UI-Assignment 1

What happens when I enter a URL in web browser and press enter?

Let’s say I have entered “www.argildx.com” in the address bar of browser and pressed enter. Then browser will convert this in correct URL format i.e. “Protocol://Host:Port/Path”.

Here browser will use http(Hyper Text Transfer Protocol) which is an **Application layer protocol** and default port number for http protocol is “80”. So the resultant URL will be:

http://www.argildx.com:80/

Behind the scene the web browser get the IP address of the URL you typed (http://www.argildx.com:80/) using a process can Domain Name System which is also an **Application layer protocol**.

DNS can be bypassed if your system contains the particular URL entry in the host file. In this case the request won’t go to DNS server and browser will pick the statically entered IP for that URL.

For windows operating system path of host file is: “C:\Windows\System32\drivers\etc\hosts”.

Now it will get in 7 layers of OSI model. Let’s understand deeply what OSI model is.

Open Systems Interconnection (OSI) Model

OSI model was established in 1947 by the International Standards Organization (ISO) is a multinational body dedicated to worldwide agreement on international standards. An ISO standard that covers all aspects of network communications is the Open Systems Interconnection (OSI) model. It was first introduced in the late 1970s.

Most descriptions of the OSI model go from top to bottom, with the numbers going from Layer 7 down to Layer 1. The layers, and what they represent, are as follows:

1. Application Layer
2. Presentation Layer
3. Session Layer
4. Transport Layer
5. Network Layer
6. Data Link Layer
7. Physical Layer

