

## DNS - Domain Name Service

Domain names - IP addresses.

- DNS

DNS - Hierarchy - from top to bottom.



Root

TLD

Authoritative DNS

Local DNS  
cache / server

Hierarchy

Root DNS Server:

1) Root DNS is the first point of contact.

DNS Query → Root Server → DNS

Local DNS - Cache - www.google.com - Visit

↓ stores the IP address

www.google.com

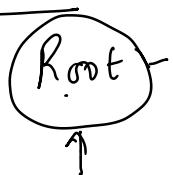
Google IP

168.194.194.194

DNS Cache - Local DNS →

Full Query → Root → TLD → Authoritative

Root DNS Server



First point of contact-

Root for all the communication  
- Starts from here.

{ Root of all the Servers - Contains the IP addresses of all the TLD Servers }

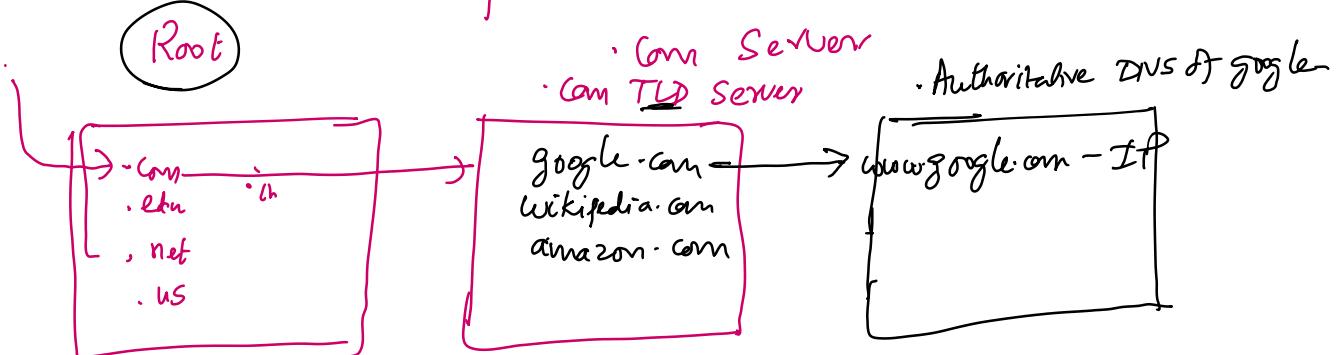
IP address of all the Top Level Domain Servers (TLD)

Root Server - Contains the IP addresses of all the TLD Servers  
{ .com, .edu, .net, .gr, .in }

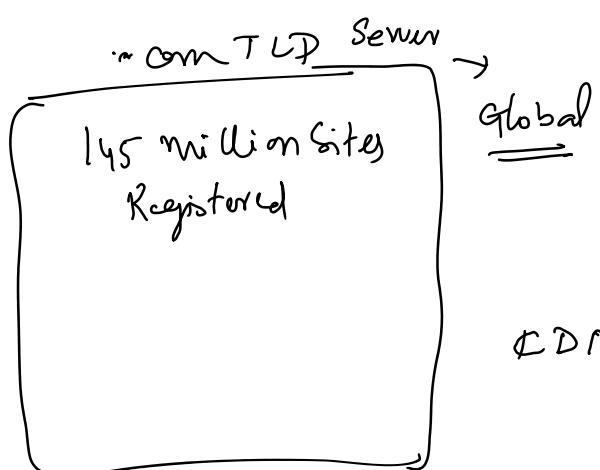
L1 LD shows  
C.com, .edu, .net, .gr, .in

## DNS Query

www.google.com - DNS Query  
↑



.com TLD servers - Distributed around



- Centralized
  - Based on Regions
  - Nearest Point
  - Spread out across different regions.

CDN - Distributed Networks  
- Global level - Spread

Root DNS - IP addresses of the TLD Servers.

- 13 DNS Servers (Root)
    - Misleading
  - 3 unique IP addresses.

