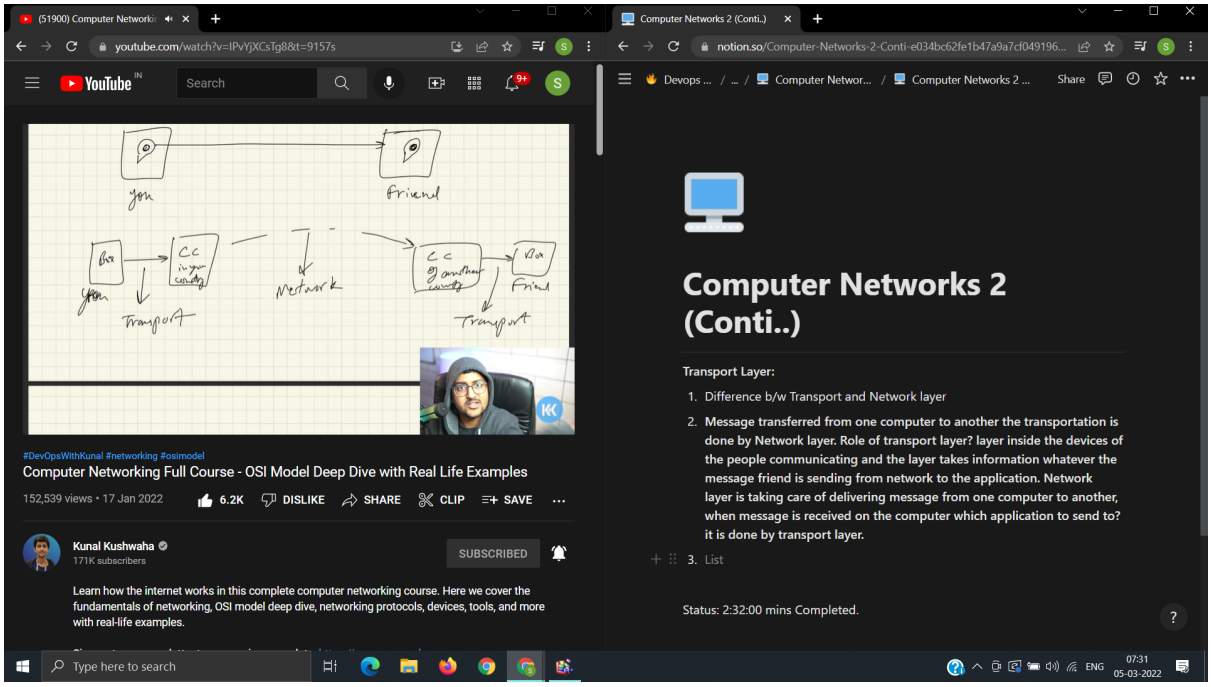
Computer Networks 2 (Conti..)

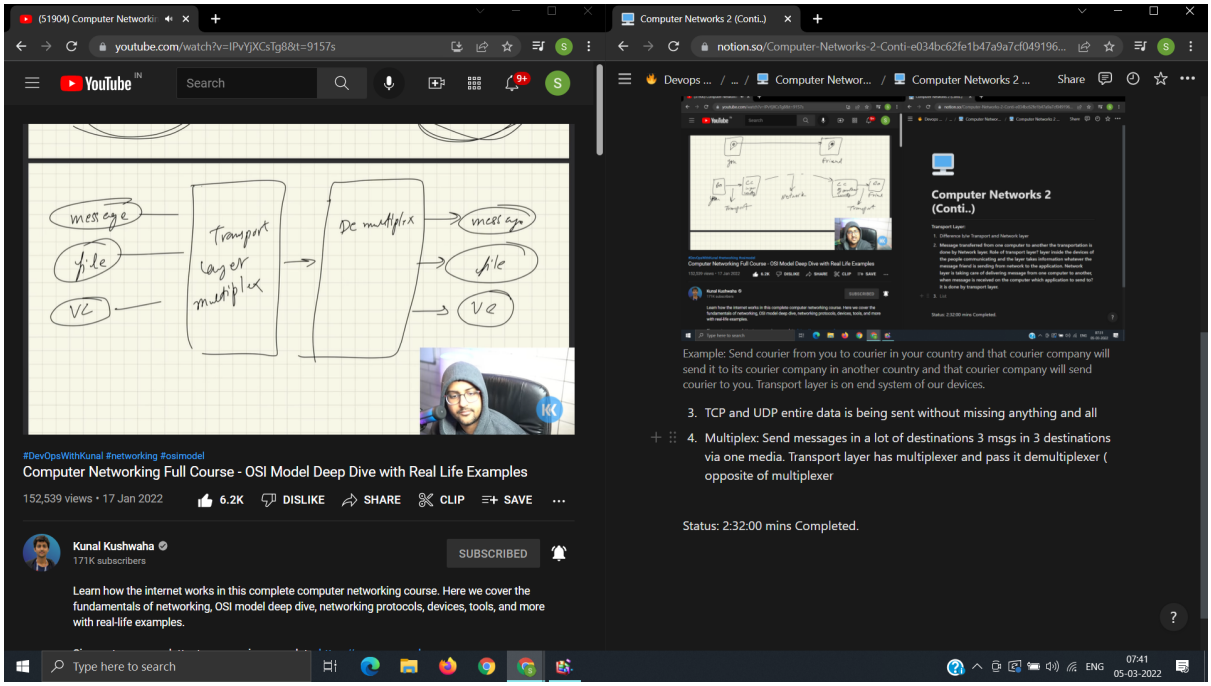
Transport Layer:

1. Difference b/w Transport and Network layer
2. **Message transferred from one computer to another the transportation is done by Network layer. Role of transport layer? layer inside the devices of the people communicating and the layer takes information whatever the message friend is sending from network to the application. Network layer is taking care of delivering message from one computer to another, when message is received on the computer which application to send to? it is done by transport layer.**