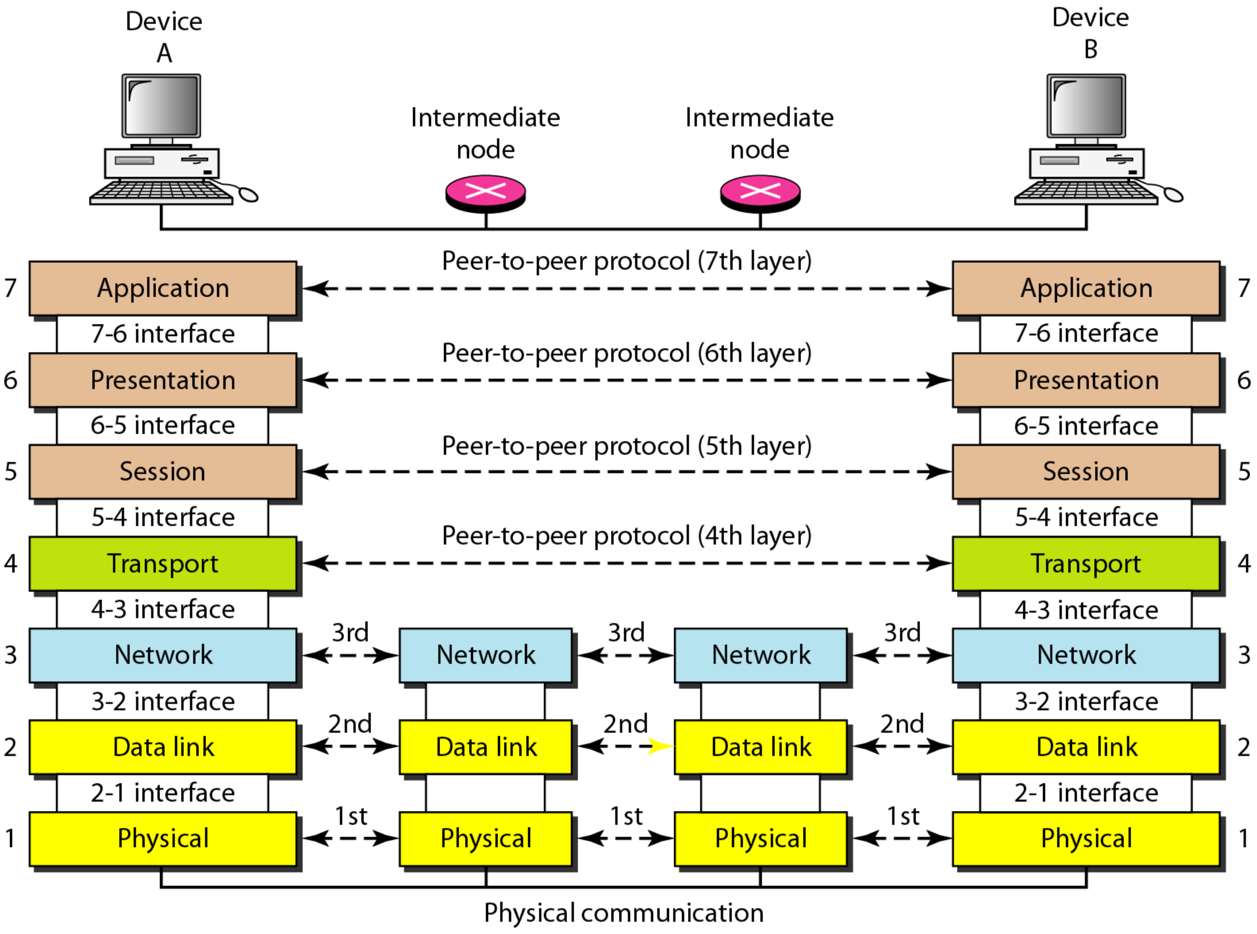
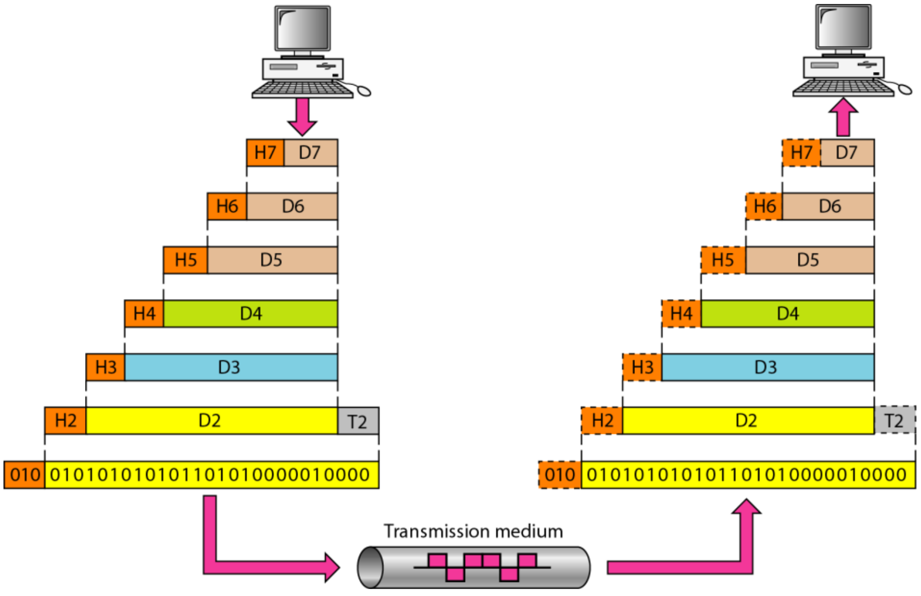


