

1.a) The first thing you would do is check if the domain name world-class-networks.com is available to purchase using a site like DomainTyper.com. If it's available, then you can decide on the domain registrar you want to use such as namecheap, godaddy, name.com, and domain.com. The final step is to actually purchase the name through one of these sites.

1.b) After finding a registrar and paying them to seed the domain name world-class-networks.com, you need to supply them with the name and IP address of your primary and secondary authoritative DNS servers. The registrar would then make sure that a type NS and Type A record are entered into the TLD com servers.

1.c)

```
$ORIGIN world-class-networks.com;
```

```
$TTL 1;
```

```
world-class-networks.com. IN SOA ns.world-class-networks.com. root.world-class-networks.com. (
```

```
2008120710;
```

```
1d;
```

```
1d;
```

```
4w;
```

```
1h;
```

```
)
```

```
world-class-networks.com. NS dns1.ntchosting.com;
```

```
world-class-networks.com. NS dns2.ntchosting.com. ;
```

```
world-class-networks.com. MX 10 mx1.ntchosting.com;
```

```
world-class-networks.com. A 209.25.134.47;
```

```
www A 209.25.134.47
```

2.) TCP Veno attempts to use the RTT-monitoring ideas of TCP Vegas while remaining as aggressive as TCP Reno in using queue capacity. A TCP Venmo sender estimates the number of packets likely in the bottleneck queue then modifies the TCP Reno congestion-avoidance rule.

TCP Cubic attempts to solve the problem of efficient TCP transport when $\text{bandwidth} \times \text{delay}$ is large. TCP Cubic allows very fast window expansion, as well as makes attempts to slow the growth of cwnd sharply as cwnd approaches the current network ceiling, and to treat other TCP connections fairly. Part of TCP Cubic's strategy to achieve this is for the window-growth function to slow down (become concave) as the previous network ceiling is approached, and then to increase rapidly again (become convex) if this ceiling is surpassed without losses.

3.)

Application layer- HTTP, SMTP, and FTP protocols are used in the application layer. The principle responsibility of this layer is to send data over multiple end systems.

Transport layer- TCP and UDP are the protocols used. This layer establishes connections between applications running on different hosts.

Network layer- This layer uses IP addresses to identify packet source and destination to move the packets across the network.

Data link layer- This is responsible for creating the frames that move across the network. These frames encapsulate the packets and use MAC addresses to identify the source and destination.

Physical layer: This layer encodes and decodes the bits found in a frame and includes the transceiver that drives and receives the signals on the network

4.a) Traceroute

4.b) You can use this tool to determine network delay by adding together the times it takes to make each hop until the destination is reached.