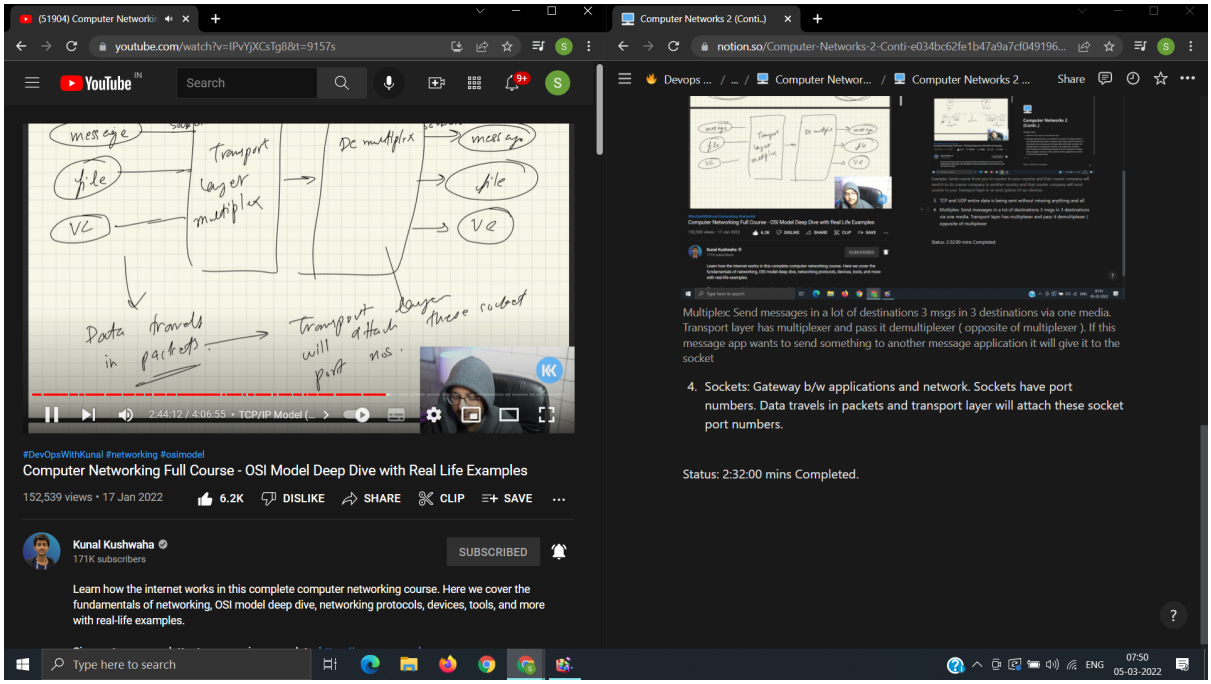


Example: Send courier from you to courier in your country and that courier company will send it to its courier company in another country and that courier company will send courier to you. Transport layer is on end system of our devices.

3. TCP and UDP entire data is being sent without missing anything and all



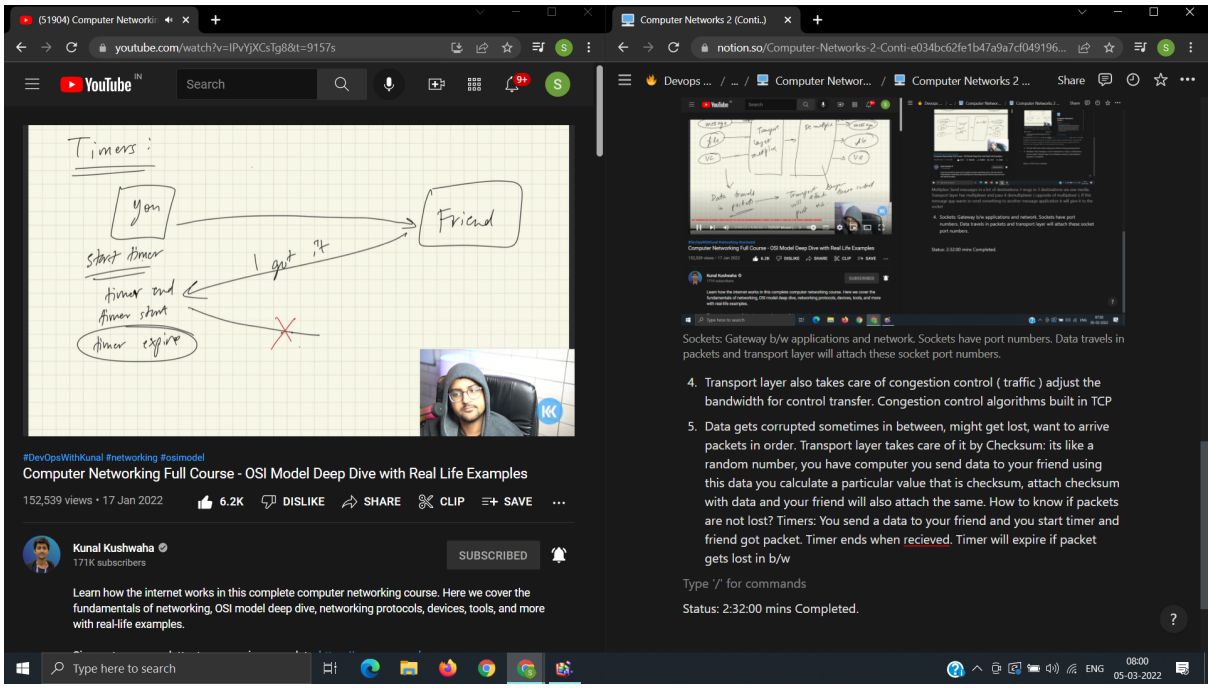
Multiplex: Send messages in a lot of destinations 3 msgs in 3 destinations via one media. Transport layer has multiplexer and pass it demultiplexer (opposite of multiplexer). If this message app wants to send something to another message application it will give it to the socket



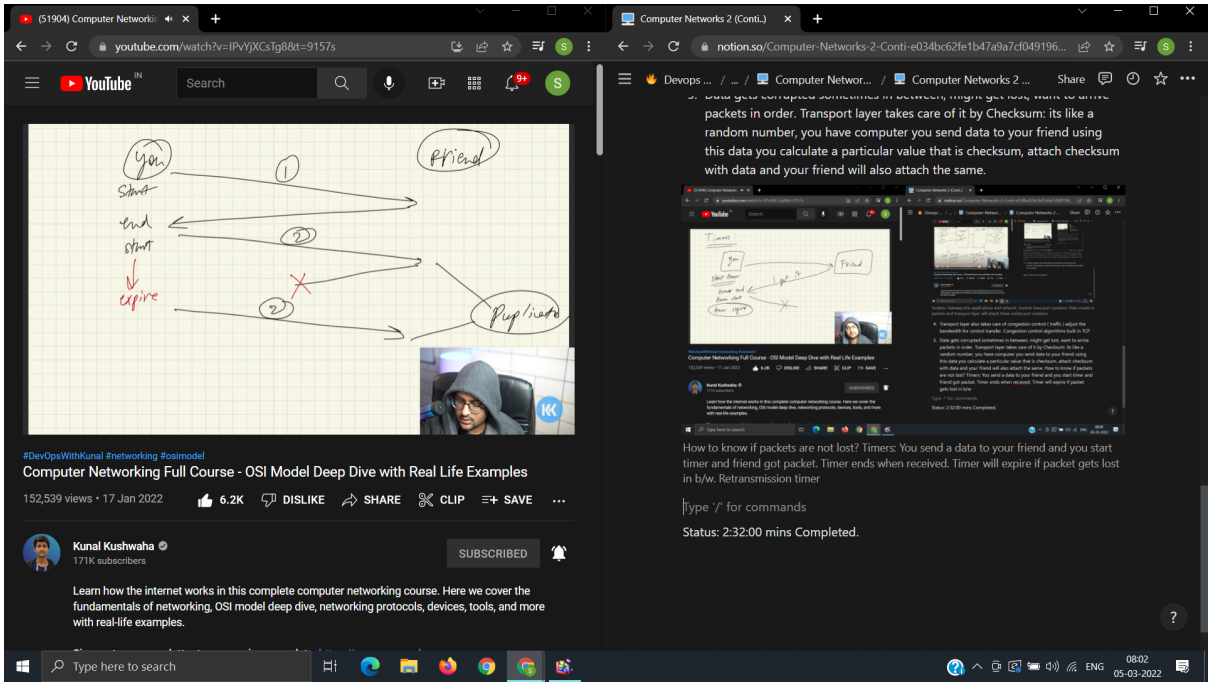
Sockets: Gateway b/w applications and network. Sockets have port numbers. Data travels in packets and transport layer will attach these socket port numbers.

4. Transport layer also takes care of congestion control (traffic) adjust the bandwidth for control transfer. Congestion control algorithms built in TCP

5. Data gets corrupted sometimes in between, might get lost, want to arrive packets in order. Transport layer takes care of it by Checksum: its like a random number, you have computer you send data to your friend using this data you calculate a particular value that is checksum, attach checksum with data and your friend will also attach the same.