Diagram showing the interaction between layers of OSI model



Data exchange using OSI model

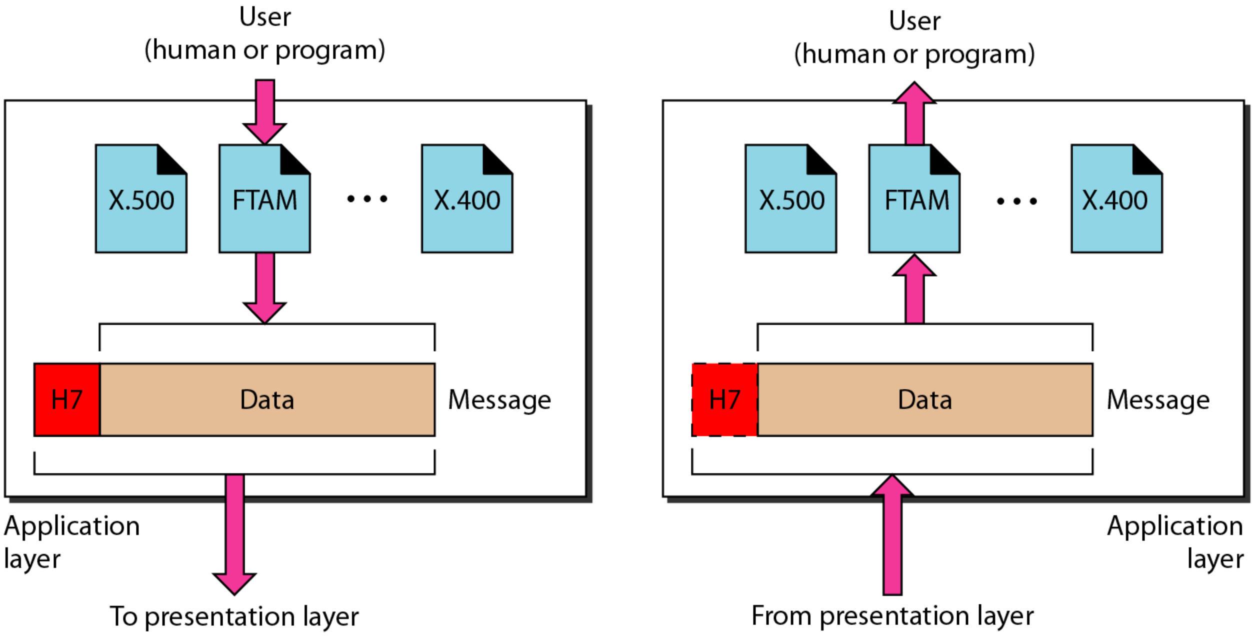
Each and every layer in OSI model append its header with the data and pass it to next layer as input data and finally physical layer converts the data into bits the will flow in the network.

1. Application Layer:

The application layer provides services for an application program to ensure that effective communication with another application program on a network is possible. The application layer should not be thought of as an application. Instead, the application layer is a component within an application that controls the communication method to other devices. It's an abstraction layer service that masks the rest of the application from the transmission process. The application layer relies on all the layers below it to complete its process. At this stage, the data, or the application, is presented in a visual form the user can understand.

Common protocols used in application layer are Domain Name Service(DNS), Dynamic Host Configuration Protocol(DHCP) etc.

Application layer is first layer for a client and last layer for a receiver.