4.c)

```
austinhall@Austins-MacBook-Air ~ % traceroute www.uct.ac.za
traceroute to ecm-vip-prd.uct.ac.za (137.158.154.230), 64 hops max, 52 byte packets
 1  10.0.0.1 (10.0.0.1)  5.715 ms  3.385 ms  4.027 ms
 2  100.76.169.1 (100.76.169.1)  12.223 ms  13.455 ms  13.901 ms
 3  po-302-1209-rur01.spokane.wa.seattle.comcast.net (68.86.113.41)  16.216 ms
   13.479 ms  14.247 ms
 4  po-2-rur02.spokane.wa.seattle.comcast.net (69.139.160.126)  24.858 ms  16.03
   3 ms  16.617 ms
 5  be-37-ar01.seattle.wa.seattle.comcast.net (68.86.96.5)  19.723 ms  20.400 ms
   21.071 ms
 6  be-33650-cr01.seattle.wa.ibone.comcast.net (68.86.93.165)  19.974 ms  24.551
   ms  21.885 ms
 7  be-10846-pe01.seattle.wa.ibone.comcast.net (68.86.86.90)  20.947 ms  21.284
   ms  23.391 ms
 8  be3014.ccr21.sea02.atlas.cogentco.com (154.54.11.229)  22.519 ms  31.848 ms
   22.254 ms
 9  be2085.ccr21.slc01.atlas.cogentco.com (154.54.2.198)  56.895 ms  59.920 ms
   57.456 ms
10  be3038.ccr22.den01.atlas.cogentco.com (154.54.42.98)  58.440 ms  58.897 ms
   57.623 ms
11  be3036.ccr22.mci01.atlas.cogentco.com (154.54.31.90)  68.743 ms
   be3035.ccr21.mci01.atlas.cogentco.com (154.54.5.90)  69.540 ms  69.339 ms
12  be2832.ccr42.ord01.atlas.cogentco.com (154.54.44.170)  85.428 ms
   be2831.ccr41.ord01.atlas.cogentco.com (154.54.42.166)  94.410 ms
   be2832.ccr42.ord01.atlas.cogentco.com (154.54.44.170)  87.334 ms
13  be2717.ccr21.cle04.atlas.cogentco.com (154.54.6.222)  87.043 ms
   be2718.ccr22.cle04.atlas.cogentco.com (154.54.7.130)  89.966 ms  88.528 ms
14  be2878.ccr21.alb02.atlas.cogentco.com (154.54.26.130)  103.954 ms  110.726 m
   s  104.223 ms
15  be3600.ccr32.bos01.atlas.cogentco.com (154.54.0.222)  110.984 ms
   be3599.ccr31.bos01.atlas.cogentco.com (66.28.4.238)  104.481 ms
   be3600.ccr32.bos01.atlas.cogentco.com (154.54.0.222)  104.623 ms
16  be2099.ccr41.lon13.atlas.cogentco.com (154.54.82.33)  169.476 ms
   be2101.ccr42.lon13.atlas.cogentco.com (154.54.82.37)  173.836 ms
   be2099.ccr41.lon13.atlas.cogentco.com (154.54.82.33)  167.385 ms
17  be2871.ccr21.lon01.atlas.cogentco.com (154.54.58.186)  177.159 ms
   be2868.ccr21.lon01.atlas.cogentco.com (154.54.57.154)  168.524 ms
   be2870.ccr22.lon01.atlas.cogentco.com (154.54.58.174)  167.738 ms
18  be2185.rcr21.b015534-1.lon01.atlas.cogentco.com (154.54.61.61)  167.460 ms
   be2186.rcr21.b015534-1.lon01.atlas.cogentco.com (154.54.61.69)  172.784 ms
   be2185.rcr21.b015534-1.lon01.atlas.cogentco.com (154.54.61.61)  177.977 ms
19  tenet.demarc.cogentco.com (149.14.146.194)  166.775 ms  166.525 ms  166.947
   ms
20  ae1-306-cpt1-ir1.net.tenet.ac.za (155.232.1.40)  330.042 ms  404.350 ms  407
   .247 ms
21  pc3-cpt2-p1.net.tenet.ac.za (155.232.64.75)  411.580 ms  326.246 ms  312.363
   ms
22  be1-104-cpt2-pe1.net.tenet.ac.za (155.232.64.73)  307.034 ms  311.361 ms  31
   2.404 ms
23  155.232.27.78 (155.232.27.78)  310.516 ms  310.516 ms  315.073 ms
24  * * *
25  * * *
```

5.) Email servers have trouble with sending pictures and video because they used to be 7-bit ascii and could only send 7-bits reliably. Now with the use of MIME, an image or video is encoded through base64 encoding to 7-bit data that is able to be sent over SMTP and then once it is received, decoded back into its original form. RFC 2045, RFC 2046, RFC 2047, RFC 4288, RFC 4289 and RFC 2049 are each responsible for the MIME we use today.

6.a) An ephemeral port is a type of port number (which is a way to uniquely identify processes) on the client side that isn't "well known" or registered, meaning it isn't registered with IANA or standardized by RFA. These ports can be used for any purpose without being registered so they are appropriate for a temporary connection. They range from 49152-65535.

6.b) There are several differences between TCP and UDP. TCP is a connection oriented protocol which means the communicating devices establish and close each connection; whereas UDP will continuously send data with no overhead in opening the connection. TCP guarantees the delivery of data where UDP does not. TCP provides extensive error checking where UDP only uses checksum. TCP sequences the data and sends it in order where UDP does not. TCP retransmits lost packets of data.