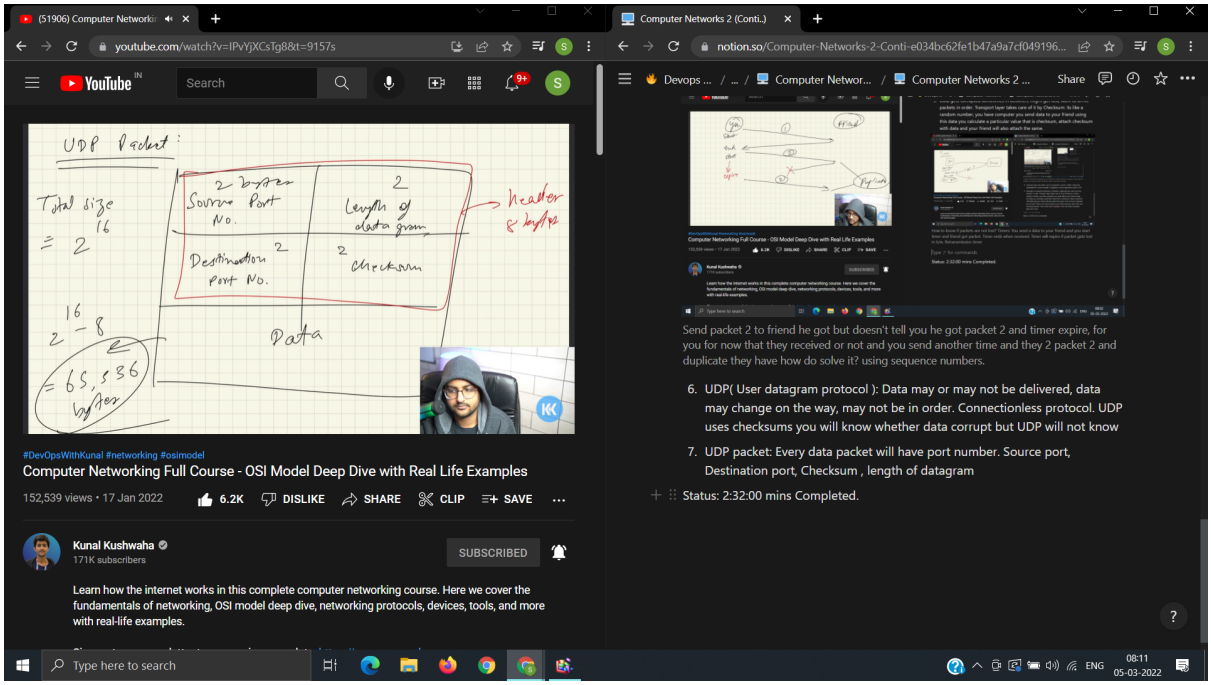


How to know if packets are not lost? Timers: You send a data to your friend and you start timer and friend got packet. Timer ends when received. Timer will expire if packet gets lost in b/w. Retransmission timer



Send packet 2 to friend he got but doesn't tell you he got packet 2 and timer expire, for you for now that they received or not and you send another time and they 2 packet 2 and duplicate they have how do solve it? using sequence numbers.

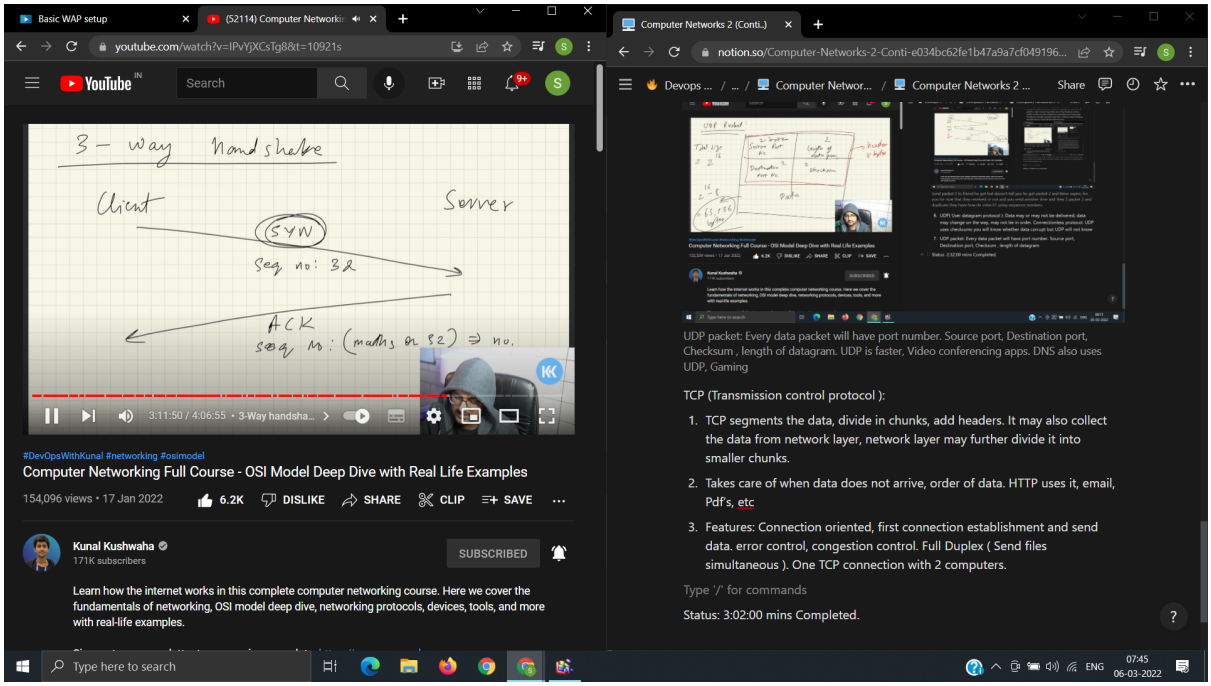
6. UDP(User datagram protocol): Data may or may not be delivered, data may change on the way, may not be in order. Connectionless protocol. UDP uses checksums you will know whether data corrupt but UDP will not know



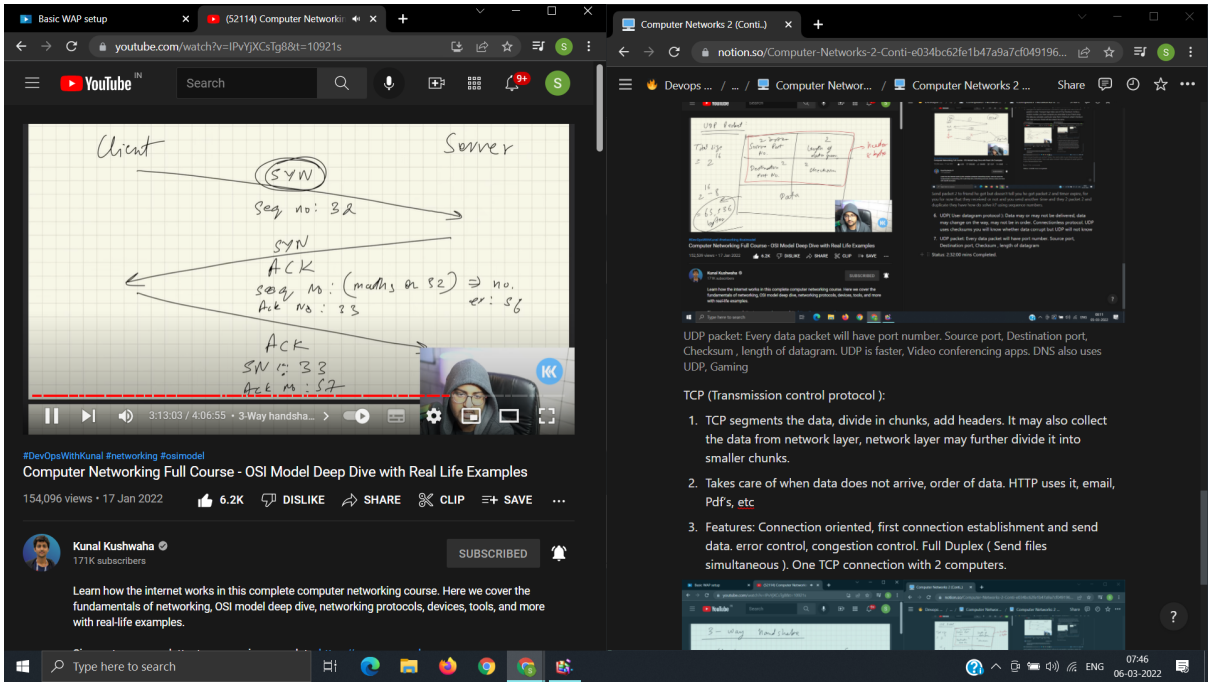
UDP packet: Every data packet will have port number. Source port, Destination port, Checksum , length of datagram. UDP is faster, Video conferencing apps. DNS also uses UDP, Gaming