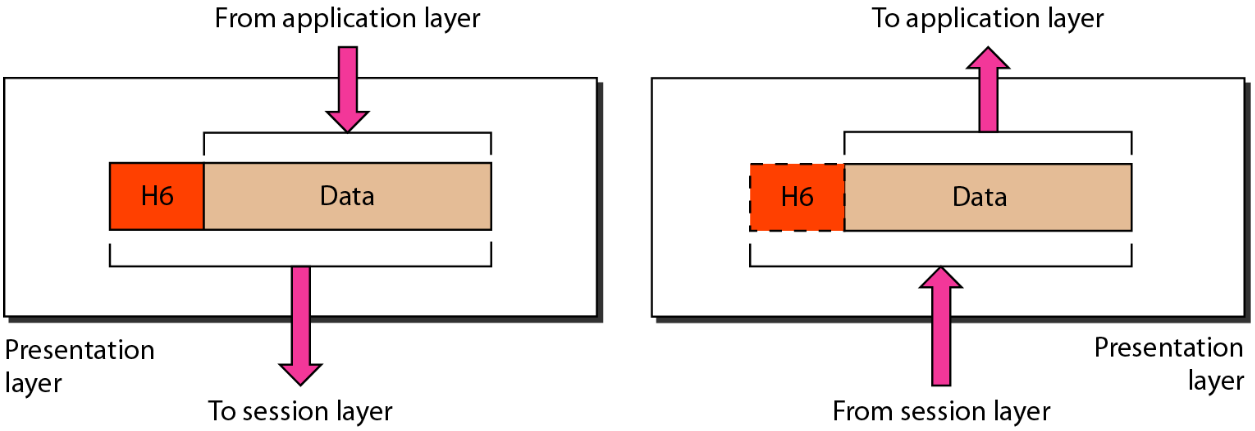
Application Layer

2. Presentation Layer:

The application layer passes data meant for transport to another device in a certain format. The presentation layer then prepares this data in the most appropriate format the receiving application can understand. Common formats include ASCII and extended binary-coded decimal interchange code (EBCDIC) for text. JPEG, GIF for images. MPEG, MIDI for video.

Encryption and decryption of data communications are also commonly performed at the presentation layer. Encryption methods and keys are exchanged between the two communicating devices. Thus, only the sender and receiver can properly encode and decode data so it returns to a readable format.

Presentation layer protocols: XDR, TLS, SSL and MIME.



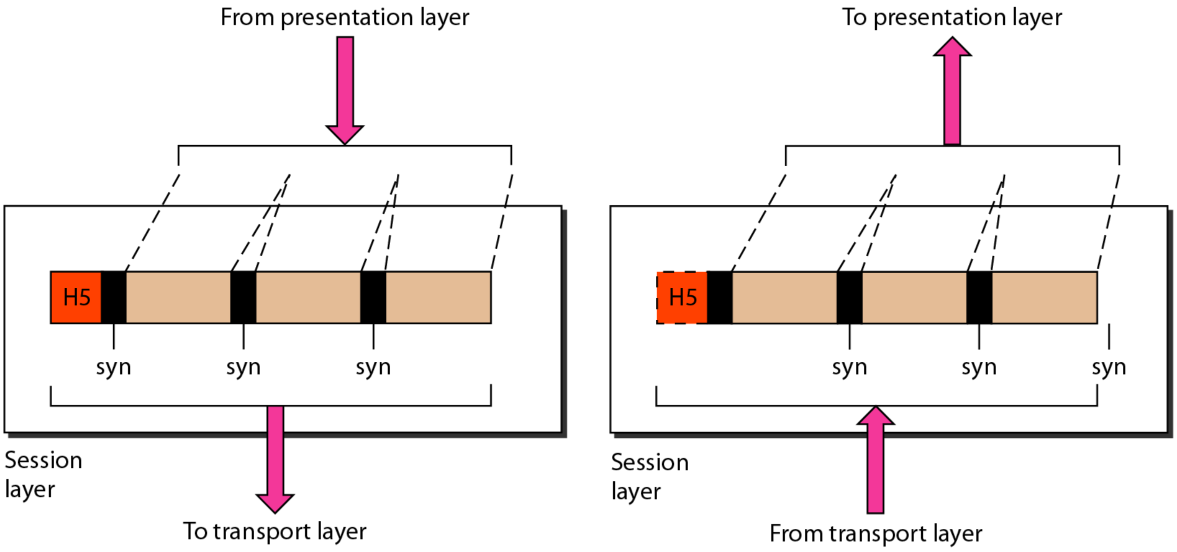
Presentation Layer

3. Session Layer:

The session layer manages the setup and teardown of the association between two communicating endpoints. A connection is established and maintained while the two endpoint applications are communicating back and forth in a conversation, or session, of some duration. Lower-level protocols are responsible for the actual transmission data. However, this is typically done in short-lived transmissions. The session layer builds a transmission bridge to provide more efficient long-term transport.

