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Homework 1
CSE 310 Fall 2022
Due date: September 13, 2022; 11:59 PM
Submission via Blackboard.

1. (10 points) True or false? Please provide a reasoning (1-2 sentences) for your answer.

a. A user requests a Web page that consists of an html file which contains the URLs to three images. Assume that HTTP/1.1 protocol is being used with persistent connection but no parallelization or pipelining. To render this page, the client will send one HTTP request and receive four HTTP responses. **False. In a persistent HTTP 1.1 (Should I write HTTP/1.1? What's the difference?) connection, the client would first have to send an HTTP request to initiate a connection to HTTP server and once the server "accepts" the connection, it will notify the client by sending an HTTP response back. Once the client receives the HTTP response, the client will send a HTTP request message asking for the HTML document to the server and the server will reply with another response message containing the HTML file, finding that it has references to 3 images. For each image, there will be one GET HTTP request and one response containing HTTP including the image. As a result, it will be 5 HTTP requests and 5 HTTP responses.**

b. Two distinct Web pages (for example, https://www.cs.stonybrook.edu/about-us.html and https://www.cs.stonybrook.edu/admissions.html) can be requested and received over the same persistent HTTP connection. **True. As long as the persistent HTTP connection is not timed out or broken, it can be used to send/receive another web page over the same port.**

c. If I want to transfer a file from my friend's computer, I have to use a standard application layer protocol such as HTTP and cannot write my own protocol. **True. In order to transfer a file from a friend's computer to another device, you have to use a standard application layer protocol such as HTTP because they are the web standards so that all packets can be interpreted from device to device in the same way.**

d. Before you start sending application-layer request and response, you need to set up a connection. This connection set up is primarily to ensure that the connection is secure. **False. The application-layer is not responsible for requests and responses itself. The application-layer talks with the transport-layer and tells the transport-layer to establish a connection with the server. However, the application-layer only needs to know how to request a connection with a remote host using the Transport layer. The transport-layer is the layer responsible for setting up a connection, and the application layer request/response can start being sent without the connection.**

e. You can connect to a server without using DNS first. **True. Theoretically, the DNS or Domain Name System is not required as long as you have the IP address of the website that you are trying to establish a connection with. However, this might not work with web pages because the server we might be talking to might be a virtual server with multiple machines and this server may have to look at the URL to determine which machine/server your request should be forwarded to.**