TCP (Transmission control protocol):

1. TCP segments the data, divide in chunks, add headers. It may also collect the data from network layer, network layer may further divide it into smaller chunks.
2. Takes care of when data does not arrive, order of data. HTTP uses it, email, Pdf's, etc
3. Features: Connection oriented, first connection establishment and send data. error control, congestion control. Full Duplex (Send files simultaneous). One TCP connection with 2 computers.



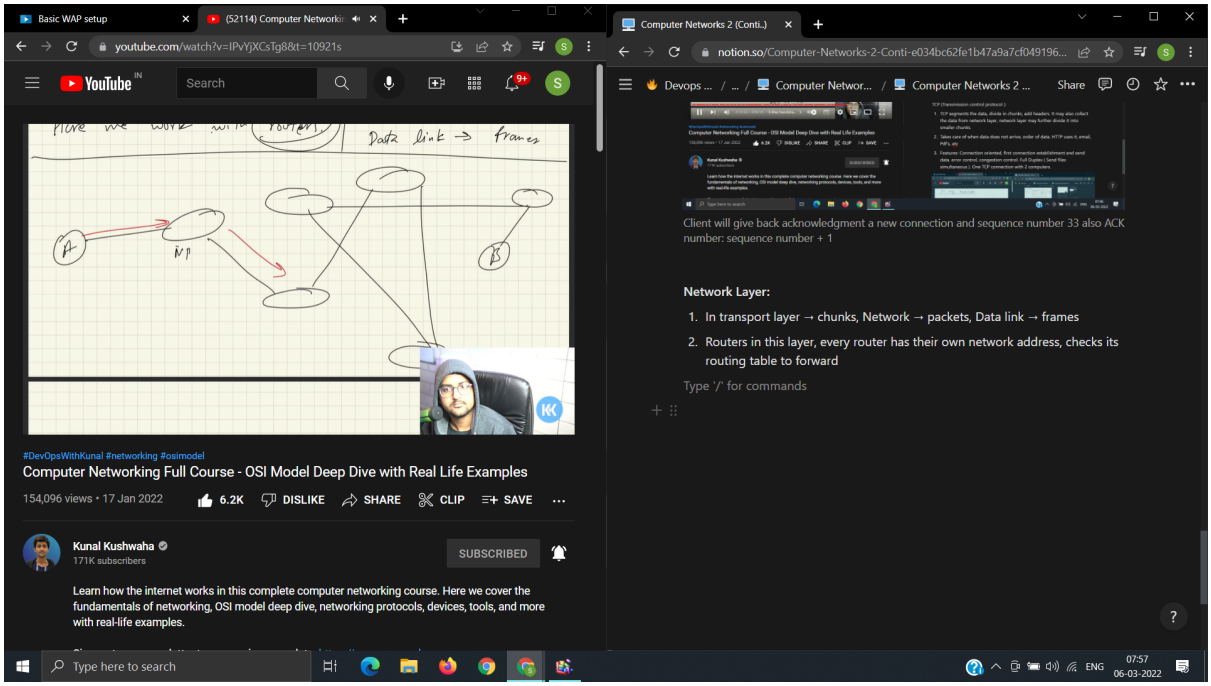
Synchronous flag value inside the header new connection, also sends sequence number(random number, why? for security purpose) and it will send that it got the flag and send back acknowledgement flag, takes sequence number from client does some math function on 32 and give a number.



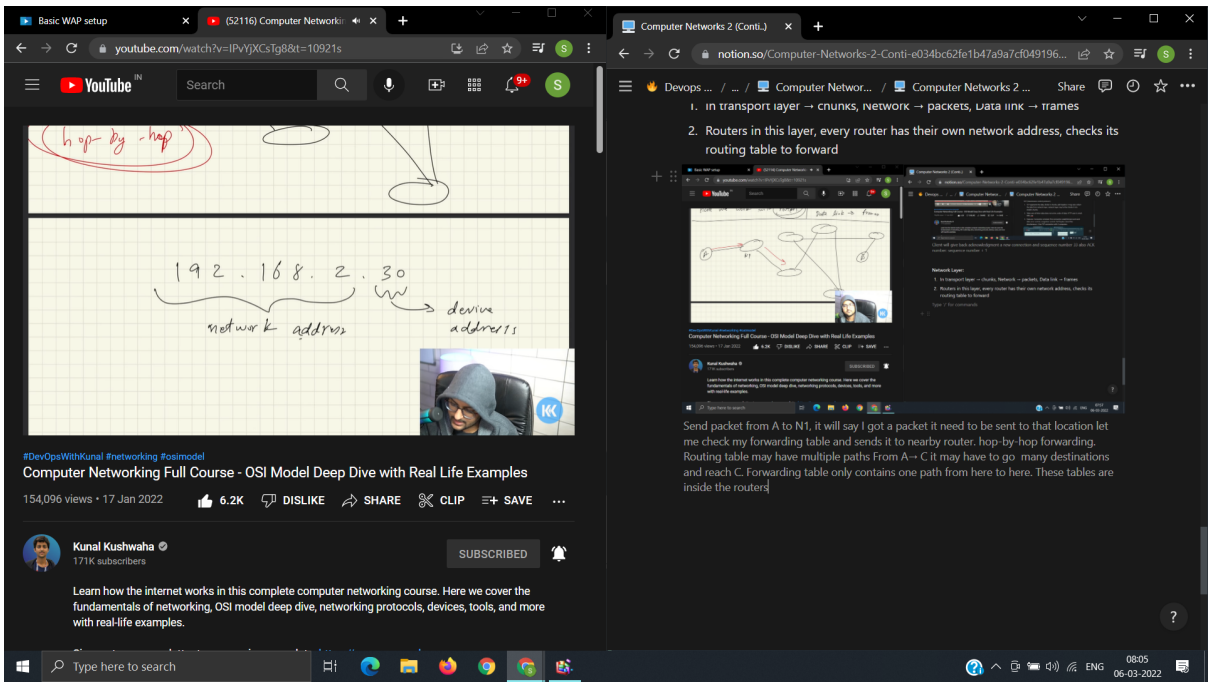
Client will give back acknowledgment a new connection and sequence number 33 also ACK number: sequence number + 1

Network Layer:

1. In transport layer → chunks, Network → packets, Data link → frames
2. Routers in this layer, every router has their own network address, checks its routing table to forward



Send packet from A to N1, it will say I got a packet it need to be sent to that location let me check my forwarding table and sends it to nearby router. hop-by-hop forwarding. Routing table may have multiple paths From A→ C it may have to go many destinations and reach C. Forwarding table only contains one path from here to here. These tables are inside the routers



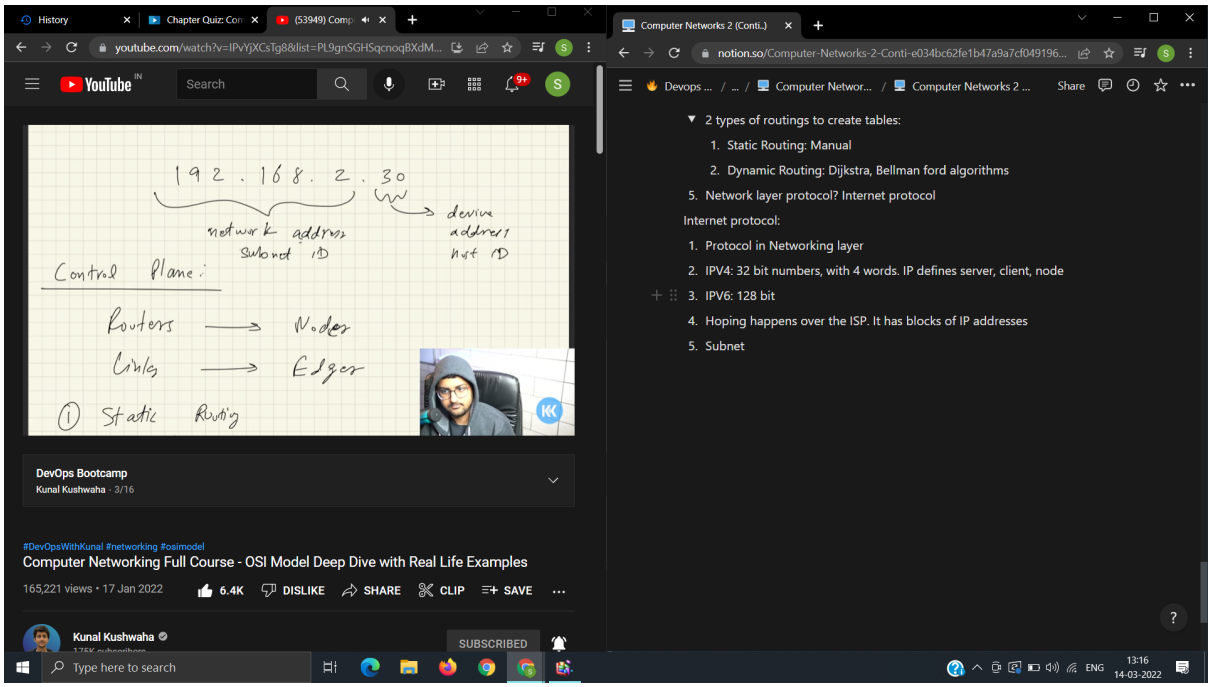
3. Who creates these routing tables? Control Plane
4. Control Plane: Routers → Nodes, Edges → Links

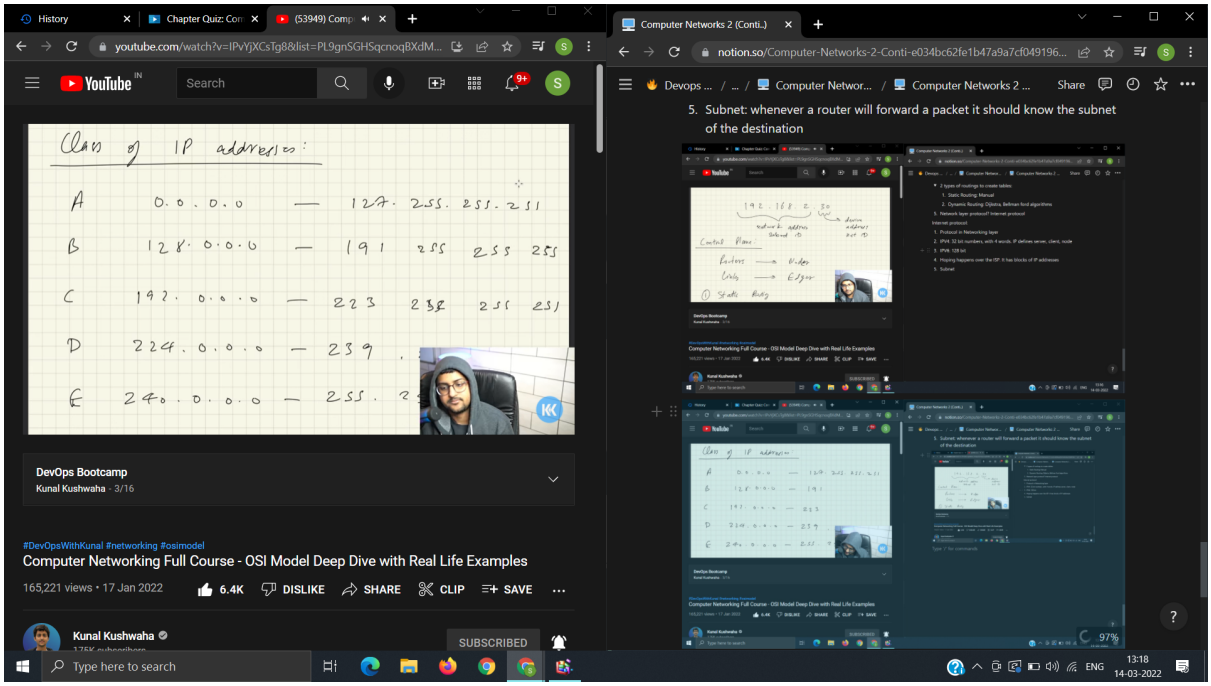
▼ 2 types of routings to create tables:

    1. Static Routing: Manual
    2. Dynamic Routing: Dijkstra, Bellman ford algorithms
5. Network layer protocol? Internet protocol

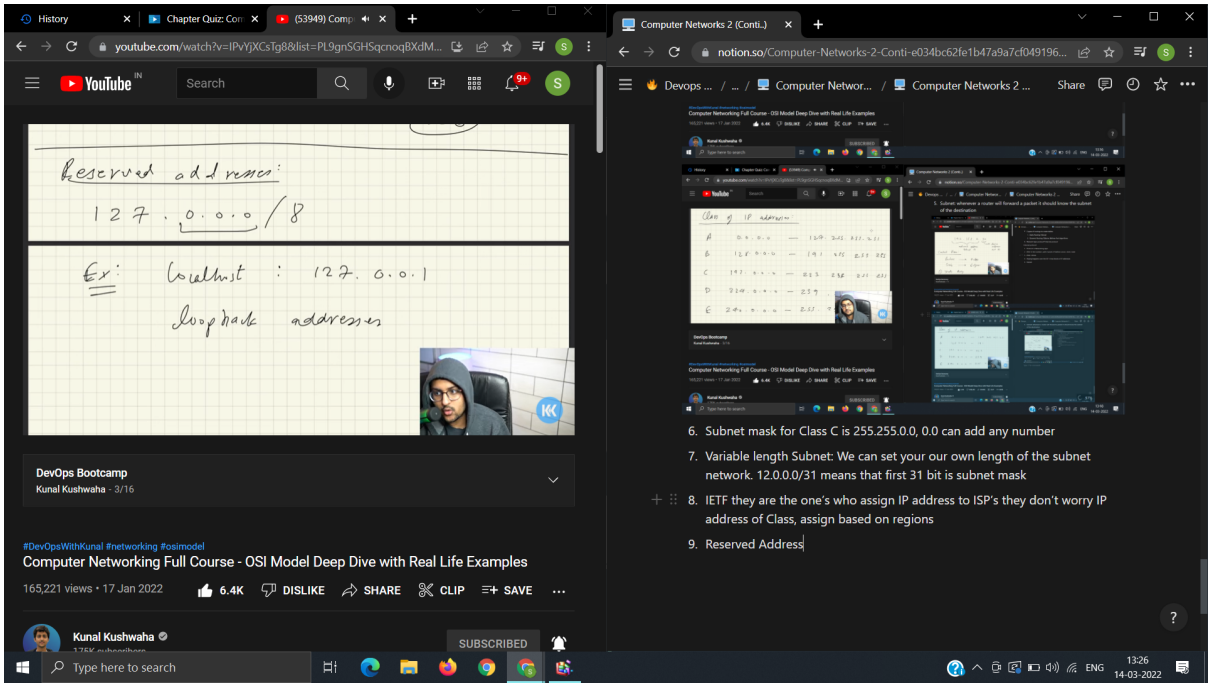
Internet protocol:

1. Protocol in Networking layer
2. IPV4: 32 bit numbers, with 4 words. IP defines server, client, node
3. IPV6: 128 bit
4. Hoping happens over the ISP. It has blocks of IP addresses
5. Subnet: whenever a router will forward a packet it should know the subnet of the destination





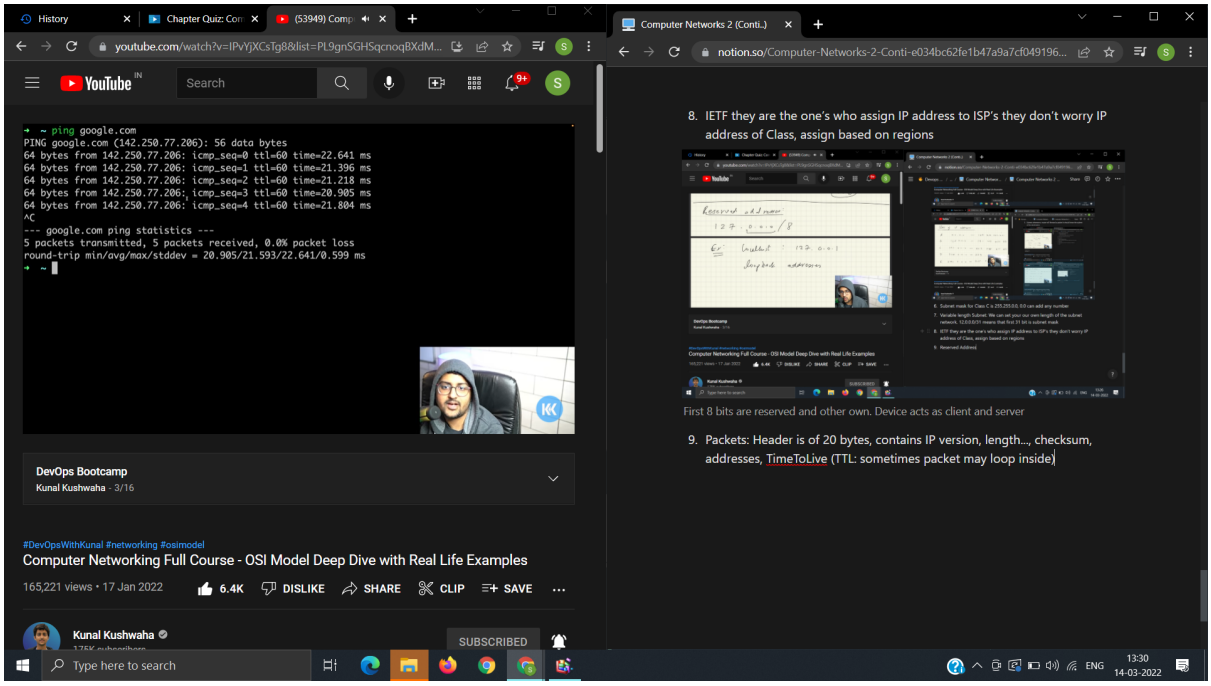
6. Subnet mask for Class C is 255.255.0.0, 0.0 can add any number
7. Variable length Subnet: We can set your our own length of the subnet network. 12.0.0.0/31 means that first 31 bit is subnet mask
8. IETF they are the one's who assign IP address to ISP's they don't worry IP address of Class, assign based on regions



First 8 bits are reserved and other own. Device acts as client and server

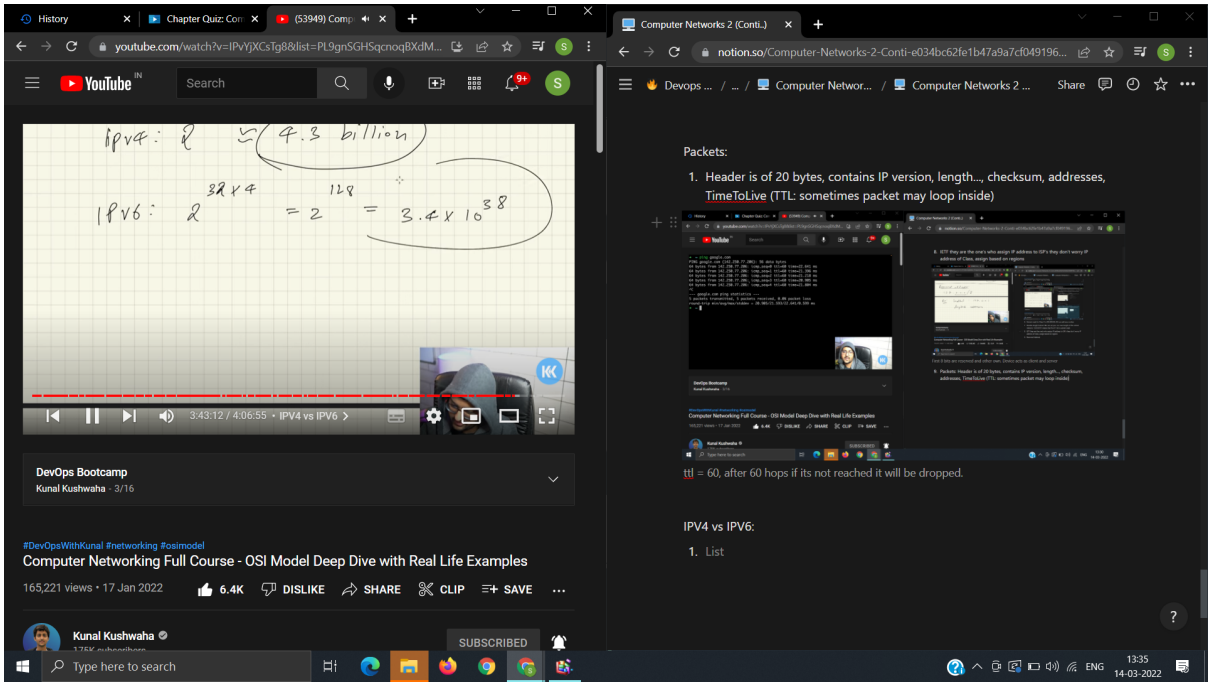
Packets:

1. Header is of 20 bytes, contains IP version, length..., checksum, addresses, TimeToLive (TTL: sometimes packet may loop inside)

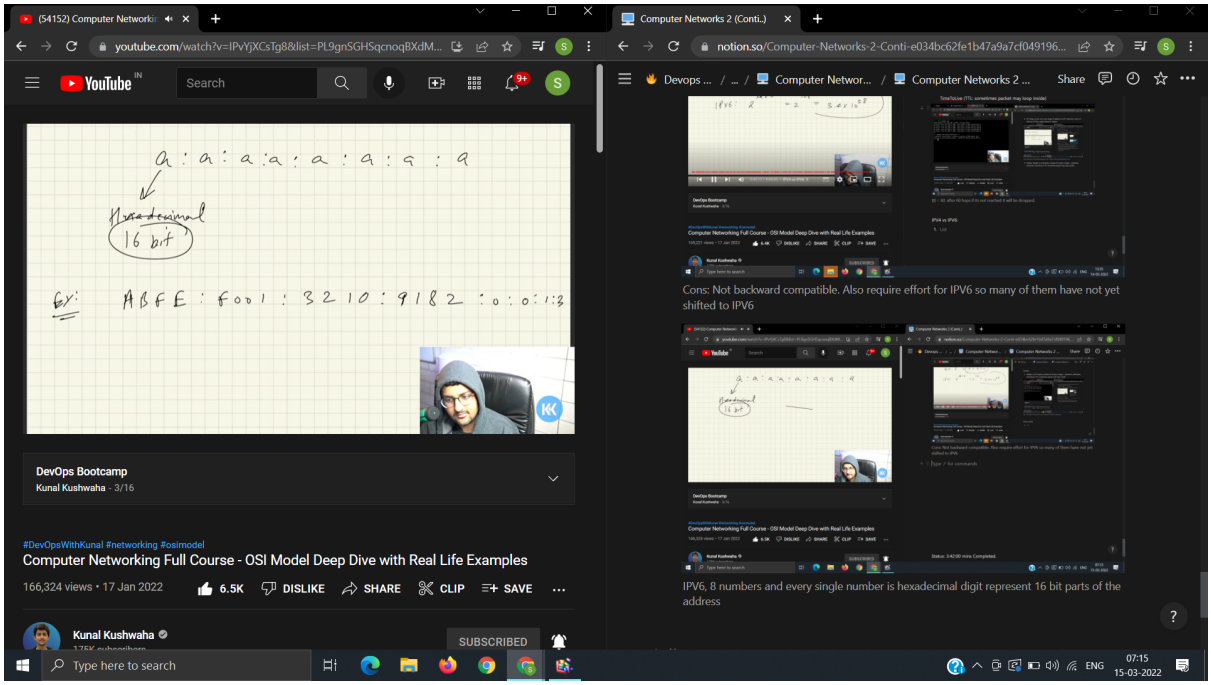


ttl = 60, after 60 hops if its not reached it will be dropped.

IPV4 vs IPV6:



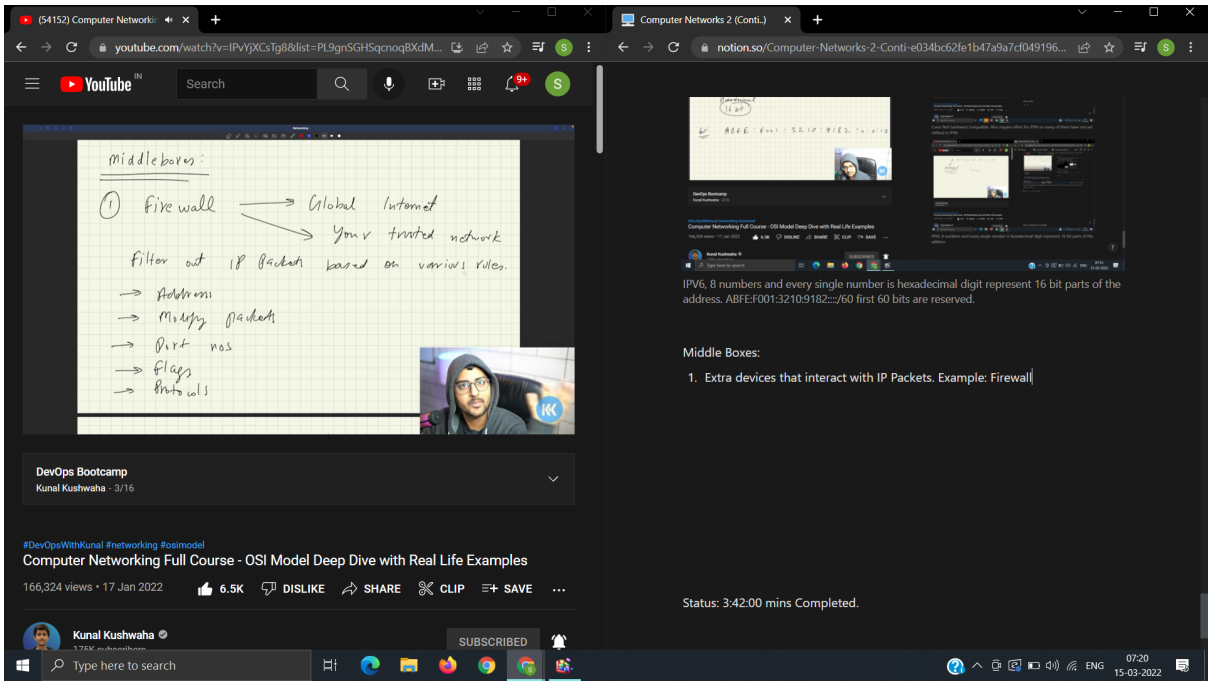
Cons: Not backward compatible. Also require effort for IPV6 so many of them have not yet shifted to IPV6



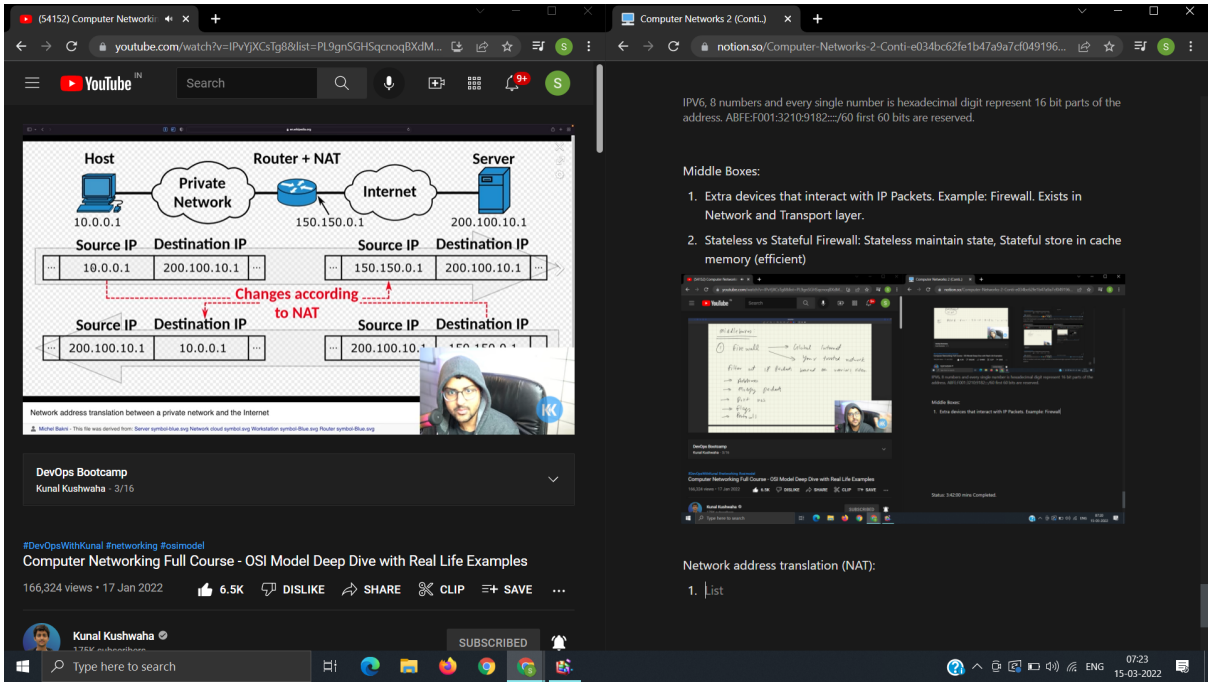
IPV6, 8 numbers and every single number is hexadecimal digit represent 16 bit parts of the address. ABFE:F001:3210:9182::::/60 first 60 bits are reserved.

