What’s in a Network?

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Informant Networks

#whoami

- Security Research, Cyber Crime
- GIT > George Mason > UC Berkeley > FireEye > On Stage
- Founded Informant Networks in 2015
- Extensive research on Cyber crime and internet threats
- Currently Building Data-driven Network Security Products at Informant Networks
- I love the Internet. A LOT!
- http://hitesh.xyz

How this works?

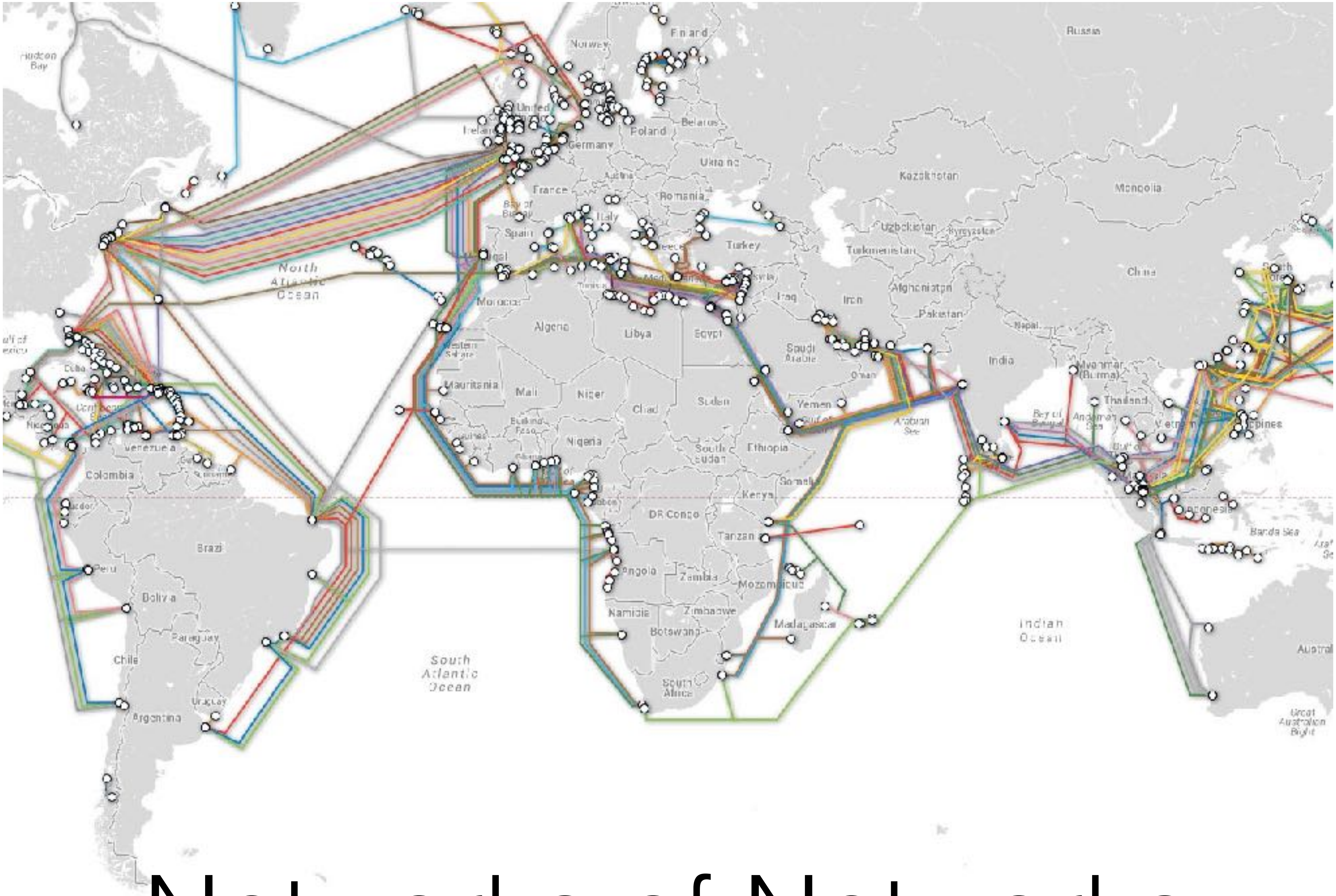
- Questions win points
- Highest points get a reward
- The best questions get a reward
- I want you to learn something valuable today

What are we talking about?

- How does the Internet work?
- What goes into a network
- Different aspects of a network
- A standard small medium business office network
- How to setup a network
- How to solve problems in a network
- 10 mins Q&A

“Internet”

What do you picture in your mind?



