Hello the task was to

Describe end-to-end communication while browsing Internet which should be related to TCP/IP stacks)

**Well first TCP/IP i.e. transmission control protocol/Internet protocol**, is a set of rules/protocols governing communications among all computers on the Internet. It dictates how information should be turned into bundles of information called [packets](https://www.computerhope.com/jargon/t/tcpip.htm#packet), sent, and received, as well as how to get to its destination.

TCP/IP is a combination of two separate protocols: [TCP](https://www.computerhope.com/jargon/t/tcp.htm) (transmission control protocol) and [IP](https://www.computerhope.com/jargon/i/ip.htm) (Internet protocol).

The Internet Protocol standard organizes packets that are sent out over networks; it tells packets where to go and how to get there. IP has a method that lets any computer on the Internet forward a packet to another computer.

The Transmission Control Protocol is responsible for ensuring the reliable transmission of data across Internet-connected networks. TCP checks packets for errors and submits requests for re-transmissions if any are found.

**Now lets move on to How TCP/IP works**

TCP/IP uses the [client/server](https://searchnetworking.techtarget.com/definition/client-server) model of communication in which client is provided a service (like sending a webpage) by another computer or a server in the network.

Collectively, the TCP/IP suite of protocols is classified as [stateless](https://whatis.techtarget.com/definition/stateless), which means each client request is considered new because it is unrelated to previous requests. Being stateless frees up network paths so they can be used continuously.

The TCP/IP stack consists of:

|  |  |
| --- | --- |
| **Protocol Layer** | **Comments** |
| Application Protocols Layer | Where Protocols are specific to applications such as WWW, e-mail, FTP, etc. |
| Transmission Control Protocol Layer | Where TCP directs packets to a specific application on a computer using a port number. |
| Internet Protocol Layer | Where IP directs packets to a specific computer using an IP address. |
| Hardware Layer | Which Converts binary packet data to network signals and back.  (E.g. ethernet network card, modem for phone lines, etc.) |

**Main**

Now let’s come to the communication flow when we request any webpage.

* Whenever we type any address suppose [prettyclick.com](http://www.google.com/) in address bar of any browser, processing gets started. Web browser uses [Hypertext Transfer Protocol](http://en.wikipedia.org/wiki/Hypertext_Transfer_Protocol) which is an Application layer protocol.
* Web browser is programmed in such a way that it extracts [IP address](http://en.wikipedia.org/wiki/IP_address) of the URL we typed using [Domain Name System](http://en.wikipedia.org/wiki/Domain_Name_System). DNS is also an Application layer protocol. Once DNS look up is done, browser gets IP address of the website’s primary server.
* Browser now creates a HTTP packet having request details of prettyclick.com.
* The packet is still in our laptop. Now browser connects to the lower layer. Every layer have some interface exposed to above and below layers so that these layers can communicate with each other.
* So the browser gives the HTTP packet to TCP process ([Transmission Control Protocol](http://en.wikipedia.org/wiki/Transmission_Control_Protocol)) which is a Transport Layer protocol.
* TCP’s main function is to split request into multiple packets. These packets are having packet level identity. TCP controls the reliability of message transmissions through handshakes and acknowledgements. TCP creates a pipe between source and destinations so that system can transfer the data. This pipe is called as TCP connection.
* TCP now put own info on top of these packets. System needs this information to maintain the session/connection.
* The packet is still in our laptop. TCP now handovers these packets to next layer through its provided interface i.e. IP process ([Internet Protocol](http://en.wikipedia.org/wiki/Internet_Protocol)) which is an Internet Layer protocol.
* The main job of IP layer is addressing and routing. This layer puts source, destination IP addresses and routing information in packets so that packets can be route to the correct location.
* IP now put its own info on top of TCP packet. System needs this information for routing in the internet.
* The packet is still in our Laptop. IP now handovers the packet to network access/network interface layer.
* Network access layer defines the protocols and hardware required to deliver data across some physical network. Let’s say we are using Ethernet.
* Our laptop now encapsulates Ethernet header and Ethernet trailer with the IP packet, creates an Ethernet frame. Ethernet contains [MAC address](http://en.wikipedia.org/wiki/MAC_address) which is used to send frame locally ([Local area network](http://en.wikipedia.org/wiki/Local_area_network))
* Now our laptop physically transmits the bits of this Ethernet frame, using electricity signals over the Ethernet cabling.
* The packet is now out of our Laptop. It reaches Prettyclicks’s web server. Note that all packets are not transmitted using same route. These may go through different routes using the most efficient routing.
* The web server physically receives the electrical signal over a cable, and re-creates the same bits by interpreting the meaning of the electrical signals.
* Web server now de-encapsulates the IP packets from the Ethernet frame by removing and discarding the Ethernet header and trailer. After this it hands over to Internet protocol layer.
* Internet protocol layer then verifies source and destination info and then hands over to TCP layer.
* TCP layer reads the TCP information. It merges all incoming packets and create HTTP packet which source created originally.
* This layer provide acknowledgement about each packet so that if any packet is missing or corrupt then source can transmit that again. This confirms the reliability of the message.
* And finally TCP hands it over to HTTP process which understands the HTTP get request.
* Web server now process the request through running web process hence generates the response.
* Server sends this response in the same way to the intended device which initiated the request.
* Finally information reaches to our device’s application layer then browser displays this as web page.
* So this is how all the layers are in action when we request a webpage.