The session layer is also responsible for masking potential transport layer failures from upper-layer protocols. This includes mechanisms to handle errors in endpoint transmit/receive synchronization, transmission checkpoints and connection recovery.

Session layer protocols: Remote procedure call protocol(RPC), Session Control Protocol(SCP).



Session Layer

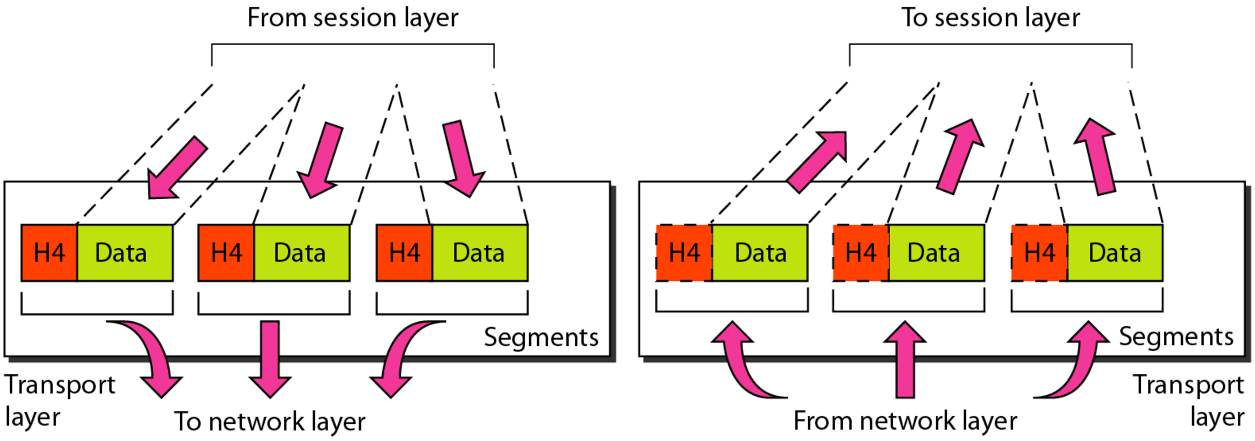
4. Transport Layer:

The transport layer takes application messages and transmits those message segments into the network layer. Once the receiving side has the segments, they are reassembled into messages and passed on to the application layer.

Functions of Transport Layer:

a) Service Point (or Port) Addressing
b) Segmentation & Reassembly
c) Connection Control
d) Flow Control
e) Error Control

Transport layer protocols: Transmission Control Protocol(TCP), User Datagram Protocol(UDP).