Networks of Networks

Internet Service Providers

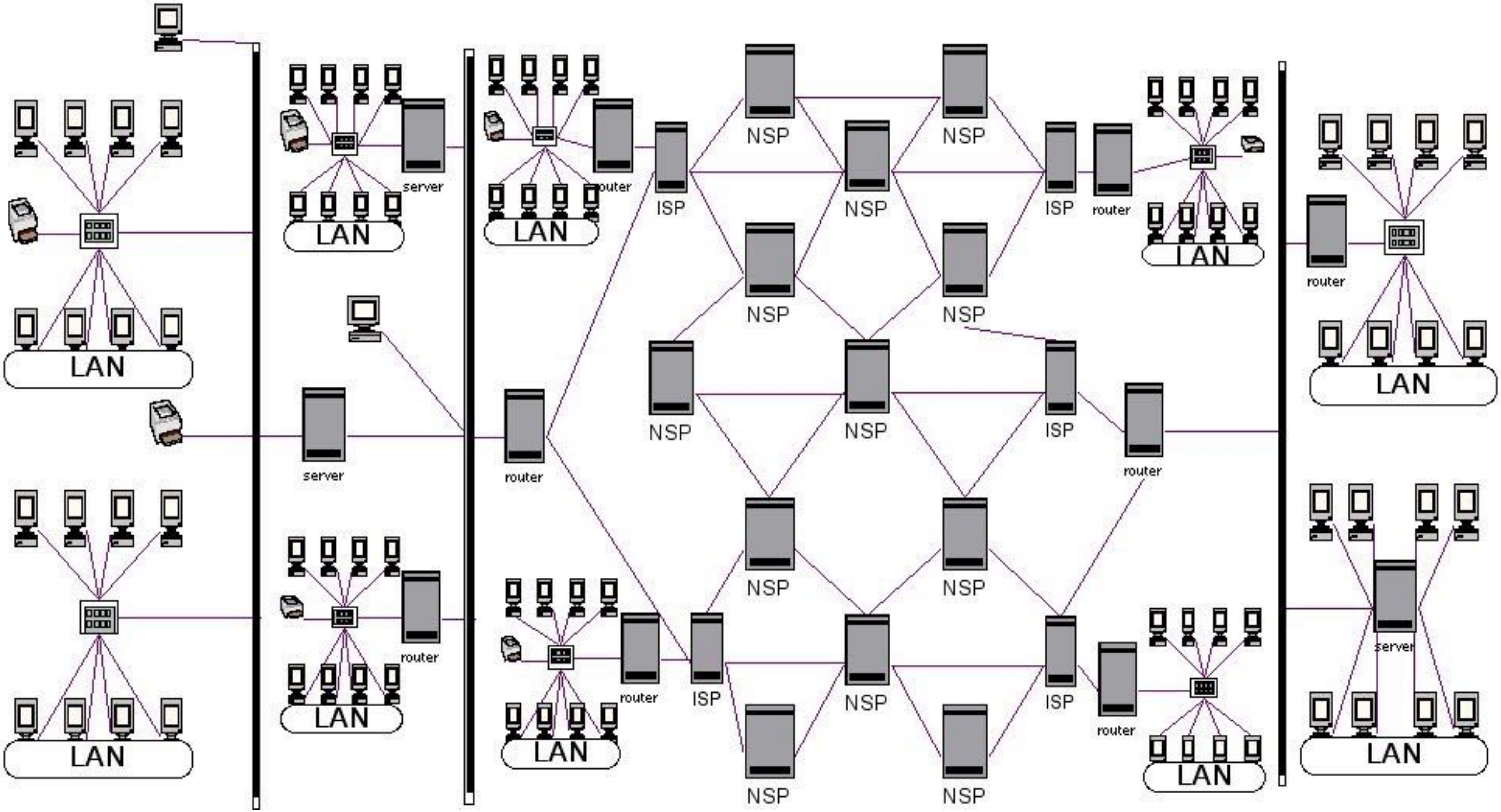
- Tier 1, Tier 2 and Tier 3
- Peering Agreements
- Large cables laid on the sea floor
- India has only one Tier 1 network. Tata Communications

WAN

- Wide area network
- A network bigger than the one you are on
- WAN also connected smaller networks to each other