A Records  $\xrightarrow{\text{DNS}}$  13 IP on TP addresses.  
name  $\xrightarrow{\text{DNS}}$  - Introduced - IPV

## IPv4 Root DNS Record

IPv4 address 32 bits

- IP VL Kot DNS Records  
 ↓  
32 bytes  
DNS  
512 bytes - UDP  
T - 32 bytes - 96 bytes  
are reserved

IPv4 address - 32 bits

1 - 32 bytes

- 96 bytes  
are reserved

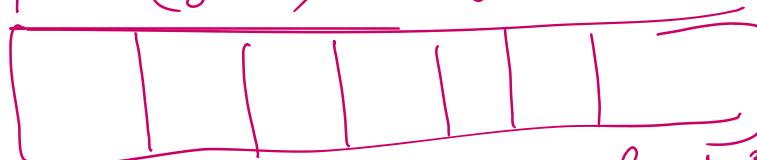
Root DNS Recrd - 32 bytes

416 bytes

$$416 \div 32 = 13$$

$$32 \times 13 = 416 \text{ bytes}$$

UDP packet (Segment) 96 bytes - Protocol information



DNS - (UDP)

512 bytes

UDP Segment

why 13?

→ Maximum no. of Root DNS Records you can fit in one UDP Segment is 13. 13 Root DNS IP addresses