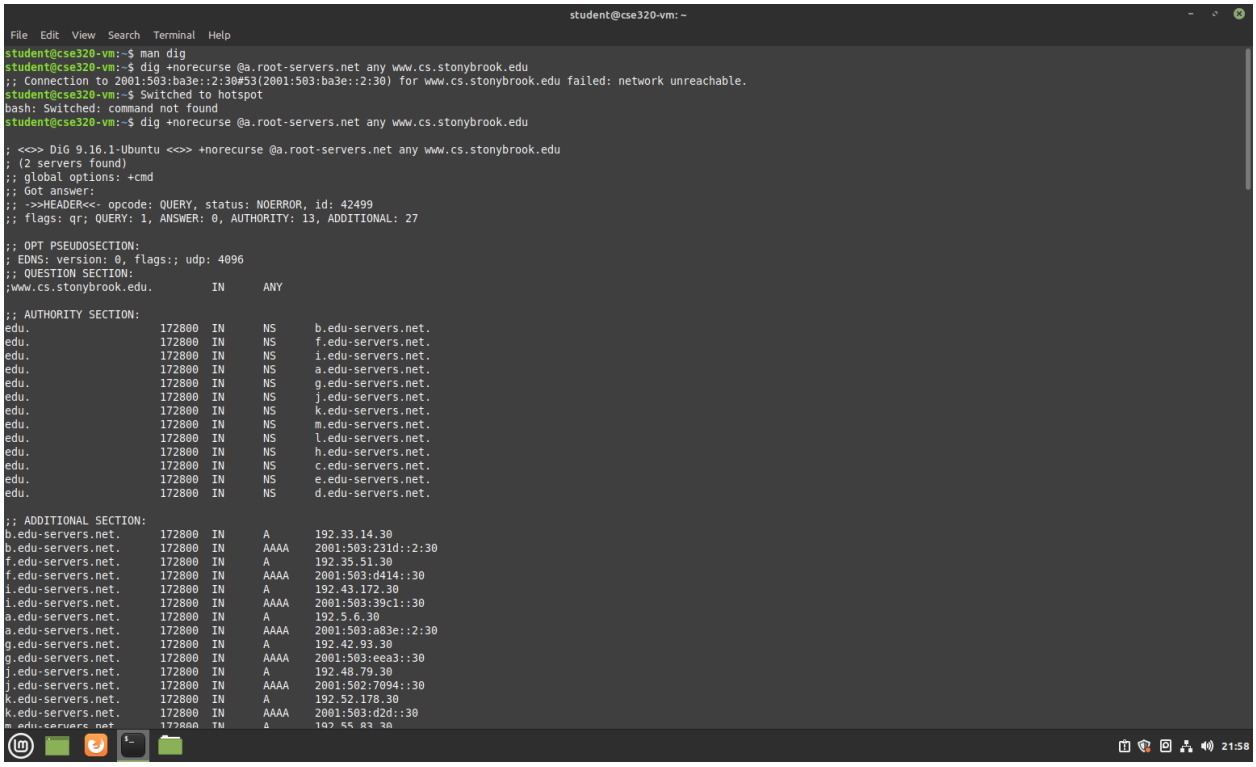
2. (6 pt) What are the major differences between HTTP 1.0 and HTTP 1.1? **The major differences between HTTP 1.0 and HTTP 1.1 are generally referred to as the three Ps: persistent connections, parallelization, and pipelining, which all generally increase efficiency in loading a website. In HTTP 1.0 you had to open a new connection for each request/response pair. And after each response the connection would be closed. This led to inefficient data transfer. One of the main objectives in the creation of HTTP 1.1 was to increase efficiency. As a result, HTTP 1.1 came with persistent connections which allowed multiple GET requests and responses to be sent over the same connection, parallelization where multiple connections are allowed to send and receive requests/responses could be sent/received at the same time on the same machine, and pipelining where multiple GET requests could be sent right after the other instead of waiting for a response back before sending another GET request.**

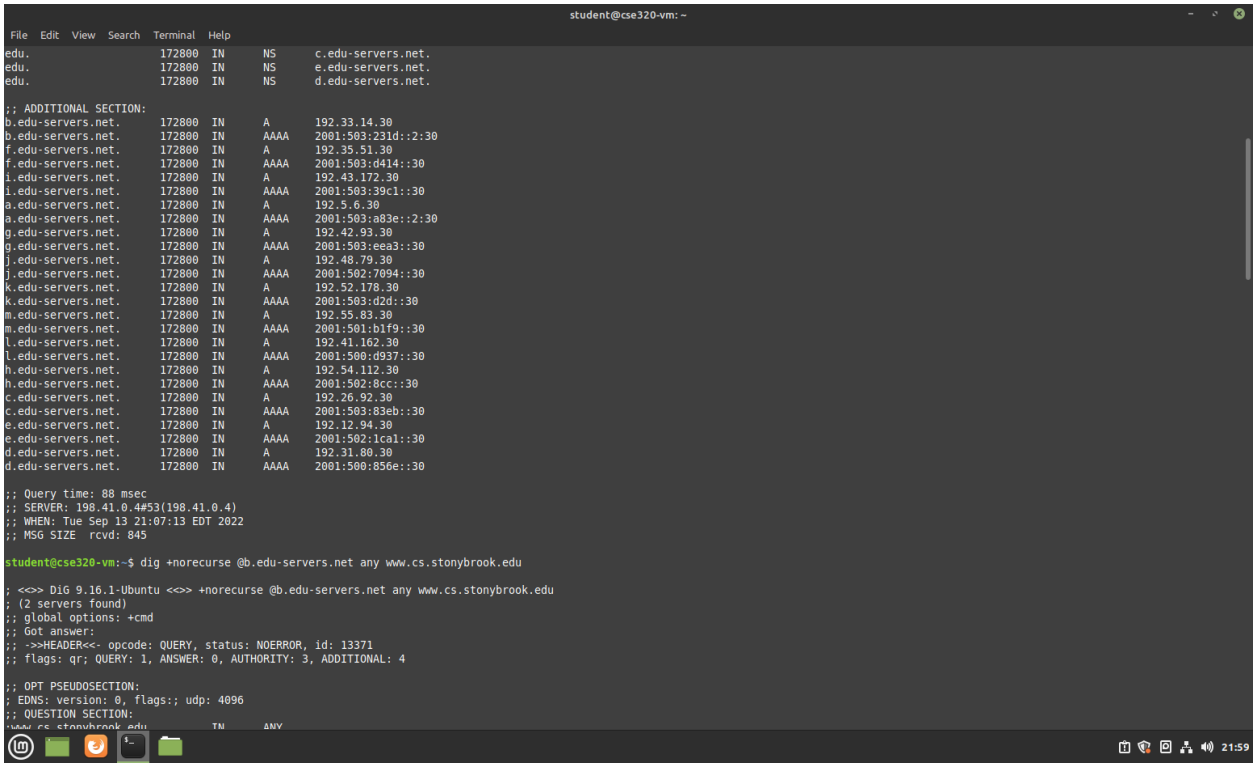
3. (4 pt) Consider a client that wants to retrieve a Web document at a given URL. The IP address of the server is initially unknown. What application-layer protocols are needed in this scenario? **We would need DNS and HTTP. Domain Name System, or DNS is necessary because we need to get the IP address of the server corresponding to the URL with the web document. We would also need to use HTTP in order to establish a connection with the server that we have the IP address of and then requesting the web document.**

