : MySQL DB, 5432 : PostgreSQL DB

27017 : MongoDB default port, 8080 : common alternative port for web servers during development.

3. Dynamic / Private / Ephemeral Ports (49152 - 65535)

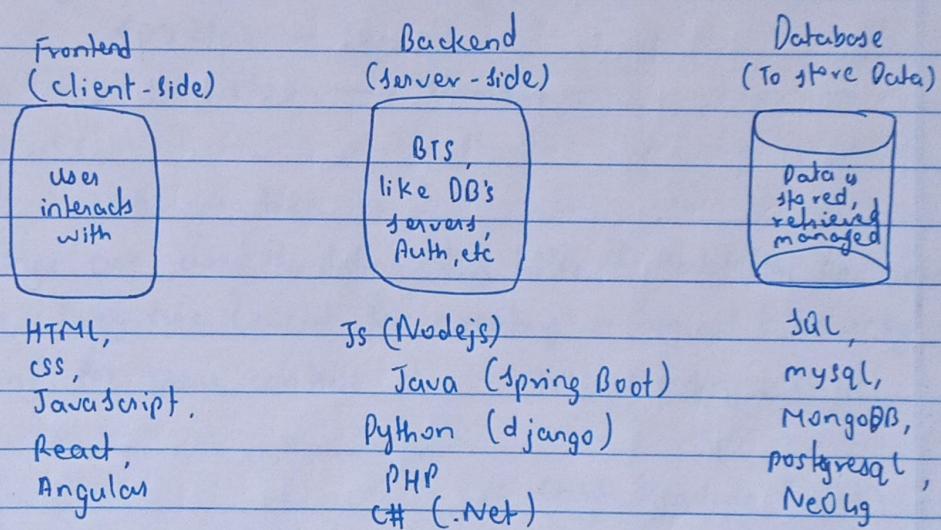
- These ports are not meant for public-facing servers. Their job is completely different.
- Controlled by No one. They are for temporary, private use.
- You never configure your server applications to listen on these ports. They are used automatically by the client side of a connection.

- Modern Routers - routers are used to connect to different local area networks.



- * There are multiple MAC addresses in one device because each hardware into the machine has its own MAC address which can be used for communication like wifi adapter, bluetooth, NIC, etc...
- Web Development - means building and maintaining websites or web Apps so that they work well on the internet & allow people to interact with information & services.

Main Parts:



HTML - used to write the content

CSS - used to style the content

JS - used to make dynamic & interactive content on webpage.

Nodejs - used to write server-side or business logics like api's..

Reactjs - a library to make interactive web pages