$$13 \times 32 = 416 + 96 \text{ bytes}$$

↓  
Protocol  
13 bytes

- 13 IP addresses  
Root IP addresses -

13 Root DNS Servers — X  
13 Root — DNS IP address — ✓

> 100 Root DNS Servers

- Spread globally

13 IP addresses — ICANN

Root — (2) ft Verisign Inc  
DNS IP

13 Authorities — Many — 13 IP addresses.

IPv4 - IPv6

↓ +  
32 bits 128 bits

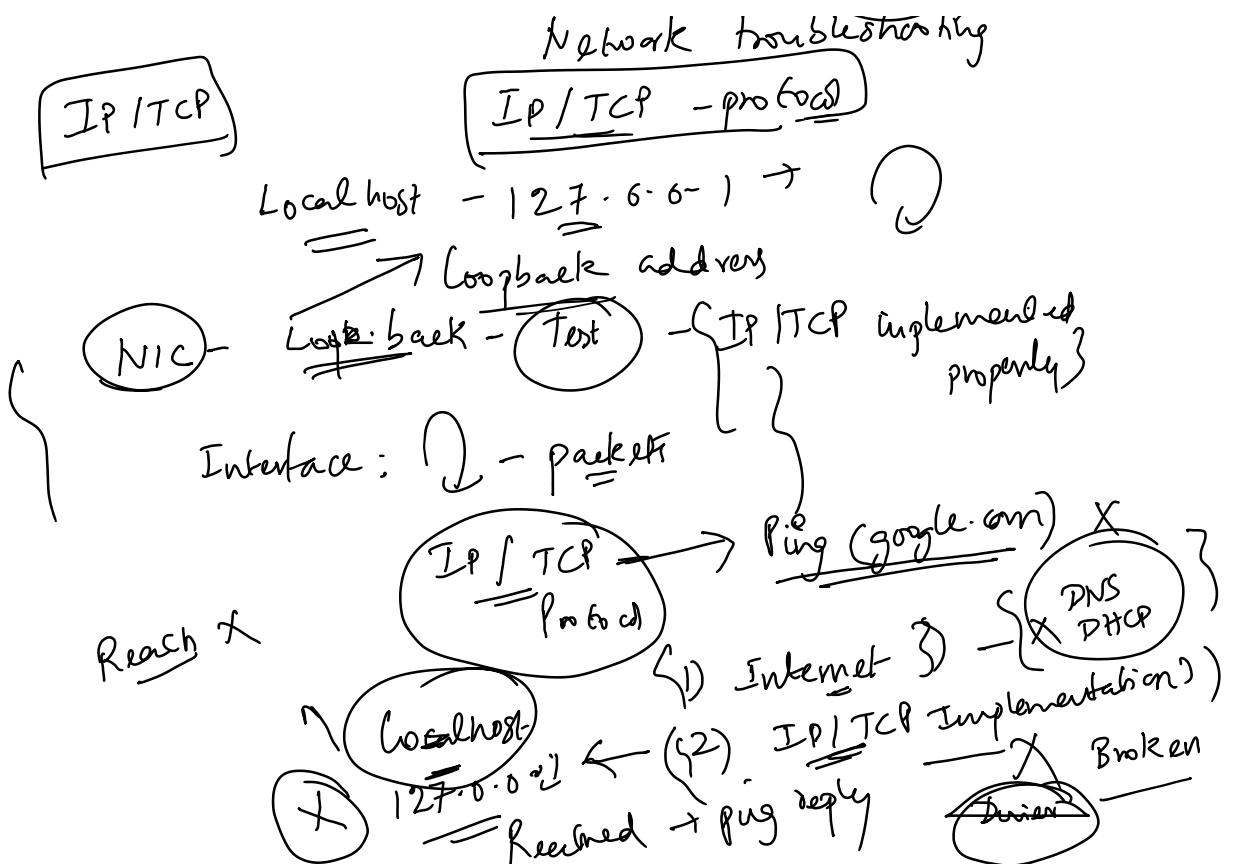