<https://www.geeksforgeeks.org/differences-between-tcp-and-udp/>

6.c)

```
Socket clientSocket = new Socket("hostname", 6789);  
BufferedReader inFromServer = new BufferedReader(new  
    InputStreamReader(clientSocket.getInputStream()));
```

6.d)

```
Socket clientSocket = new Socket("hostname", 6789);  
DataOutputStream outToServer = new DataOutputStream(clientSocket.getOutputStream());
```

6.e) On my computer, it prints 127.0.0.1 which is the local loopback IP of my computer used to establish a connection with itself. `getLocalHost()` will get the local inet address and `getHostAddress()` will then return that as a string representation.

7.) The first thing you would look at in the header is the "received: from" portion which will show if the email address shown in the "from" part of the simple email header is the same. If these two addresses are different, then you should be suspicious. But, its possible that the two email addresses belong to the same owner. You can check the SPF record to determine if this is the case. Next, we would compare the IP address of this email from the IP listed in the SPF record. If its the same, its safe to assume that this is a legitimate email.

8.) Ping is not strictly a client server architecture because ping is a utility used to test the reachability of an IP using ICMP echo messages. ICMP is an integral part of IP and must be implemented in any IP module. It's not necessary for the "client" to connect to a "server" and be served data, since it is only bouncing an echo off of the "server."

9.) Transmission, propagation, processing, and queuing are the delays encountered in a packet switched network. Each are constant, except for queuing which is variable depending on the amount of network traffic and size of packet.

10.a)

I choose the article “EFF Fights to Protect Anonymity of Glassdoor Commenter” from the Press Release portion of the site. This article is about an anonymous Glassdoor commenter who was recently laid off from Kraken, a cryptocurrency exchange company. EFF filed a motion to squash a subpoena from Kraken to unmask the identity of the former employee who they claim to have breached severance agreements. This former employee “signed a severance agreement promising not to disclose confidential information or disparage or defame the company.” The anonymous commenter deleted their comment which read that they often felt trepidation working at the company, but according to Kraken, simply deleting the comment wasn’t enough. They wanted to know the identity of this person. EFF Staff Attorney Aaron Mackey says that “This litigation is designed to harass and silence current and former Kraken employees for speaking about their experiences at the company, Kraken’s efforts to unmask and sue its former employees discourages everyone from talking about their work and demonstrates why California courts must robustly protect anonymous speakers’ First Amendment rights.”

Personally, I side with the anonymous commenter. I believe that NDA’s that restrict an individual’s opinions and free speech are unconstitutional. This would be a different story if the commenter was revealing company secrets or aggressively defaming the company, but their comment was innocuous. It’s important not to let big corporations control people in this way, and not to let them infringe on constitutional rights. The action taken by Kraken is a scare tactic to keep others from voicing their opinion about what it is like to work there, which is what Glassdoor was created to do. It’s important to let others know what the negative aspects of working at a company are. But more than this, it’s important to allow people to speak freely, and if they choose, anonymously.

10.b)

The Electronic Frontier Foundation is a nonprofit organization dedicated to defending civil liberties in the digital world. They ensure rights and freedoms are protected and enhanced through “impact litigation, policy analysis, grassroots activism, and technology development” as the use of technology is expanded. The EFF is aided by technologists, activists, and attorneys to defend and fight for our rights and protection online. The primary purpose of the EFF is lobbying, and according to wikipedia, the EFF “provides funds for legal defense in court, presents amicus curiae briefs, defends individuals and new technologies from what it considers abusive legal threats, works to expose government malfeasance, provides guidance to the government and courts, organizes political action and mass mailings, supports some new technologies which it believes preserve personal freedoms and online civil liberties, maintains a database and web sites of related news and information, monitors and challenges potential legislation that it believes would infringe on personal liberties and fair use and solicits a list of what it considers abusive patents with intentions to defeat those that it considers without merit.”