

1. What does the traceroute program do? Visit www.traceroute.org and run a traceroute from two different cities in Europe to www.unt.edu and copy paste the output on your homework. How many links are the same in the two traceroutes? Is the trans-oceanic link the same?

The traceroute program provides delay measurement from source to router along end to end Internet path towards destination. For all i , it sends 3 packets that will reach router i on path towards destination, router i will return packets to sender, sender times interval between transmission and reply. I ran two different traceroutes and copied and pasted their outputs below. 4 of the links are the same in the two traceroutes. The trans-oceanic link is not the same.

France

ETSI (AS8567)

<http://portal.etsi.org/webstats/traceroute.asp>

<http://traceroute.sdv.fr/index.php?v6=0&host=www.unt.edu>

1	wblindex.sdv.fr	212.95.66.126	0.24 ms
2	border-gateway2.sdv.fr	212.95.69.227	0.851 ms
3	th2-10g-6-3.sdv.fr	212.95.64.54	7.578 ms
4	10gigabitethernet-2-2.par2.he.net	195.42.144.104	12.893 ms
5	100ge8-2.core1.ash1.he.net	184.105.213.173	90.227 ms
6	100ge8-2.core1.atl1.he.net	184.105.213.69	95.845 ms
7	100ge12-1.core1.dal1.he.net	184.105.81.170	121.351 ms
8	learn.gigabitethernet2-15.core1.dal1.he.net	216.66.73.226	119.239 ms
9	vl801-unt-ntg-gw2.dfw.tx-learn.net	208.76.224.86	120.65 ms
10	129.120.14.74	129.120.14.74	164.792 ms
11	129.120.14.76	129.120.14.76	121.983 ms
14	129.120.255.81	129.120.255.81	123.641 ms
15	129.120.255.82	129.120.255.82	125.23 ms
16	129.120.255.5	129.120.255.5	124.615 ms

Germany

HanNet (AS1275)

<http://www.han.de/cgi-bin/nph-trace.cgi>

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traceroute to www.unt.edu (129.120.231.230), 30 hops max, 60 byte
packets
 1  * * *
 2  ae3.cr-vega.sxb1.core.heg.com (87.230.114.21)  0.233 ms  0.238 ms
0.223 ms
 3  ffm-b1-link.telial.net (80.239.192.121)  6.822 ms  6.811 ms  6.792
ms
 4  ffm-bb4-link.telial.net (62.115.116.163)  7.287 ms ffm-bb4-
link.telial.net (62.115.121.8)  7.092 ms ffm-bb3-link.telial.net
(62.115.141.238)  6.896 ms
 5  * * hbg-bb1-link.telial.net (213.155.135.145)  12.329 ms
 6  * dls-b21-link.telial.net (213.155.137.29)  134.146 ms dls-b22-
link.telial.net (62.115.120.117)  131.933 ms
 7  learnlonestar-ic-309343-dls-bb1.c.telial.net (213.248.104.82)
134.656 ms dls-b22-link.telial.net (62.115.143.57)  135.021 ms nyk-bb1-
link.telial.net (80.91.247.115)  90.750 ms
 8  learnlonestar-ic-309343-dls-bb1.c.telial.net (213.248.104.82)
134.601 ms  134.945 ms  131.953 ms
 9  learnlonestar-ic-309343-dls-bb1.c.telial.net (213.248.104.82)
135.731 ms vl803-unt-ntg-gw2.dfw.tx-learn.net (208.76.224.218)
131.970 ms learnlonestar-ic-309343-dls-bb1.c.telial.net
(213.248.104.82)  132.746 ms
10 learnlonestar-ic-309343-dls-bb1.c.telial.net (213.248.104.82)
141.898 ms * *
11 * * 129.120.255.81 (129.120.255.81)  133.429 ms
12 129.120.255.81 (129.120.255.81)  133.392 ms  136.433 ms *
13 * * *
14 129.120.255.82 (129.120.255.82)  141.755 ms 129.120.255.81
(129.120.255.81)  141.314 ms 129.120.255.5 (129.120.255.5)  138.337 ms
15 129.120.255.82 (129.120.255.82)  142.471 ms * *
16 * * *
17 * * *
18 * * *
19 * * *
20 * * *
21 * * *
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29 * * *
30 * * *