To ITRP

127.0.0.1 — Local host  
own local IP

Home & Host

Network troubleshooting

To ITRP - protocol



Root DNS - IP - B  
= - Authority (Root zone)  
B Root DNS IPs

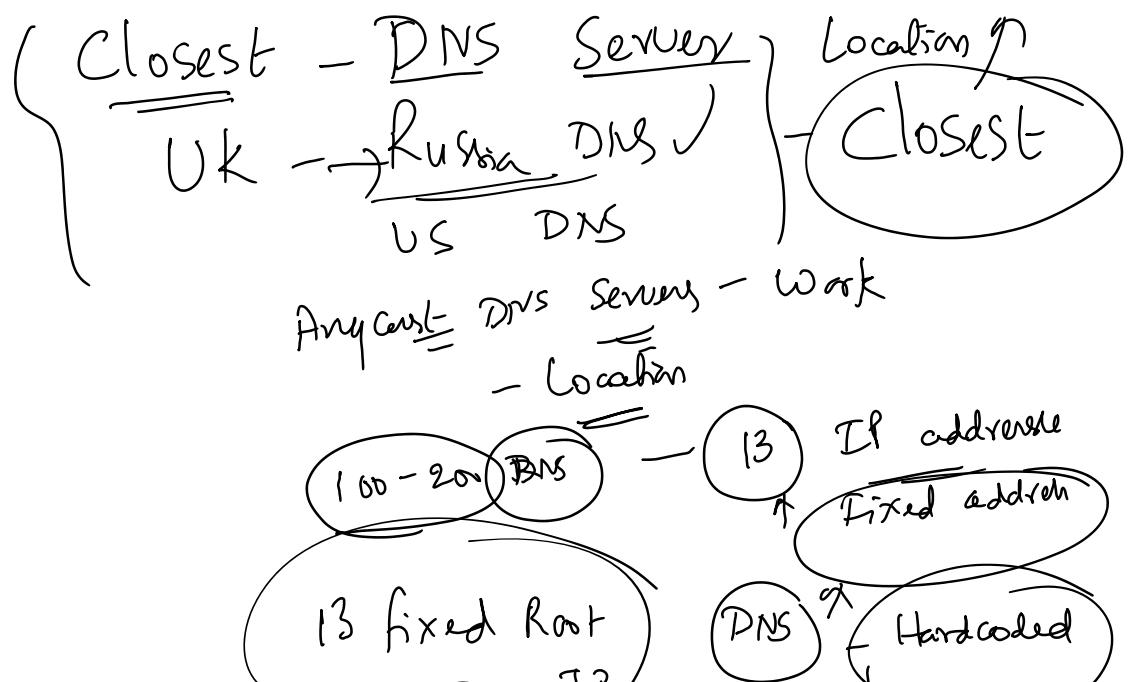
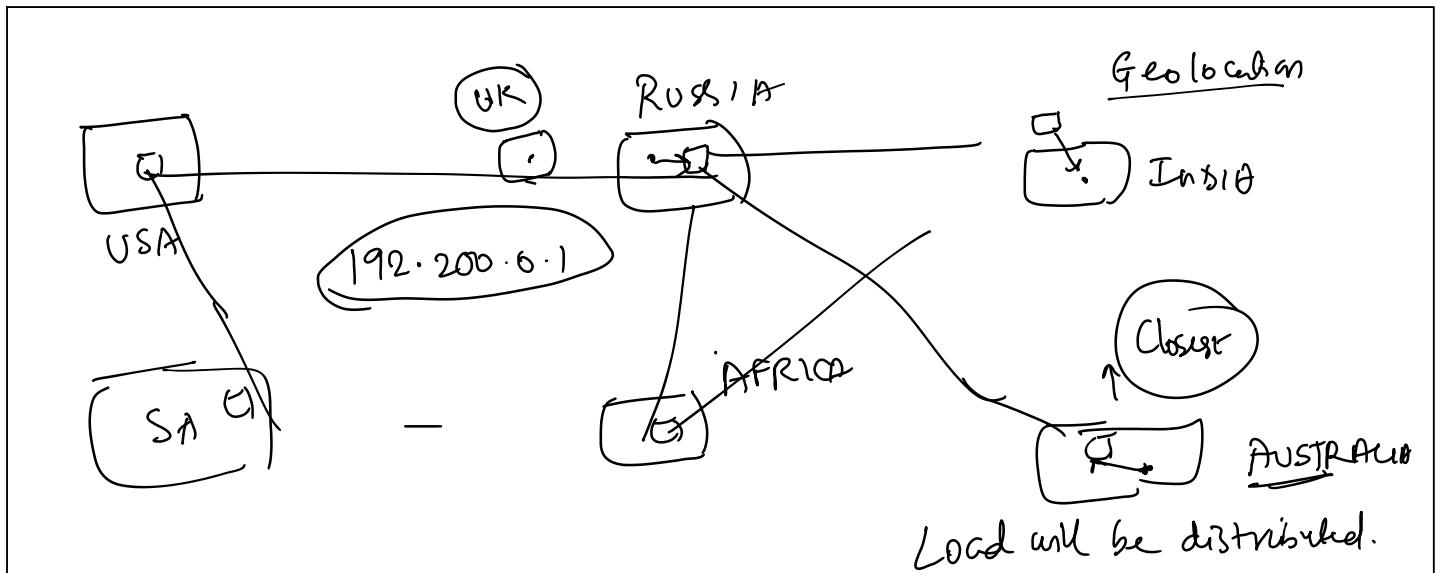
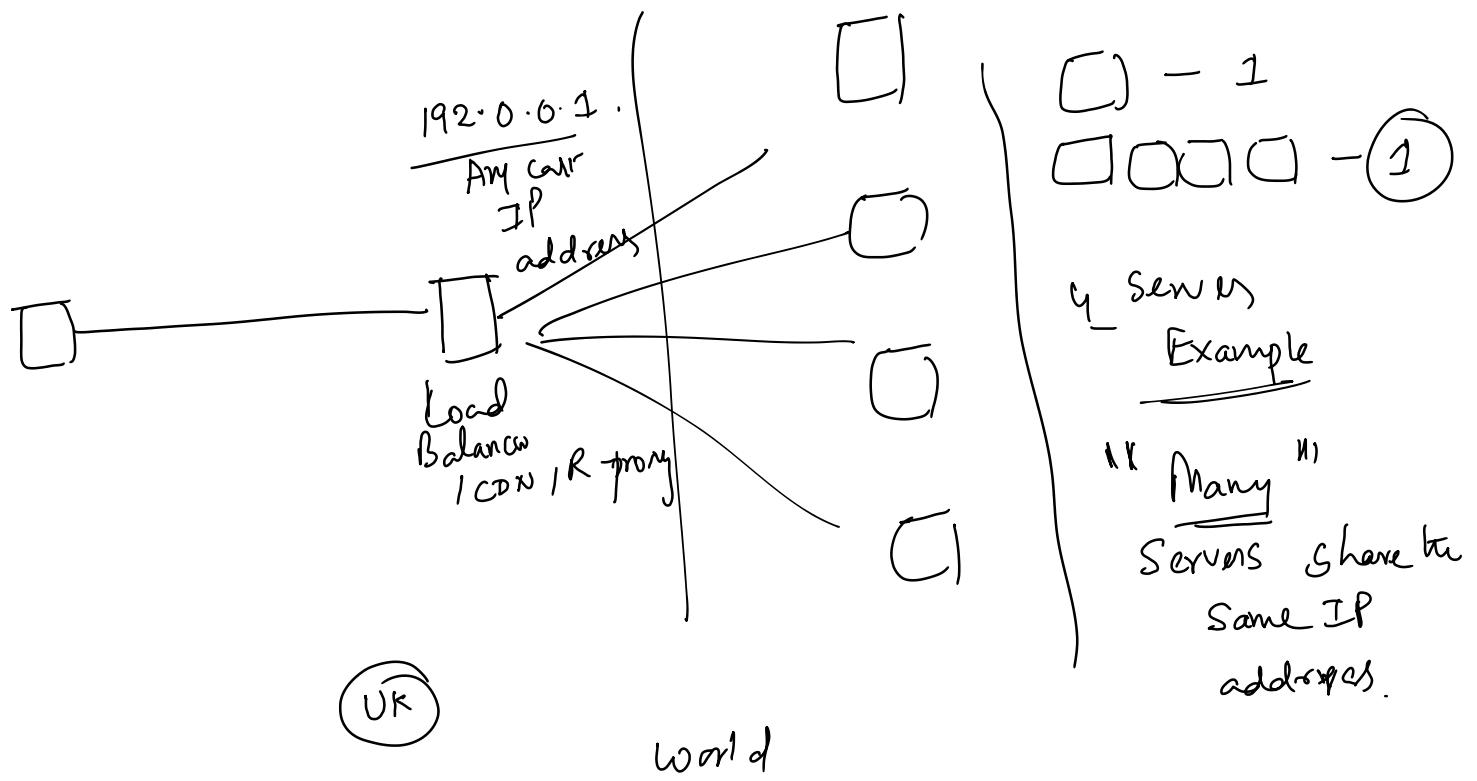
Many Root Servers - Around the world  
- Spread globally.