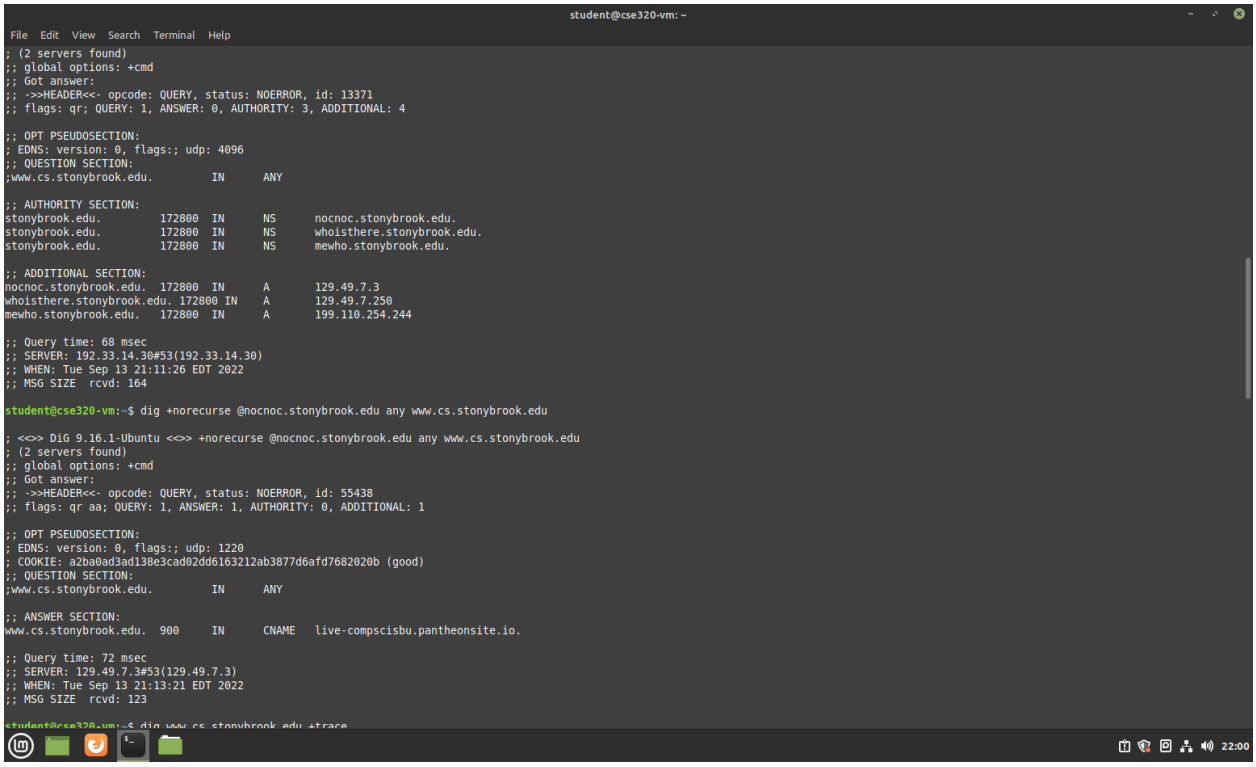
4. (10 pt) What is the function of a DNS server? Please describe how an iterative query and a recursive query will be handled by DNS servers. **The purpose of DNS, or Domain Name System, is to type in a given URL into a browser or such and a DNS server will reply with an IP address that your browser can than use to try to establish a connection to the correct "server" (in reality could be a cluster of machines that are associated with that one IP address) so that you are able to load/upload the content you are trying to load from/to that "server."**