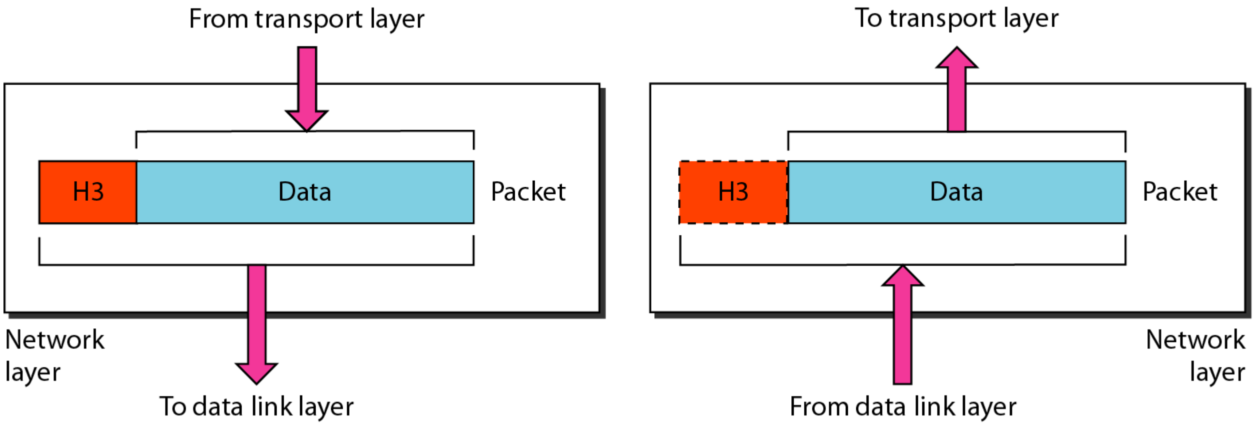
Transport Layer

5. Network Layer:

The network layer's primary function is to move data into and through other networks. Network layer protocols accomplish this goal by packaging data with correct network address information, selecting the appropriate network routes and forwarding the packaged data up the stack to the transport layer.

The routing information contained within a packet includes the source of the sending host and the eventual destination of the remote host. This information is contained within the network layer header that encapsulates network frames at the data link layer.

Network layer protocols: Address Resolution Protocol(ARP), Internet Protocol Version 4(IPv4).



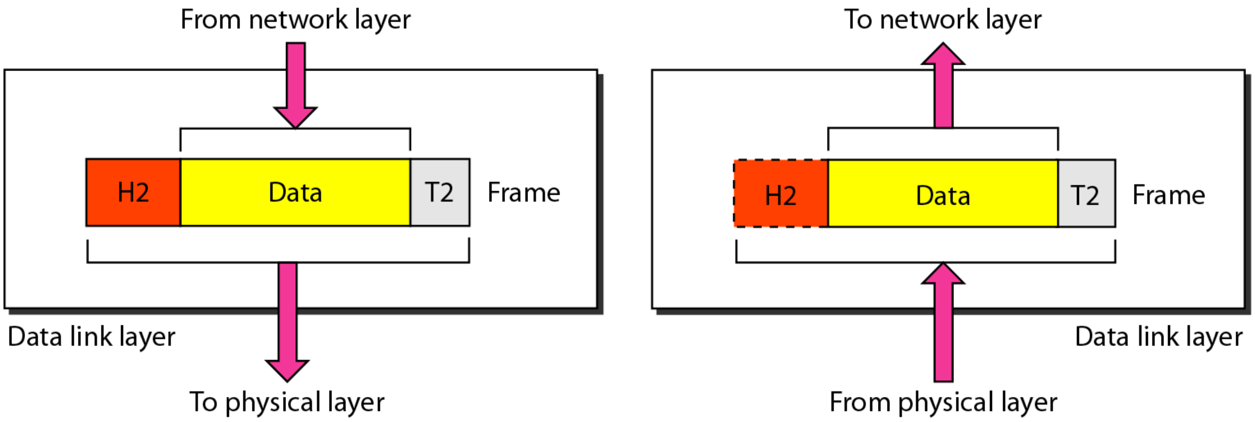
Network Layer

6. Data Link Layer:

The data link layer is the protocol layer in a program that handles the moving of data into and out of a physical link in a network. The data link layer is architecture model for a set of telecommunication protocols. Data bits are encoded, decoded and organized in the data link layer, before they are transported as frames between two adjacent nodes.

The data link layer also determines how devices recover from collisions that may occur when nodes attempt to send frames at the same time.

Data Link layer protocols: Synchronous Data Link Protocol(SDLC), High-level Data Link Control(HDLC).