Middle Boxes:

1. Extra devices that interact with IP Packets. Example: Firewall. Exists in Network and Transport layer.
2. Stateless vs Stateful Firewall: Stateless maintain state, Stateful store in cache memory (efficient)

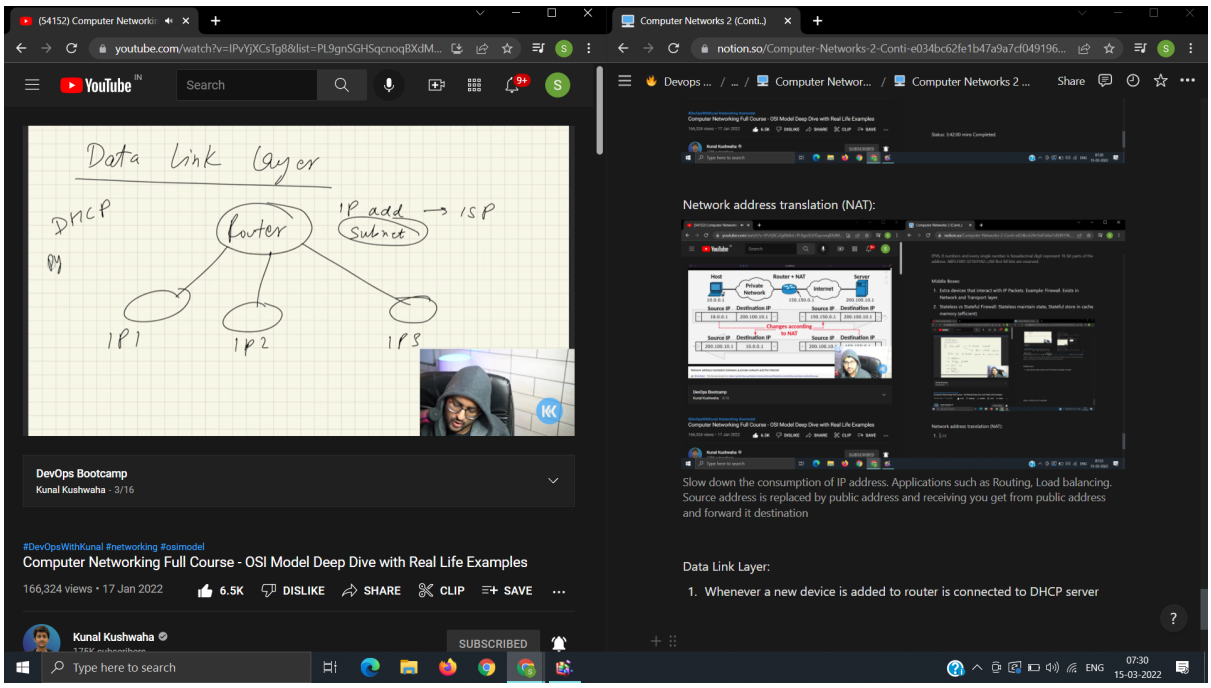


Network address translation (NAT):



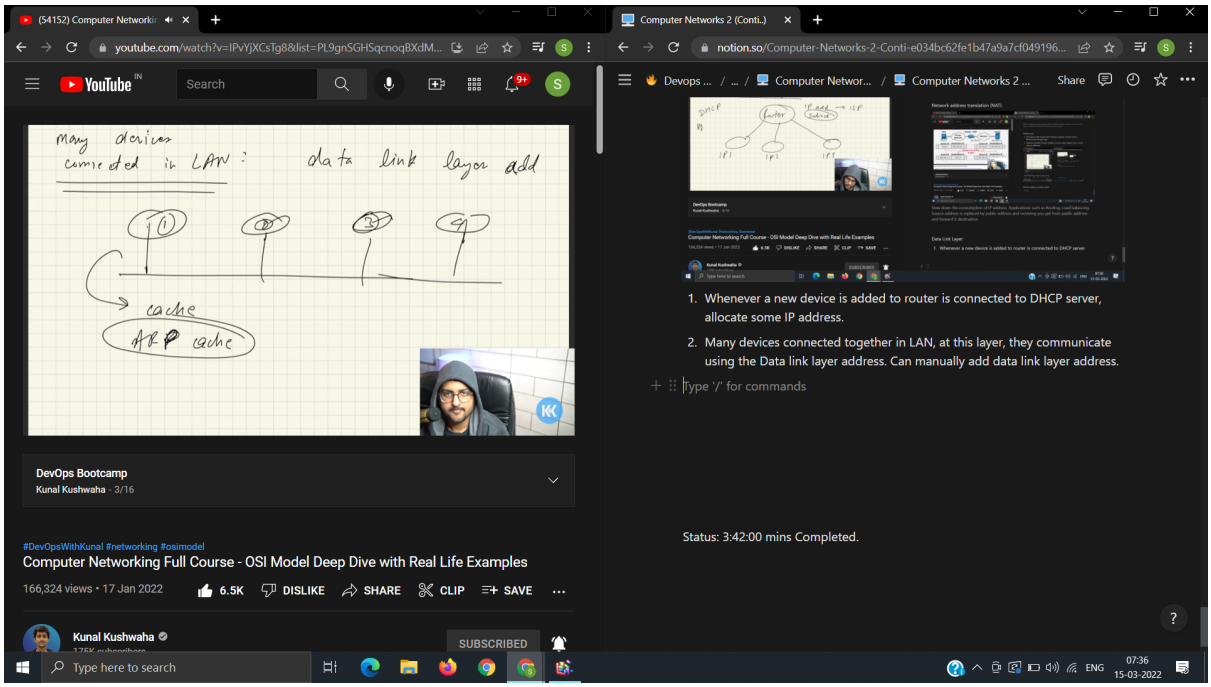
Slow down the consumption of IP address. Applications such as Routing, Load balancing. Source address is replaced by public address and receiving you get from public address and forward it destination

Data Link Layer:



1. Whenever a new device is added to router is connected to DHCP server, allocate some IP address.

2. Many devices connected together in LAN, at this layer, they communicate using the Data link layer address. Can manually add data link layer address.



Devices connected in one LAN, device 1 sends to 4, 1 asks itself checks in its cache, do I have the data link layer address of device 4, it says no. If no then asks with other devices known as ARP cache. Message will be sent to other devices a request in Frame by sending its DLLA and its IP address. Address resolution protocol (ARP). Data link layer address is known as MAC address, works with physical layer.

Status: Completed.