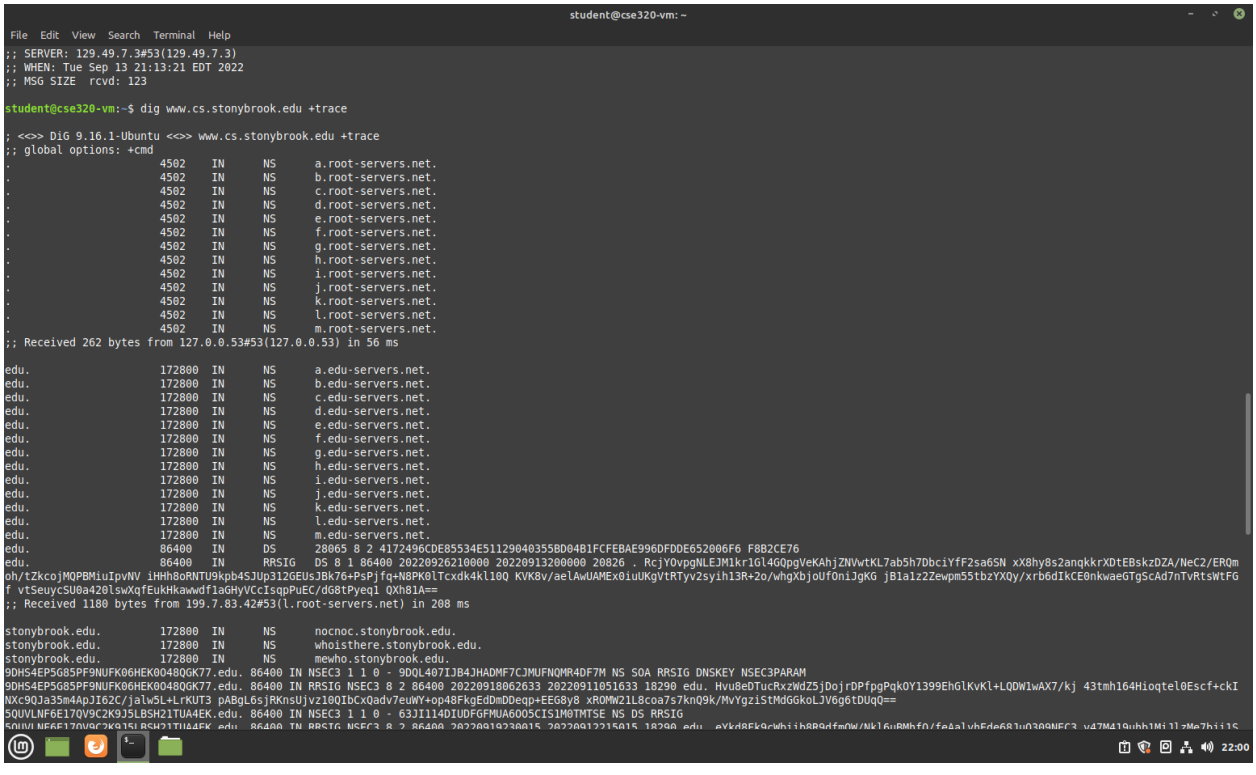
5. (10 pt) In this problem, we use the useful dig tool available on Unix and Linux hosts to explore the hierarchy of DNS servers. Recall that a DNS server higher in the DNS hierarchy delegates a DNS query to a DNS server lower in the hierarchy, by sending back to the DNS client the name of that lower-level DNS server. First read the man page for dig (e.g., http://linux.die.net/man/1/dig) , and then answer the following question. Starting with a root DNS server (from one of the root servers [a-m].root- servers.net), initiate a sequence of queries for the IP address for your department's Web server (www.cs.stonybrook.edu) by using dig. You cannot use the +trace option. Show the list of the names of DNS servers in the delegation chain in answering your query. Back up your answers with screen shots that show the results of your dig queries.
b.edu-servers.net.
nocnoc.stonybrook.edu
SERVER: 129.49.7.3#53(129.49.7.3)