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2. Briefly explain the functions of each layer of the ISO-OSI model.

a. Application: supporting network applications such as FTP, SMTP, and HTTP

- b. Presentation: allows applications to interpret the meaning of data such as encryption, compression, and machine-specific conventions
 - c. Session: synchronization, checkpointing, recovery of data exchange
 - d. Transport: process to process data transfer such as TCP and UDP
 - e. Network: routing of datagrams from source to destination such as IP and routing protocols
 - f. Link: data transfer between neighboring network elements such as Ethernet, 802.111(WiFi), and PPP
 - g. Physical: bits "on the wire"
3. Explain at least two prevalent types of network attack?
- a. Denial of Service (DoS): attackers make resources (the server and bandwidth) unavailable to legitimate traffic by overwhelming resource with bogus traffic
 - b. Packet sniffing: promiscuous network interface reads/records all packets (which could include private personal information like your passwords) passing by over broadcast media (shared Ethernet and WiFi)
4. Differentiate (at least two differences) between client-server and P2P architecture.
- a. Client-Server
 - i. Server is always on, ready for connections
 - ii. Add data centers for scaling
 - b. P2P
 - i. No always-on-server
 - ii. Self-scalability – New peers bring new service capacity as well as new service demands
5. Differentiate (at least two differences) between TCP and UDP services.
- a. TCP
 - i. Reliable transport
 - ii. Provides flow control and congestion control
 - b. UDP
 - i. Unreliable data transfer
 - ii. Does not provide flow control or congestion control
6. The nearest Yahoo server from UNT DP is located in Fort Worth, TX. The optic fiber cable connection between UNT DP and the Yahoo server is 30 miles long and the propagation speed through the optic fiber cable is that of light. The transmit rate and receive rate is 10 Gbps. Assume packets containing only control signals (ACK or handshaking) are 200 bits long. Now consider the HTTP protocol, and suppose that initial downloaded page from Yahoo server is 20,000 bits long, and that the initial downloaded page contains 5 referenced objects from the Yahoo server. Each referenced object is 5,000 bits long. Answer the below questions. Assume that N parallel connections each get 1/N of the link bandwidth.
- a. What would be the total time required to download the complete page using non-persistent HTTP?
 - i. $(3LC/R + Ld/R + 4d/s) + 5*(3LC/R + Ld/R + 4d/s) = (3*200\text{bits}/10\text{Gbps} + 20,000\text{bits}/10\text{Gbps} + 4*30\text{mi}/3*10^8\text{s}) + 5*(3*200\text{bits}/10\text{Gbps} + 5,000\text{bits}/10\text{Gbps} + 4*30\text{mi}/3*10^8\text{s}) = 7.26*10^{-6} \text{ seconds}$