Internet

- The biggest WAN
- You connect to your ISP
- Your ISP connects to the regional hub
- the regional hub is connected to geographic hub
- geographic hub connected to main backbone
- backbone connected to Tier-1 ISP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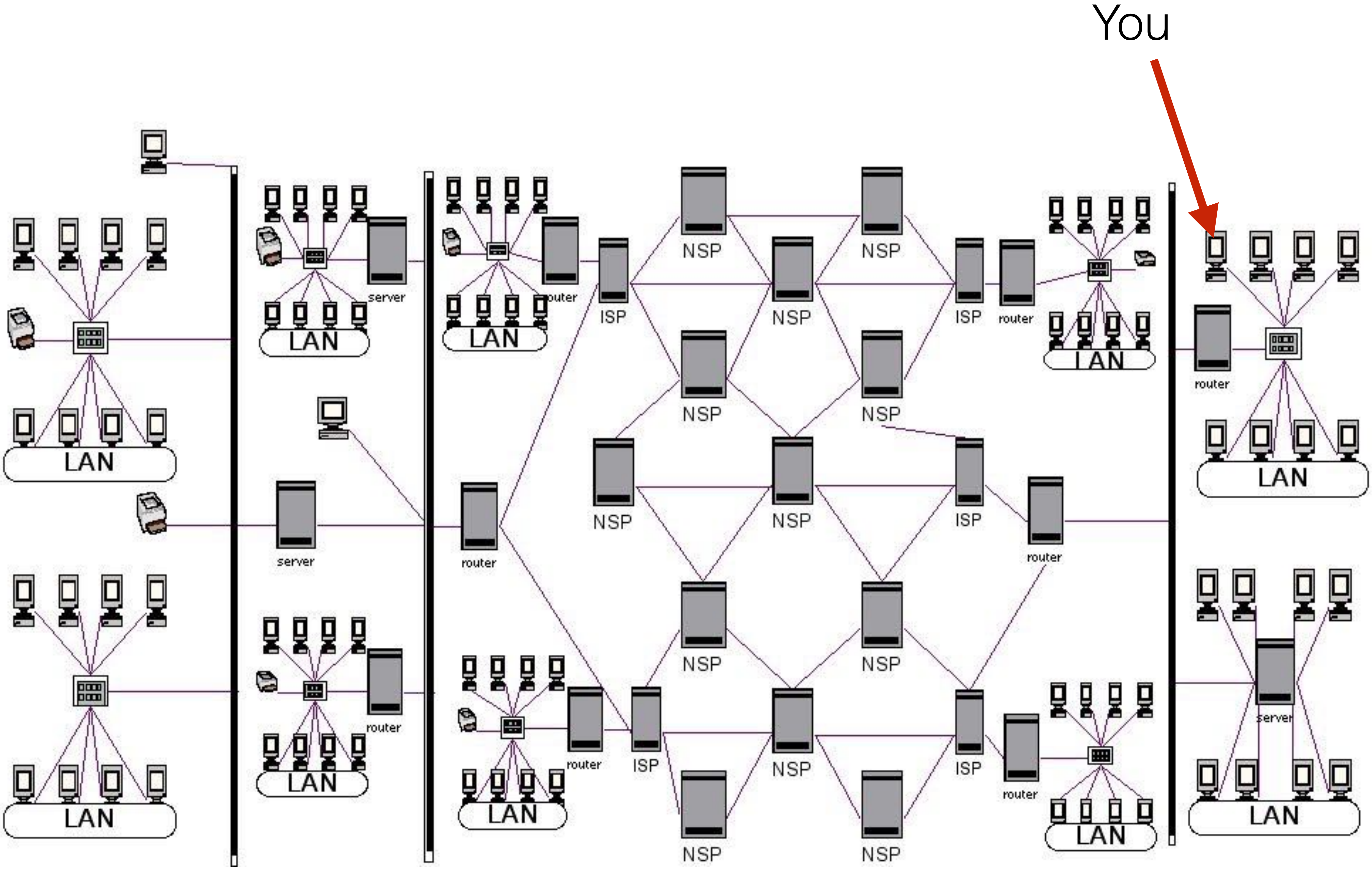