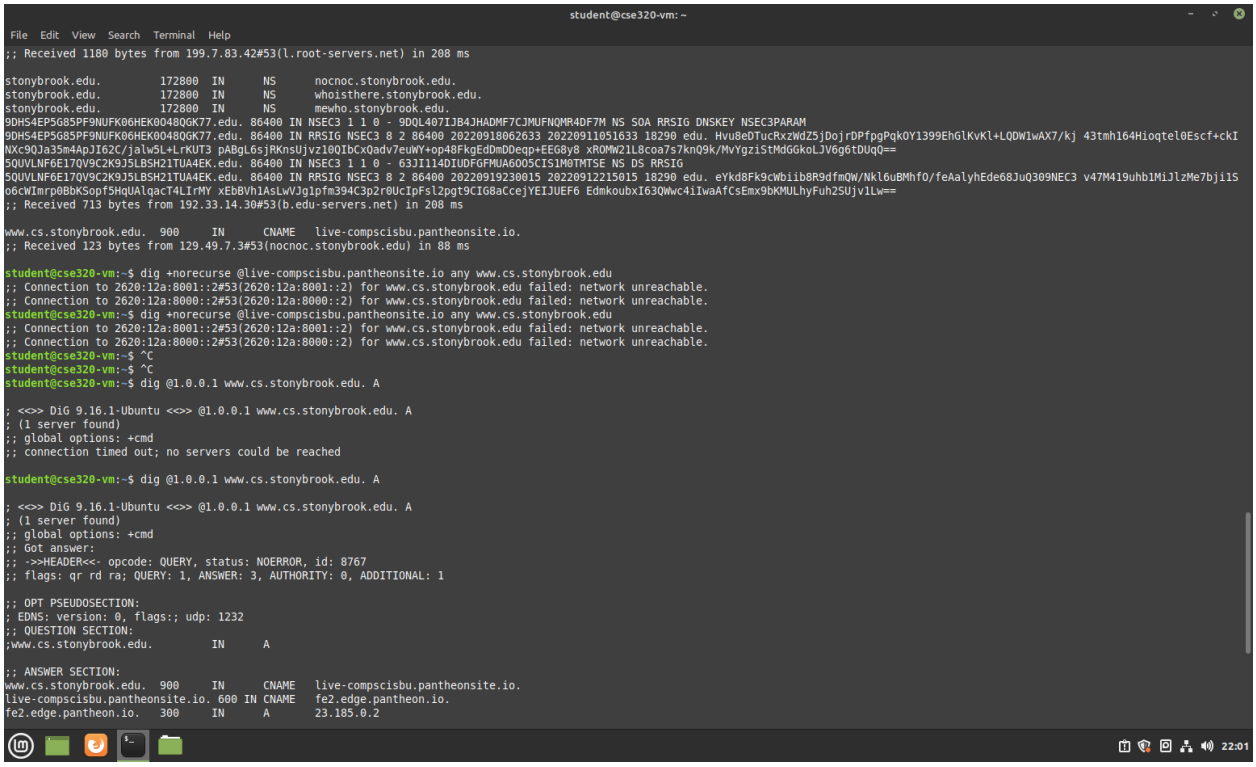
Another correct IP address seems to be: 23.185.0.2 but I am not sure?


