Fundamental Network Topics

Understanding Basic Network Terms like IP, TCP/IP, DNS, DHCP and more.

These exercises are meant to be answered with text, based on internet searches so write down your reply so you will remember for later.

* **What is your public IP address right now, and how did you find it?**

**185.107.178.128** – according to a Google search.

* **What is your private IP address right now (do this both at home and in school), and who/what gave you that address?**

**192.168.7.234** – The private IP address is provided by a DHCP (Dynamic Host Configuration Protocol) server upon booting a device with a DHCP client on it. The IP provided is leased, meaning it is not permanently assigned to the specific device, but temporarily used for it. The leasing period is server-specified, so it can be anywhere from a couple of hours to several days.

* **What’s special about these address ranges?**

All of the addresses in these ranges are reserved IPv4 addresses that are used as private addresses for private networks. Private networks do not need necessarily need unique IP addresses, and since there is a finite amount of IP address combinations, certain ranges of IP addresses have been reserved for this purpose to conserve public address space. This also means that the IP addresses within these ranges are not publicly routable on the internet. There are three different ranges, and they are as follows:

* + **10.0.0.0 – 10.255.255.255**
  + This IPv4 address range is for single class A networks.
  + **172.16.0.0 – 172.31.255.255**
  + This IPv4 address range is for the contiguous range of 16 Class B blocks.
  + **192.168.0.0 – 192.168.255.255**
  + This IPv4 address range is for the contiguous range of 256 Class C blocks.
* **What’s special about this ip-address: 127.0.0.1?**

**127.0.0.1** is the IPv4 address that represents the ‘localhost’, or in other words the current computer used to access it. Any network services running on the host can be accessed with it via a loopback network interface. An example of this is opening a locally installed website in a browser, which does not require you to connect to the internet. When using the URL ‘https://localhost’, the name is resolved to the aforementioned IP address – 127.0.0.1.

* **What kind of service would you expect to find on a server using these ports: 22, 23, 25, 53, 80, 443?**

**22:** This port is for the SSH Remote Login Protocol. It is used for secure logins with SSH keys (public/private keys), file transferring (SCP (Secure Copy Protocol)/SFTP (SSH File Transfer Protocol) and port forwarding (redirecting a request from an IP address and port combination to another one while the packets (sent with the request) are going through a network gateway).

**23:** This port is used for the Telnet protocol, which is for unencrypted text communications.

**25:** This port is used for SMTP (Simple Mail Transfer Protocol), which is for email routing between mail servers.

**53:** This port is used for the DNS (Domain Name System) protocol, which is for resolving IP addresses to their domain names through DNS servers.

**80:** This port is used for the HTTP (Hypertext Transfer Protocol), which is for transmitting hypermedia documents (e.g. HTML).

**443:** This port is also used for the Hypertext Transfer Protocol, but a more secure version called HTTPS (HyperText Transfer Protocol Secure) with encryption provided by TLS (Transport Layer Security) and formerly by SSL (Secure Socket Layer).

* **What is the IP address of studypoints.info and how did you find it?**

The IPv4 address of studypoints.info is: 157.230.21.145. I found it by using the ‘nslookup’ command in the command prompt, followed by the URL.

* **If you write https://studypoints.info in your browser, how did “it” figure out that it should go to the IP address you discovered above?**  
  The browser connected to a DNS server (or several if necessary) to find the IP address that is linked with the URL/domain name. It was then able to connect to the server with the IP address linked to the domain name and retrieve all of the page information for studypoints.info by resolving the name to the IP address of the website’s server.
* **Explain shortly the purpose of an ip-address and a port-number and why we need both**The IP address can be thought of as an ID that identifies the device you are using to connect to the internet and distinguishes it from other devices. The DHCP server that provides you with your IP address also provides you with a specific port number, which specifies which port all communication to your IP address must go through.

The port number we use determines what protocol we will be using – most often with webpages we will use port 80 (8080), which is for the HTTP(S) protocol. If we do not use port 80, we will not be able to send or receive browser data (typically in the form of HTML).

* **What is your (nearest) DNS server?**

I would guess that my nearest DNS server is my ISP’s.

* **What is (conceptually) the DNS system and the purpose with a DNS Server?**

The DNS system can be thought of as a phone book. Instead of having to memorize phone numbers, you can instead remember people’s names and use a phone book to look up their phone numbers. In the case of DNS, you can replace phone numbers with IP addresses and people’s names with domain names.   
  
When you type in the name of someone on your phone’s phone book, for example, a result comes back showing that person’s phone number. When you enter a domain name into the browser search bar and press enter, your computer connects to one or several DNS servers to find the IP address to resolve to from the provided domain name.  
  
In short, the purpose of a DNS server is to simplify the process of remembering and connecting to various websites (servers with IP addresses) on the internet by storing the relations between domain names and IP addresses in a database.

* **What is your current Gateway, and how did you find it?**

**192.168.7.1** - found it through the Windows Control Panel:

Control Panel 🡪 View network status and tasks 🡪 Ethernet 🡪 Details.

* **What is the address of your current DHCP-Server, and how did you find it?**

The IP address of my DHCP server is the same as my Gateway’s IP: **192.168.7.1**.



I found it by using the command ‘ipconfig /all’ in the command prompt.

* **Explain (conceptually) about the TCP/IP-protocol stack**

The TCP/IP protocol stack, also known as the Internet protocol suite, is a set of communications protocols used on the internet and in computer networks. It provides specification for how data should be packetized, addressed, transmitted, routed, and received. It is split into four layers through which data travels, and they are as follows from top to bottom: Application layer, transport layer, network layer, and the link layer.

We watched a video that visualizes how the TCP/IP protocol stack works with 3d animations. It is depicted as a factory (the device or computer sending a request) preparing a packet that is then sent out onto the Internet, depicted as a highway, until it eventually reaches the firewall that it has to go through to reach its destination.

If the port that the packet wants to go through is not open on said firewall, the packet will not go any further. If it is, the packet continues to its destination where it is deconstructed and processed, after which a response is sent back to the device that made the request with the requested information.

* **Explain about the HTTP Protocol (the following exercises will go much deeper into this protocol)**

The HTTP protocol is a request-response protocol used in the client-server computing model. If the client sends a request to the server, the server will send back a response, containing completion status information and possibly requested information as well.

It is integral to the functionality of the internet, as it enables communications between clients and servers and was designed within the framework of the Internet protocol suite.

* **Explain (conceptually) how HTTP and TCP/IP are connected (what can HTTP do, and where does it fit into TCP/IP)**

If we think of the TCP/IP protocol stack as unique houses (server and client with unique IP addresses), each with a certain number of open doors (ports), then the HTTP protocol serves as the road between the two houses. It establishes a connection between the residents of the two houses and facilitates travel (communication) between them by providing a clear path from one to the other.

In other words, the TCP/IP protocol stack allows us to identify and connect with other devices (and vice versa) and determine which requests/responses go where (with ports), and the HTTP protocol allows us to send requests and responses containing information/data to each other (packets).

More specifically, TCP defines how applications can create channels of communication across a network (ports), as well as how messages should be converted into packets before transmission on the internet and ensures that they are received in the correct order. IP defines how to address and route each packet to make sure it reaches the right destination.

The Internet protocol suite (TCP/IP) uses the HTTP protocol for communication between a web server and a web browser, using requests and responses to transfer data back and forth between the two.