- b. What would be the total time required to download the complete page using 5 parallel instances of non-persistent HTTP?
- i. $(3LC/R + Ld/R + 4d/s) + (3LC/R + Ld/R + 4d/s) = (3 \cdot 200\text{bits}/10\text{Gbps} + 20,000\text{bits}/10\text{Gbps} + 4 \cdot 30\text{mi}/3 \cdot 10^8\text{s}) + (3 \cdot 200\text{bits}/10\text{Gbps} + 5,000\text{bits}/10\text{Gbps} + 4 \cdot 30\text{mi}/3 \cdot 10^8\text{s}) = 3.42 \cdot 10^{-6}$ seconds
- c. What would be the total time required to download the complete page using persistent HTTP?
- i. $(3LC/R + Ld/R + 4d/s) + 5 \cdot (LC/R + d/s + Ld/R + d/s) = (3 \cdot 200\text{bits}/10\text{Gbps} + 20,000\text{bits}/10\text{Gbps} + 4 \cdot 30\text{mi}/3 \cdot 10^8\text{s}) + 5 \cdot (3 \cdot 200\text{bits}/10\text{Gbps} + 30\text{mi}/3 \cdot 10^8\text{s} + 5000\text{bits}/10\text{Gbps} + 30\text{mi}/3 \cdot 10^8\text{s}) = 6.26 \cdot 10^{-6}$ seconds
- d. Which is better non-persistent HTTP or persistent HTTP?
- i. Non-persistent HTTP running in parallel was the fastest.
7. After looking at the hit rate, Yahoo decided to host a server in the UNT main campus which is 10 miles away from UNT DP campus and is connected by copper cable and the propagation speed through the copper cable is 2.5×10^8 m/s. All the Yahoo traffic from UNT DP now goes to the Yahoo server at the main campus. The transmit rate and receive rate is 100 Mbps. Assume packets containing only control signals (ACK or handshaking) are 200 bits long. Now consider the HTTP protocol, and suppose that initial downloaded page from Yahoo server is 20,000 bits long, and that the initial downloaded page contains 5 referenced objects from the Yahoo server. Each referenced object is 5,000 bits long. Answer the below questions. Assume that N parallel connections each get $1/N$ of the link bandwidth.
- a. What would be the total time required to download the complete page using non-persistent HTTP?
- i. $(3LC/R + Ld/R + 4d/s) + 5 \cdot (3LC/R + Ld/R + 4d/s) = (3 \cdot 200\text{bits}/100\text{Mbps} + 20000\text{bits}/100\text{Mbps} + 4 \cdot 10\text{mi}/2.5 \cdot 10^8\text{m/s}) + 5 \cdot (3 \cdot 200\text{bits}/100\text{Mbps} + 5000\text{bits}/100\text{Mbps} + 4 \cdot 10\text{mi}/2.5 \cdot 10^8\text{m/s}) = 4.87 \cdot 10^{-4}$ seconds
- b. What would be the total time required to download the complete page using 5 parallel instances of non-persistent HTTP?
- i. $(3LC/R + Ld/R + 4d/s) + (3LC/R + Ld/R + 4d/s) = (3 \cdot 200\text{bits}/100\text{Mbps} + 20000\text{bits}/100\text{Mbps} + 4 \cdot 10\text{mi}/2.5 \cdot 10^8\text{m/s}) + (3 \cdot 200\text{bits}/100\text{Mbps} + 5000\text{bits}/100\text{Mbps} + 4 \cdot 10\text{mi}/2.5 \cdot 10^8\text{m/s}) = 2.62 \cdot 10^{-4}$ seconds
- c. What would be the total time required to download the complete page using persistent HTTP?
- i. $(3LC/R + Ld/R + 4d/s) + 5 \cdot (LC/R + d/s + Ld/R + d/s) = (3 \cdot 200\text{bits}/100\text{Mbps} + 20000\text{bits}/100\text{Mbps} + 4 \cdot 10\text{mi}/2.5 \cdot 10^8\text{m/s}) + 5 \cdot (3 \cdot 200\text{bits}/100\text{Mbps} + 5000\text{bits}/100\text{Mbps} + 2 \cdot 10\text{mi}/2.5 \cdot 10^8\text{m/s}) = 4.87 \cdot 10^{-4}$ seconds
- d. Which is better non-persistent HTTP or persistent HTTP?
- i. Non-persistent HTTP in parallel is the fastest.
8. Explain web caching.
- a. Used to satisfy client request without involving the origin server.

- b. Reduces response time for the client request.
 - c. Reduces traffic on an institution's access link.
- 9. What are cookies? Explain how cookies are used to keep the state of the users.
 - a. A cookie is data that your web browser saves for websites, such as authorization shopping carts, recommendations, and user session state.
 - b. Protocol endpoints: maintain state at sender/receiver over multiple transactions, and cookies: http messages carry state