student@cse320-vm: ~
File Edit View Search Terminal Help
student@cse320-vm:~$ man dig
student@cse320-vm:~$ dig +norecurse @a.root-servers.net any www.cs.stonybrook.edu
;; Connection to 2001:503:ba3e::2:30#53(2001:503:ba3e::2:30) for www.cs.stonybrook.edu failed: network unreachable.
student@cse320-vm:~$ Switched to hotspot
bash: Switched: command not found
student@cse320-vm:~$ dig +norecurse @a.root-servers.net any www.cs.stonybrook.edu
; <<>> DiG 9.16.1-Ubuntu <<>> +norecurse @a.root-servers.net any www.cs.stonybrook.edu
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 42499
;; flags: qr; QUERY: 1, ANSWER: 0, AUTHORITY: 13, ADDITIONAL: 27
;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.cs.stonybrook.edu. IN ANY
;; AUTHORITY SECTION:
edu. 172800 IN NS b.edu-servers.net.
edu. 172800 IN NS f.edu-servers.net.
edu. 172800 IN NS i.edu-servers.net.
edu. 172800 IN NS a.edu-servers.net.
edu. 172800 IN NS g.edu-servers.net.
edu. 172800 IN NS j.edu-servers.net.
edu. 172800 IN NS k.edu-servers.net.
edu. 172800 IN NS m.edu-servers.net.
edu. 172800 IN NS l.edu-servers.net.
edu. 172800 IN NS h.edu-servers.net.
edu. 172800 IN NS c.edu-servers.net.
edu. 172800 IN NS e.edu-servers.net.
edu. 172800 IN NS d.edu-servers.net.
;; ADDITIONAL SECTION:
b.edu-servers.net. 172800 IN A 192.33.14.30
b.edu-servers.net. 172800 IN AAAA 2001:503:231d::2:30
f.edu-servers.net. 172800 IN A 192.35.51.30
f.edu-servers.net. 172800 IN AAAA 2001:503:d414::30
i.edu-servers.net. 172800 IN A 192.43.172.30
i.edu-servers.net. 172800 IN AAAA 2001:503:39c1::30
a.edu-servers.net. 172800 IN A 192.5.6.30
a.edu-servers.net. 172800 IN AAAA 2001:503:a83e::2:30
g.edu-servers.net. 172800 IN A 192.42.93.30
g.edu-servers.net. 172800 IN AAAA 2001:503:eea3::30
j.edu-servers.net. 172800 IN A 192.48.79.30
j.edu-servers.net. 172800 IN AAAA 2001:502:7094::30
k.edu-servers.net. 172800 IN A 192.52.178.30
k.edu-servers.net. 172800 IN AAAA 2001:503:d2d::30
21:58


student@cse320-vm: ~
File Edit View Search Terminal Help
edu. 172800 IN NS c.edu-servers.net.
edu. 172800 IN NS e.edu-servers.net.
edu. 172800 IN NS d.edu-servers.net.
;; ADDITIONAL SECTION:
b.edu-servers.net. 172800 IN A 192.33.14.30
b.edu-servers.net. 172800 IN AAAA 2001:503:231d::2:30
f.edu-servers.net. 172800 IN A 192.35.51.30
f.edu-servers.net. 172800 IN AAAA 2001:503:d414::30
i.edu-servers.net. 172800 IN A 192.43.172.30
i.edu-servers.net. 172800 IN AAAA 2001:503:39c1::30
a.edu-servers.net. 172800 IN A 192.5.6.30
a.edu-servers.net. 172800 IN AAAA 2001:503:a83e::2:30
g.edu-servers.net. 172800 IN A 192.42.93.30
g.edu-servers.net. 172800 IN AAAA 2001:503:eea3::30
j.edu-servers.net. 172800 IN A 192.48.79.30
j.edu-servers.net. 172800 IN AAAA 2001:502:7094::30
k.edu-servers.net. 172800 IN A 192.52.178.30
k.edu-servers.net. 172800 IN AAAA 2001:503:d2d::30
m.edu-servers.net. 172800 IN A 192.55.83.30
m.edu-servers.net. 172800 IN AAAA 2001:501:b1f9::30
l.edu-servers.net. 172800 IN A 192.41.162.30
l.edu-servers.net. 172800 IN AAAA 2001:500:d937::30
h.edu-servers.net. 172800 IN A 192.54.112.30
h.edu-servers.net. 172800 IN AAAA 2001:502:8cc::30
c.edu-servers.net. 172800 IN A 192.26.92.30
c.edu-servers.net. 172800 IN AAAA 2001:503:83eb::30
e.edu-servers.net. 172800 IN A 192.12.94.30
e.edu-servers.net. 172800 IN AAAA 2001:502:1ca1::30
d.edu-servers.net. 172800 IN A 192.31.80.30
d.edu-servers.net. 172800 IN AAAA 2001:500:856e::30
;; Query time: 88 msec
;; SERVER: 198.41.0.4#53(198.41.0.4)
;; WHEN: Tue Sep 13 21:07:13 EDT 2022
;; MSG SIZE rcvd: 845
student@cse320-vm:~$ dig +norecurse @b.edu-servers.net any www.cs.stonybrook.edu
; <<>> DiG 9.16.1-Ubuntu <<>> +norecurse @b.edu-servers.net any www.cs.stonybrook.edu
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 13371
;; flags: qr; QUERY: 1, ANSWER: 0, AUTHORITY: 3, ADDITIONAL: 4
;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
21:59