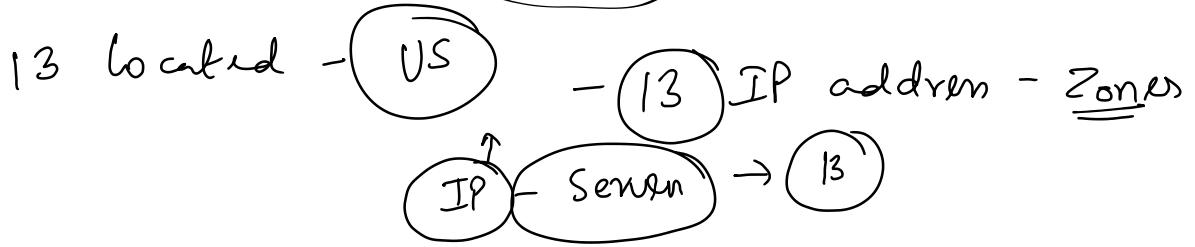
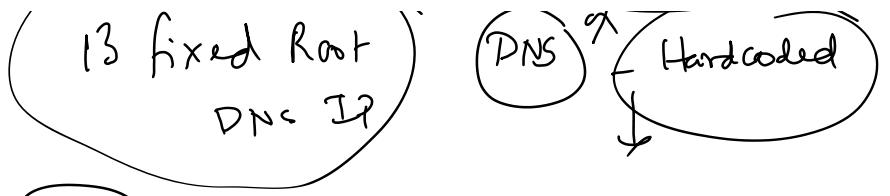
1000 servers - 13 IP addresses?  
Anycast Address.