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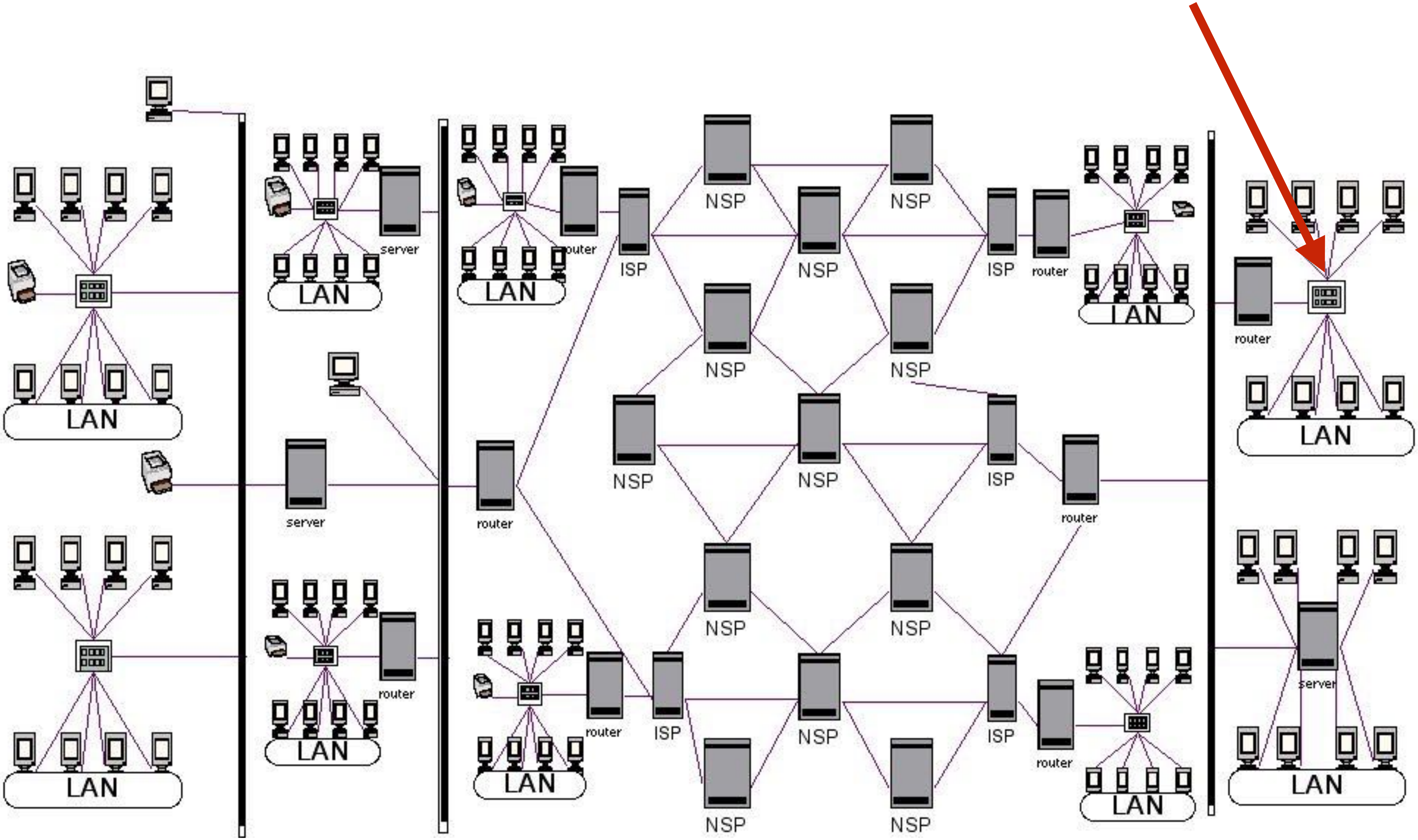
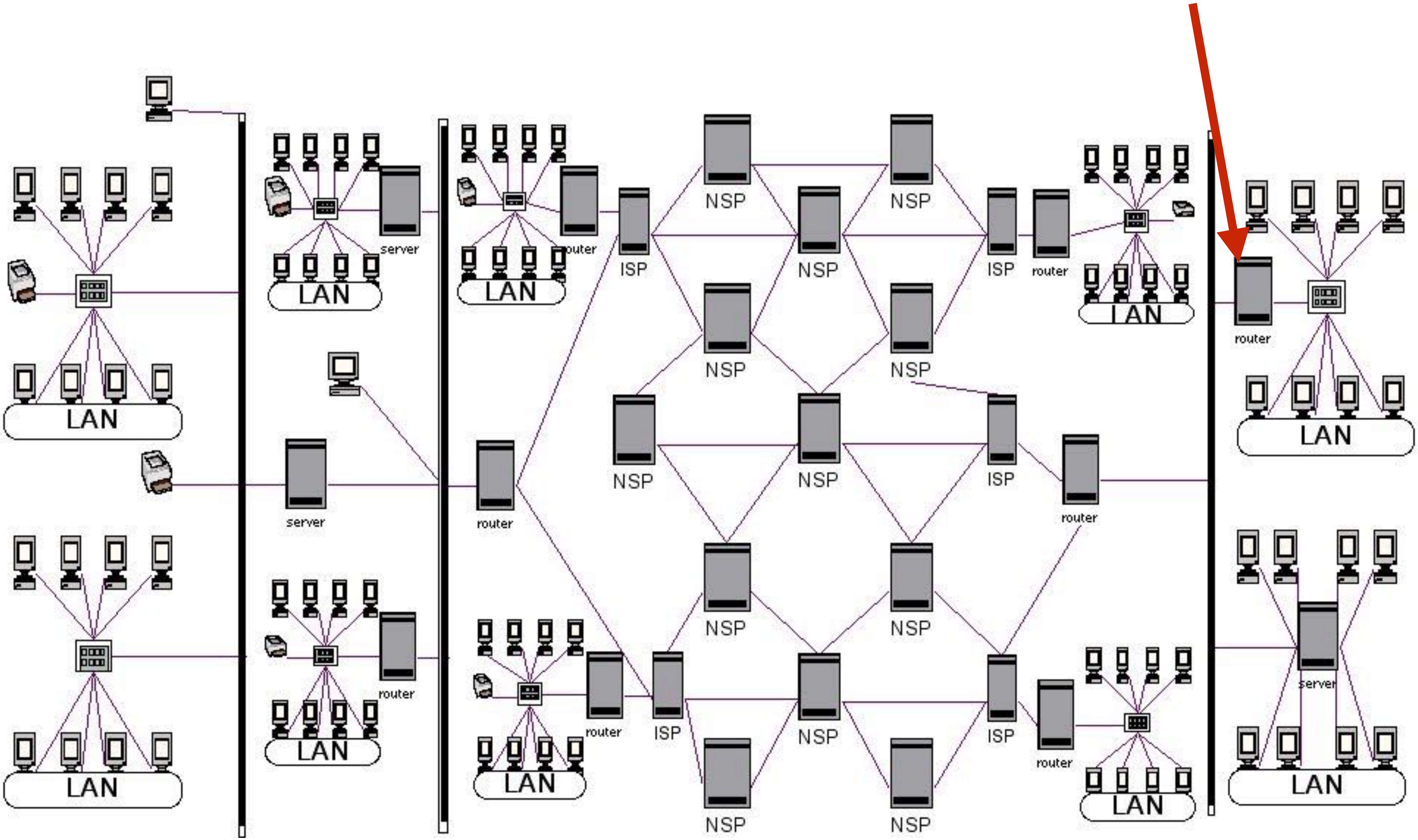
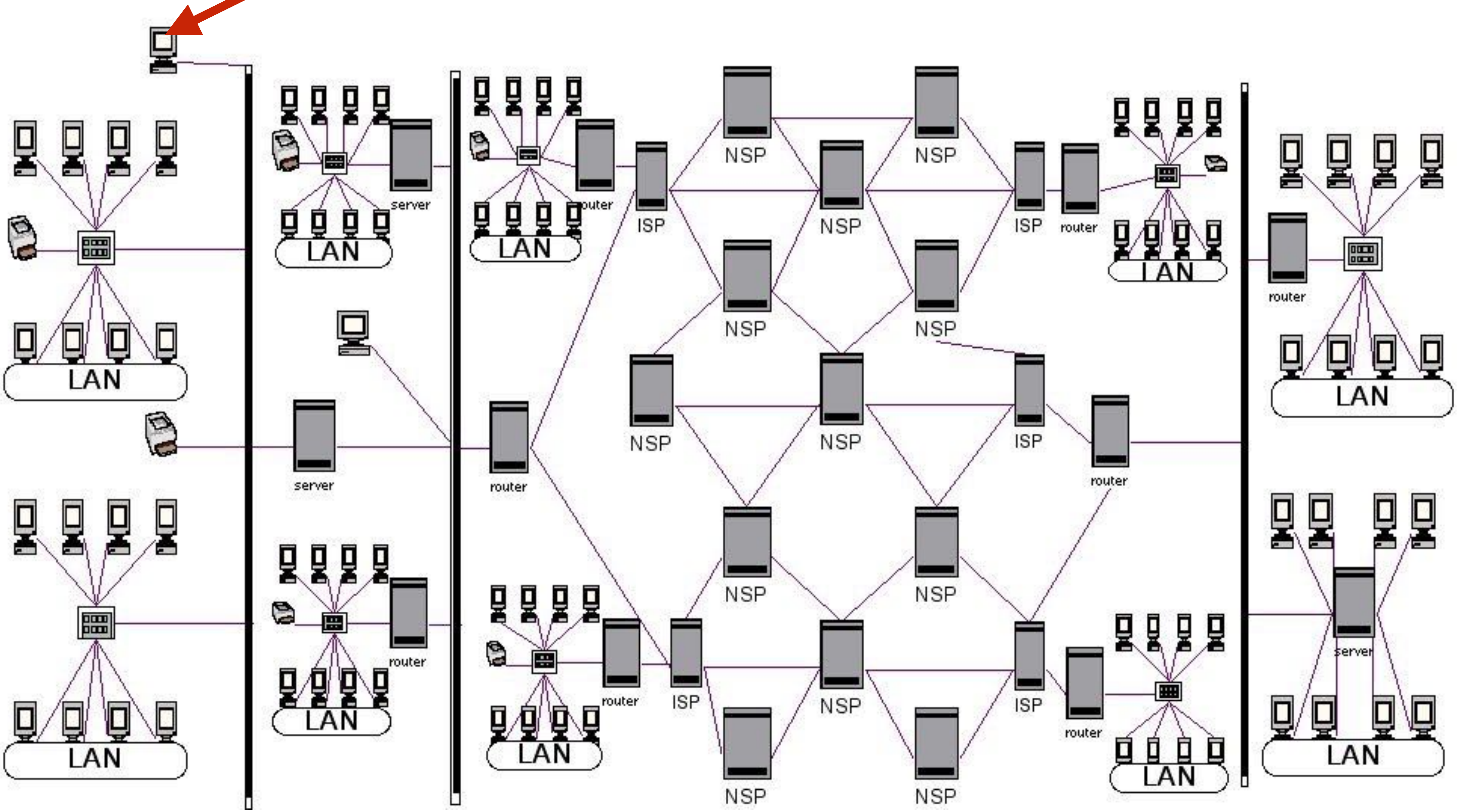
Your Home Router