student@cse320-vm: ~
File Edit View Search Terminal Help
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 13371
;; flags: qr; QUERY: 1, ANSWER: 0, AUTHORITY: 3, ADDITIONAL: 4
;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.cs.stonybrook.edu. IN ANY
;; AUTHORITY SECTION:
stonybrook.edu. 172800 IN NS nocnoc.stonybrook.edu.
stonybrook.edu. 172800 IN NS whoisthere.stonybrook.edu.
stonybrook.edu. 172800 IN NS mewho.stonybrook.edu.
;; ADDITIONAL SECTION:
nocnoc.stonybrook.edu. 172800 IN A 129.49.7.3
whoisthere.stonybrook.edu. 172800 IN A 129.49.7.250
mewho.stonybrook.edu. 172800 IN A 199.110.254.244
;; Query time: 68 msec
;; SERVER: 192.33.14.30#53(192.33.14.30)
;; WHEN: Tue Sep 13 21:11:26 EDT 2022
;; MSG SIZE rcvd: 164
student@cse320-vm:~$ dig +norecurse @nocnoc.stonybrook.edu any www.cs.stonybrook.edu
; <<>> DiG 9.16.1-Ubuntu <<>> +norecurse @nocnoc.stonybrook.edu any www.cs.stonybrook.edu
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 55438
;; flags: qr aa; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1
;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1220
; COOKIE: a2ba0ad3ad138e3cad02dd6163212ab3877d6afd7682020b (good)
;; QUESTION SECTION:
;www.cs.stonybrook.edu. IN ANY
;; ANSWER SECTION:
www.cs.stonybrook.edu. 900 IN CNAME live-compscisbu.pantheonsite.io.
;; Query time: 72 msec
;; SERVER: 129.49.7.3#53(129.49.7.3)
;; WHEN: Tue Sep 13 21:13:21 EDT 2022
;; MSG SIZE rcvd: 123
student@cse320-vm:~$ dig www.cs.stonybrook.edu +trace
22:00