1) Unicast - 1 device - 1 IP address

2) Multicast/Broadcast - 255.255.255.255  
Sent to every one in the Subnet

3) Anycast - Multiple servers  
- 1 IP address

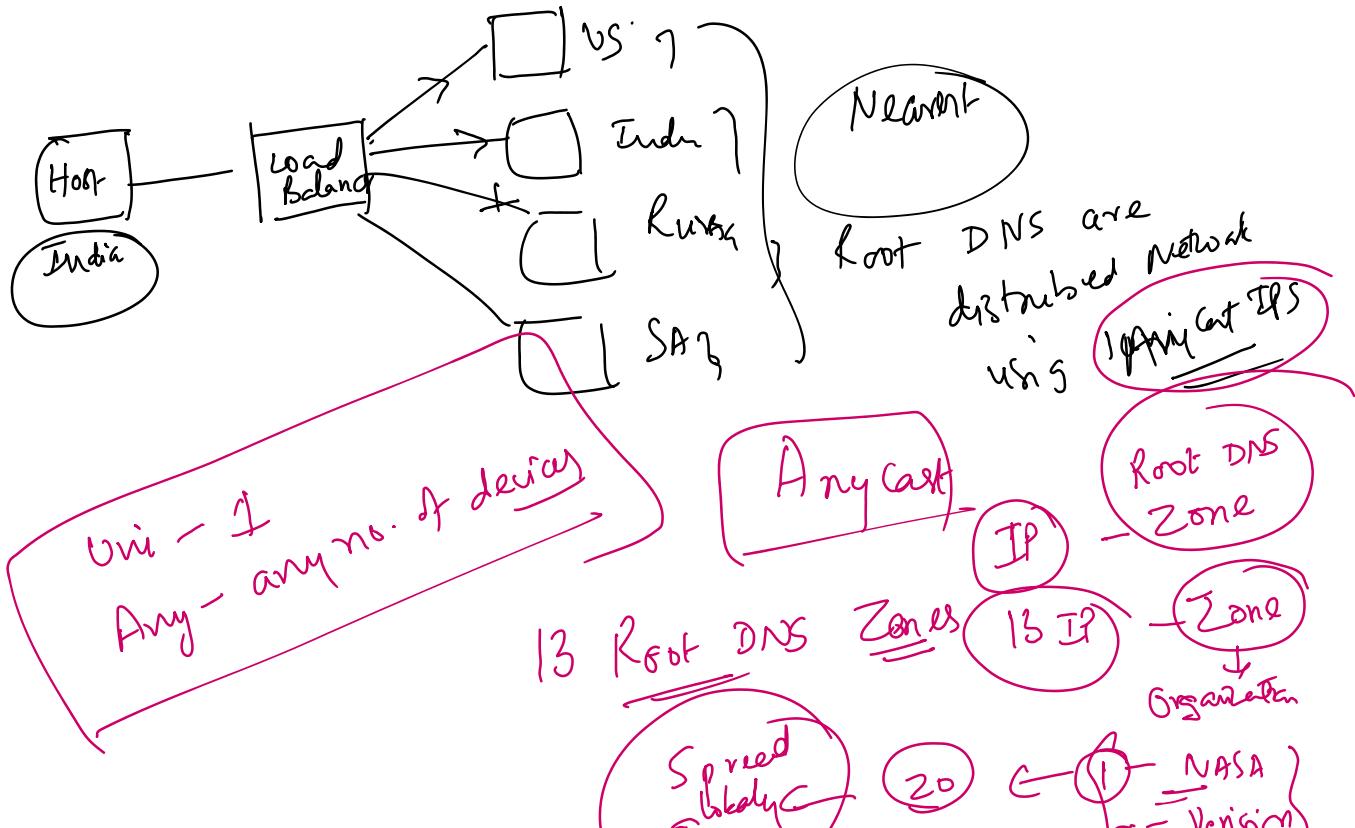
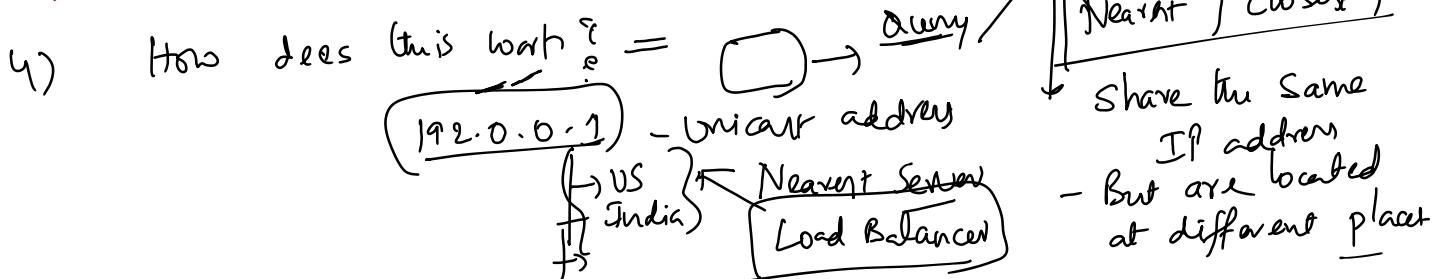


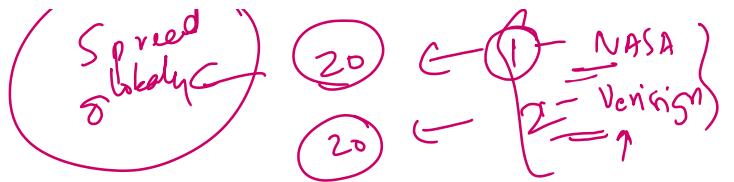


1) How many Root DNS Servers are present?  
- Many, spread around the world

2) But, why do they say there are only 13?  
- Root DNS server IP address - 13

3) How? - It uses Anycast address.





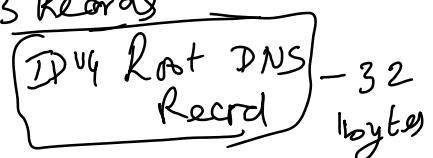
13

Why only 13: maximum

In the earlier days of DNS, the packet size was only 512 bytes.  
To send all the root DNS "TLD records" in one segment (UDP),

the maximum possible records are only " "  
 $13 \cdot (13 \times 32 = 416 \text{ bytes})$

1 512 byte Segment - 13 Records



IPV4 address - ~~32 bytes~~

IPV4 Root DNS Record - 32 bytes

512 - 13 Records

13 Root DNS EPS

: Anti-virus article:

Enough?

- Any questions! - X

Okay.

- X

End