Your ISPs Router



google.com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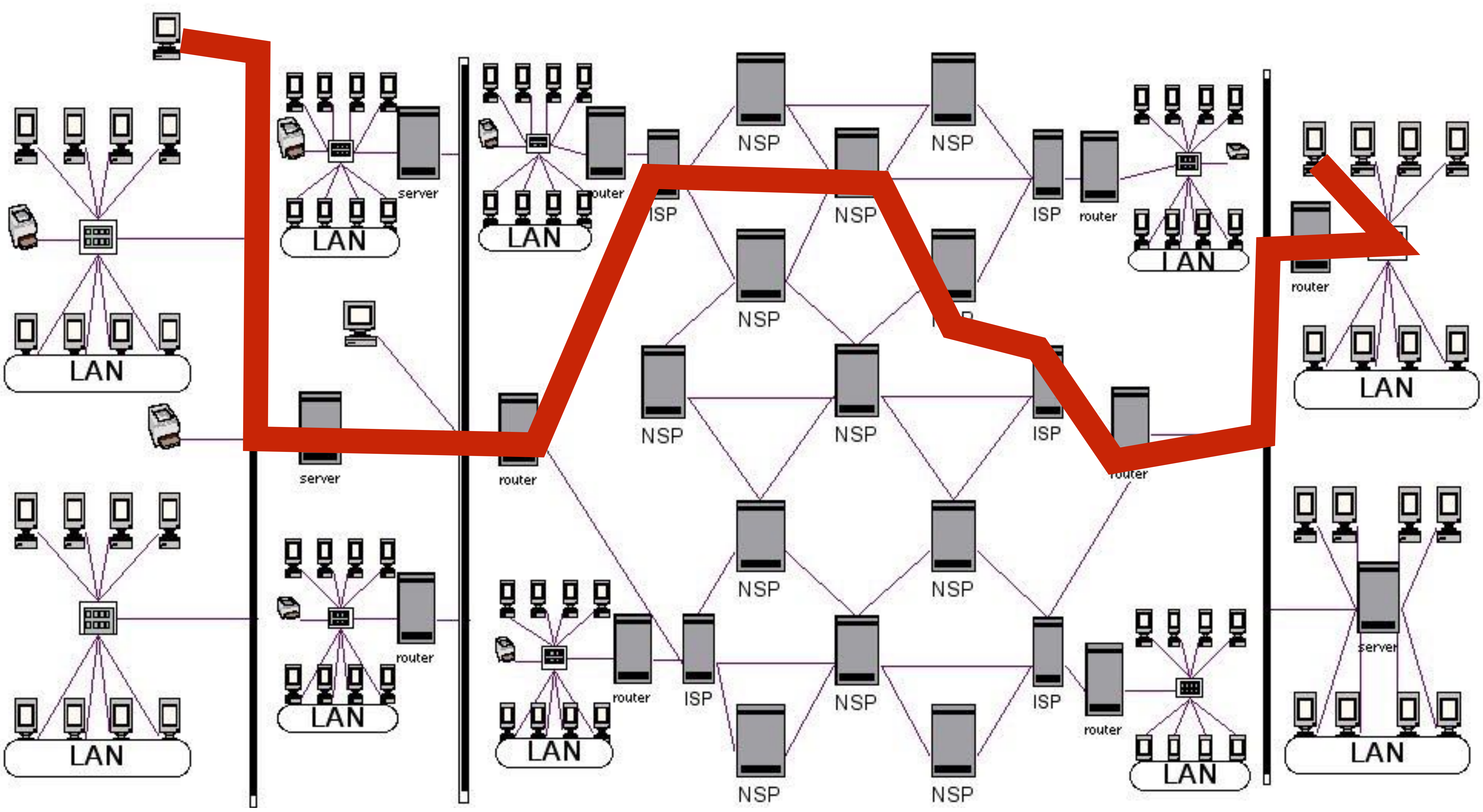