student@cse320-vm: ~
File Edit View Search Terminal Help
;; SERVER: 129.49.7.3#53(129.49.7.3)
;; WHEN: Tue Sep 13 21:13:21 EDT 2022
;; MSG SIZE rcvd: 123
student@cse320-vm:~$ dig www.cs.stonybrook.edu +trace
; <<>> DiG 9.16.1-Ubuntu <<>> www.cs.stonybrook.edu +trace
;; global options: +cmd
. 4502 IN NS a.root-servers.net.
. 4502 IN NS b.root-servers.net.
. 4502 IN NS c.root-servers.net.
. 4502 IN NS d.root-servers.net.
. 4502 IN NS e.root-servers.net.
. 4502 IN NS f.root-servers.net.
. 4502 IN NS g.root-servers.net.
. 4502 IN NS h.root-servers.net.
. 4502 IN NS i.root-servers.net.
. 4502 IN NS j.root-servers.net.
. 4502 IN NS k.root-servers.net.
. 4502 IN NS l.root-servers.net.
. 4502 IN NS m.root-servers.net.
;; Received 262 bytes from 127.0.0.53#53(127.0.0.53) in 56 ms
edu. 172800 IN NS a.edu-servers.net.
edu. 172800 IN NS b.edu-servers.net.
edu. 172800 IN NS c.edu-servers.net.
edu. 172800 IN NS d.edu-servers.net.
edu. 172800 IN NS e.edu-servers.net.
edu. 172800 IN NS f.edu-servers.net.
edu. 172800 IN NS g.edu-servers.net.
edu. 172800 IN NS h.edu-servers.net.
edu. 172800 IN NS i.edu-servers.net.
edu. 172800 IN NS j.edu-servers.net.
edu. 172800 IN NS k.edu-servers.net.
edu. 172800 IN NS l.edu-servers.net.
edu. 172800 IN NS m.edu-servers.net.
edu. 86400 IN DS 28065 8 2 4172496CDE85534E511290403558D04B1FCFEBAE996DFDDE652006F6 F8B2CE76
edu. 86400 IN RRSIG DS 8 1 86400 20220926210000 20220913200000 20826 . RcjYOvpgNLEJM1kr1Gl4GQpgVeKAhjZNVwtKL7ab5h7DbciYfF2sa6SN xX8hy8s2anqkkrXDtEBskzDZA/NeC2/ERQmoh/tZkcojMQPBMiuIpvNV iHHh8oRNTU9kpb4SJUp312GEUsJBk76+PsPjfq+N8PK0lTcxdk4kl10Q KVK8v/aelAwUAMEx0iuUKgVtRTyv2syih13R+2o/whgXbjoUfOniJgKG jB1a1z2Zewpm55tbzYXQy/xrb6dIkCE0nkwaeGTgScAd7nTvRtsWtFGf vtSeuycSU0a420lswXqfEukHkawwdf1aGHyVCcIsqpPuEC/dG8tPyeq1 QXh81A==
;; Received 1180 bytes from 199.7.83.42#53(l.root-servers.net) in 208 ms
stonybrook.edu. 172800 IN NS nocnoc.stonybrook.edu.
stonybrook.edu. 172800 IN NS whoisthere.stonybrook.edu.
stonybrook.edu. 172800 IN NS mewho.stonybrook.edu.
9DHS4EP5G85PF9NUFK06HEK0O48QGK77.edu. 86400 IN NSEC3 1 1 0 - 9DQL407IJB4JHADMF7CJMUFNQMR4DF7M NS SOA RRSIG DNSKEY NSEC3PARAM
9DHS4EP5G85PF9NUFK06HEK0O48QGK77.edu. 86400 IN RRSIG NSEC3 8 2 86400 20220918062633 20220911051633 18290 edu. Hvu8eDTucRxzWdZ5jDojrDPfpgPqkOY1399EhGlKvKl+LQDW1wAX7/kj 43tmh164Hioqtel0Escf+ckI NXc9QJa35m4ApJI62C/jalw5L4LrKUT3 pABgL6sjRKnsUjyz10QIbCxQadv7euWY+op48FkgEdDmDDeqp+EE68y8 xROMW21L8coa7s7knQ9k/MvYgziStMdGGkoLJV6g6tDUqQ==
5QUVLNF6E17QV9C2K9J5LBSH21TUA4EK.edu. 86400 IN NSEC3 1 1 0 - 63JI114DIUDFGFMUA6OO5CIS1M6TMTSE NS DS RRSIG
5QUVLNF6E17QV9C2K9J5LBSH21TUA4EK.edu. 86400 IN RRSIG NSEC3 8 2 86400 20220919230015 20220912215015 18290 edu. eYkd8Fk9cWbiih8R9dfmOW/Nkl6vRMbfO/feAalvbEde68JuO309NEC3 v47M419ubb1Mi1lzMe7bii1S
22:00



6. (10 pts) A server www.foo.com is interested in using a CDN to scale its operations. To do this, foo.com registers an image on its site (img1.foo.com) with the CDN and receives a CNAME.

(i) Explain how foo.com uses DNS redirection so that a browser will download the image from the CDN instead of the server **If the CNAME that we received was img1.cdn. You register the CNAME that we received from the CDN with a DNS authoritative name server (img1.foo.com IN CNAME img1.cdn). After it is registered, the browser is redirected to img1.cdn in order to download the image from the CDN instead of the server and the CDN will occasionally refresh the content.**

(ii) Explain how foo.com redirects the browser to the CDN but does not use DNS redirection **If foo.com wanted to redirect the browser to the CDN for the image without using DNS redirection, foo.com would have to change the original URL (img1.foo.com) embedded into the index.HTML file of www.foo.com to the new CDNs URL which we assume to be something similar to img1.cdn.**