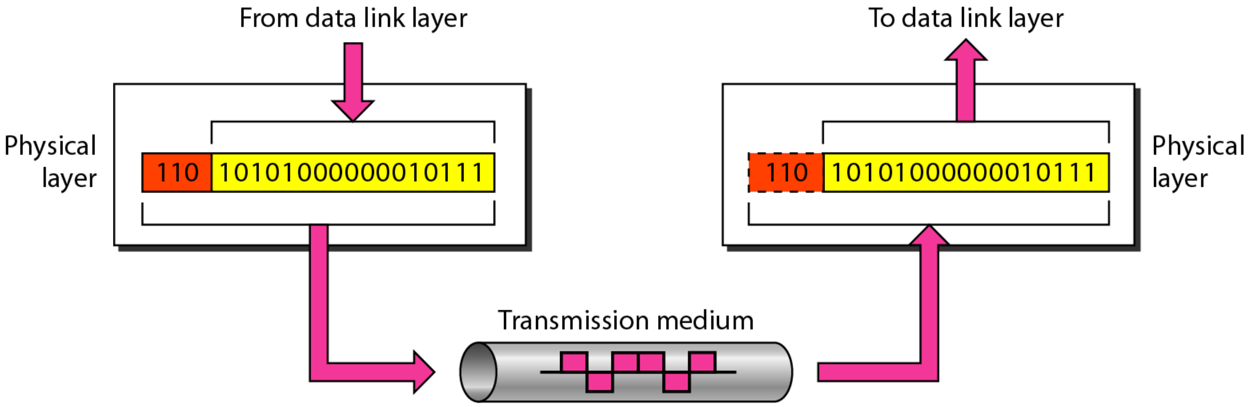


Data Link Layer

7. Physical Layer:

The physical layer is responsible for sending computer bits from one device to another along the network. It does not understand the bits; rather, its role is determining how physical connections to the network are set up and how bits are represented into predictable signals as they are transmitted either electrically, optically or via radio waves.

Physical layer protocols: Ethernet(IEEE 802.3), Digital Subscriber line(DSL).



Physical Layer

List of events that occur right from pressing enter on browser until the page is rendered on the browser:

1. I type “http://argildx.com” into a browser, and hit enter.
2. Request will go to application layer. This layer will generate an HTTP GET request to send toward your specified webserver, i.e. google.com. We have that GET request, which is considered "data". HTTP is an application layer protocol, this layer will add that header and pass the data to presentation layer.
3. In presentation layer the data will be formatted and a header will be appended to the formatted data and passed onto the session layer.
4. Session layer knows we're trying to contact a webserver, we need to make this request in a format the application as a whole can understand, for this we use an Application Program Interface (API). This is what manages the applications session. This will add its header and pass the data to transport layer.
5. At transport layer we decide how our data gets to the destination server i.e. TCP or UDP Protocol. This layer needs to establish a connection with the web server. Here TCP 3-way handshake would happen. We encapsulate what we currently have in a TCP header, this contains things like source and destination port numbers, sequence and acknowledgment numbers, and TCP windowing information.
6. In the network layer the packets are addressed to their destinations, it will need IP addresses to get to places on a network. This layer will add its source and destination IP address. Not only will the packets get to the right destination, but that endpoint will use our source IP address to send it back to us when it needs to send us data of any kind. Our PC will have a routing table just like routers. This layer will add the IP header and pass the data to data link layer.
7. Data Link Layer uses media access control (MAC) addresses to move that data. So it will add its header as a destination MAC address and pass the data to physical layer. Now we have everything we need to put that data onto the wire as bits.
8. In physical layer the data flows over the wire, here we can see the raw 1's and 0's.
9. Now we have bits on the wire, on the way to our Router.

10. Now your Router receives the 1's and 0's. The NIC (interface) on the router gets that data and pass it on to the data link layer, so it can read the data.
11. The Router reads 2nd frame, and finds that the destination MAC address is of its own machine. So it will de-encapsulate the 2nd header and pass the data to the network layer.
12. Router network will check the source and destination IP address. Now it will check that the destination IP differs from its IP. So it will lookup a route for the destination IP address (google.com) in its routing table and use that entry and add the IP header and pass it to the data link layer of router.
13. Again data link layer of router will add the destination MAC address as header and pass the data to physical layer.
14. After some network hops the data will reach to the destination server and that server will open the data from different layers and do the processing on data and send it back to the source server, from initial request came.
15. Once the data will reach to initial server, data will open it upto the application layer and browser will render the data.