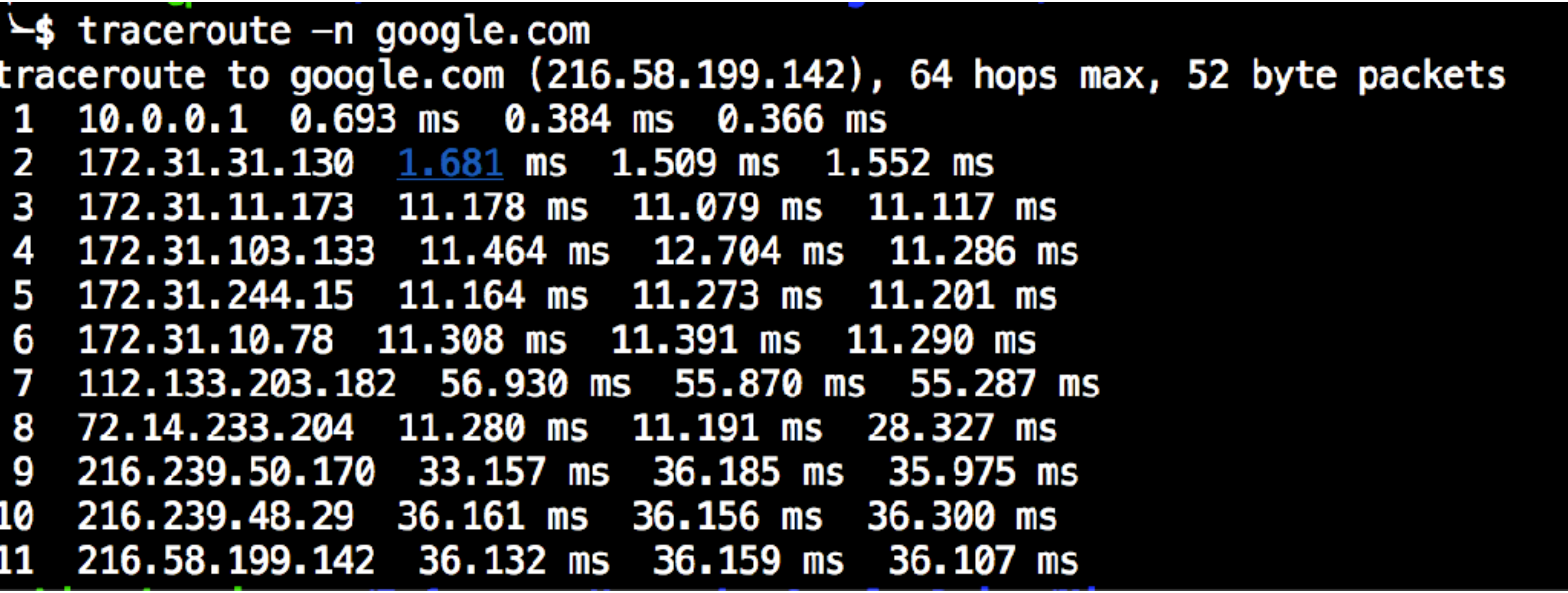
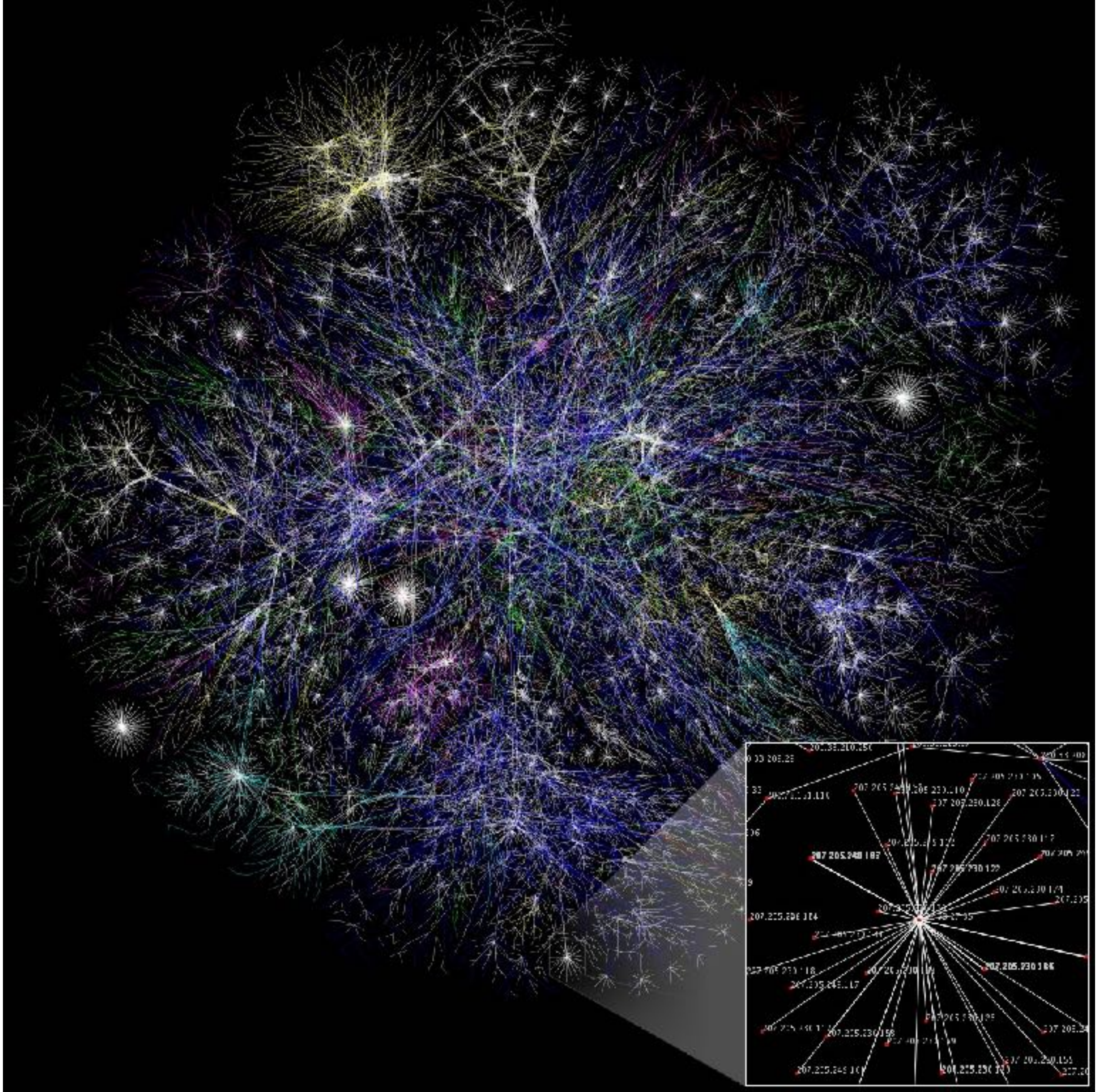


Go to google.com

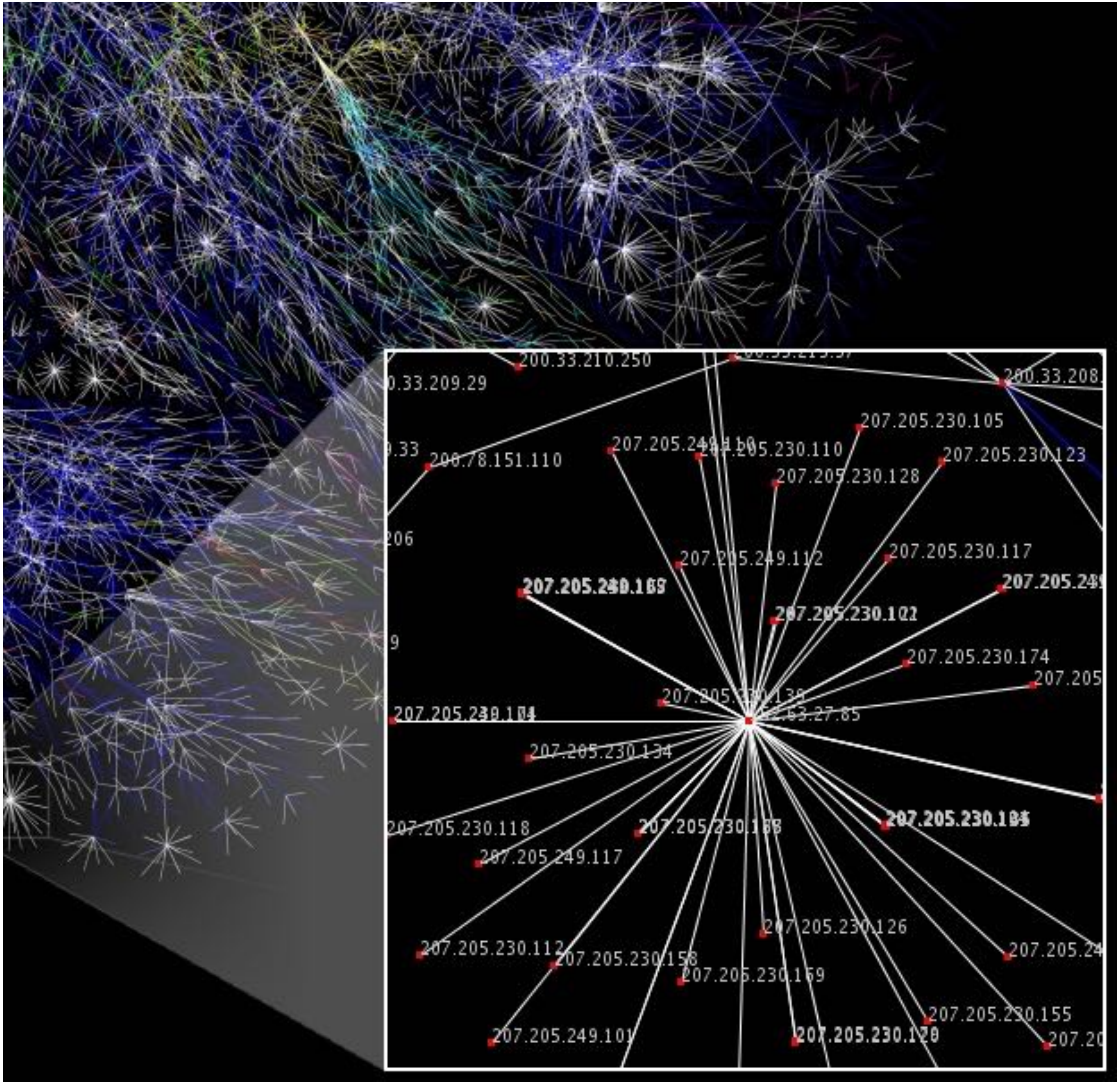
But Practically?



```
└$ traceroute -n google.com
traceroute to google.com (216.58.199.142), 64 hops max, 52 byte packets
 1  10.0.0.1  0.693 ms  0.384 ms  0.366 ms
 2  172.31.31.130  1.681 ms  1.509 ms  1.552 ms
 3  172.31.11.173  11.178 ms  11.079 ms  11.117 ms
 4  172.31.103.133  11.464 ms  12.704 ms  11.286 ms
 5  172.31.244.15  11.164 ms  11.273 ms  11.201 ms
 6  172.31.10.78  11.308 ms  11.391 ms  11.290 ms
 7  112.133.203.182  56.930 ms  55.870 ms  55.287 ms
 8  72.14.233.204  11.280 ms  11.191 ms  28.327 ms
 9  216.239.50.170  33.157 ms  36.185 ms  35.975 ms
10  216.239.48.29  36.161 ms  36.156 ms  36.300 ms
11  216.58.199.142  36.132 ms  36.159 ms  36.107 ms
```



207.205.248.187
207.205.230.128
207.205.230.122
207.205.230.117
207.205.230.129
207.205.230.174
207.205.236.184
207.205.230.166
207.205.248.117
207.205.230.158
207.205.230.155
207.205.248.10


200.33.210.250
0.33.209.29
200.33.208.
207.205.230.105
207.205.230.110
207.205.230.123
9.33
200.78.151.110
207.205.230.128
206
207.205.249.112
207.205.230.117
207.205.24
207.205.230.174
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.63.27.85
207.205.230.134
207.205.230.118
207.205.249.117
207.205.230.126
207.205.230.112
207.205.230.158
207.205.230.169
207.205.24
207.205.230.155
207.205.249.101
207.20

But how does that work?

- PPPoE/ Leased Line/FTTH
- DHCP
- DNS
- TCP/UDP

PPPoE

- Point to point over Ethernet
- Connect you with the nearest router
- Give username and password
  - Decides if you are a subscriber
  - How much speed you should get?

What does a computer need to know?

- Who am I? - > An IP Address
- Who is my gateway
- What network am i on?
- Who should i contact for DNS ?

DHCP

- Dynamic Host Configuration Protocol
- When a device connects to the network. Give it the correct network configuration
- Give MAC, get back configuration

DNS

- Connected to Internet
- Domain name server
- Give domain, Get back IP Address(es)

TCP/UDP

- Protocols that do data transfer from Point A to Point B (i.e. From your IP to Other IP)

- TCP - Provides Guarantee that traffic will be received

- UDP - No Guarantee for receipt

TCP at a glance

- Sender numbers the packets 1. 2, 3, 4, 5…
- Receiver acknowledges last received number.
    - If 1, 2 and 3 are received, it sends back 3
- Hence, If sender sent 1,2,3,4,5 and got back 3, it sends 4 and 5 again
- This mechanism guarantees that all packets will be sent

UDP

- I dont care
- Here are 500 packets

Ping

- Send one ICMP Packet (HELLO)
- Get back packet if machine is on (ACK HELLO)
- Machine is alive!

When a network goes down

- Check if the machine has an IP from DHCP
- Check local network (Ping Local Gateway)
- Check router status (PPPoE Internet connection status)
- Ping by IP (8.8.8.8)
- Ping by Domain Name (google.com)