1)
rskelly@Jon-Snow:~$ dig

; <<>> DiG 9.16.1-Ubuntu <<>>
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 45947
;; flags: qr rd ad; QUERY: 1, ANSWER: 26, AUTHORITY: 0, ADDITIONAL: 0
;; WARNING: recursion requested but not available

;; QUESTION SECTION:
;.   IN   NS

;; ANSWER SECTION:
.   0   IN   NS   l.root-servers.net.
.   0   IN   NS   m.root-servers.net.
.   0   IN   NS   j.root-servers.net.
.   0   IN   NS   b.root-servers.net.
.   0   IN   NS   c.root-servers.net.
.   0   IN   NS   a.root-servers.net.
.   0   IN   NS   h.root-servers.net.
.   0   IN   NS   f.root-servers.net.
.   0   IN   NS   i.root-servers.net.
.   0   IN   NS   e.root-servers.net.
.   0   IN   NS   d.root-servers.net.
.   0   IN   NS   g.root-servers.net.
.   0   IN   NS   k.root-servers.net.
j.root-servers.net.   0   IN   A   **192.58.128.30**
j.root-servers.net.   0   IN   AAAA   2001:503:c27::2:30
b.root-servers.net.   0   IN   A   199.9.14.201
b.root-servers.net.   0   IN   AAAA   2001:500:200::b
c.root-servers.net.   0   IN   A   192.33.4.12
c.root-servers.net.   0   IN   AAAA   2001:500:2::c
a.root-servers.net.   0   IN   A   198.41.0.4
a.root-servers.net.   0   IN   AAAA   2001:503:ba3e::2:30
h.root-servers.net.   0   IN   A   198.97.190.53
h.root-servers.net.   0   IN   AAAA   2001:500:1::53
f.root-servers.net.   0   IN   A   192.5.5.241
f.root-servers.net.   0   IN   AAAA   2001:500:2f::f
i.root-servers.net.   0   IN   A   192.36.148.17

;; Query time: 0 msec
;; SERVER: 172.31.128.1#53(172.31.128.1)
;; WHEN: Sun Oct 02 19:00:15 EDT 2022

;; MSG SIZE rcvd: 838

rskelly@Jon-Snow:~$ dig ryanskelly.com @192.58.128.30

; <<>> DiG 9.16.1-Ubuntu <<>> ryanskelly.com @192.58.128.30
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 13738
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 13, ADDITIONAL: 27
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;ryanskelly.com.   IN   A

;; AUTHORITY SECTION:
com.   172800 IN   NS   e.gtld-servers.net.
com.   172800 IN   NS   b.gtld-servers.net.
com.   172800 IN   NS   j.gtld-servers.net.
com.   172800 IN   NS   m.gtld-servers.net.
com.   172800 IN   NS   i.gtld-servers.net.
com.   172800 IN   NS   f.gtld-servers.net.
com.   172800 IN   NS   a.gtld-servers.net.
com.   172800 IN   NS   g.gtld-servers.net.
com.   172800 IN   NS   h.gtld-servers.net.
com.   172800 IN   NS   l.gtld-servers.net.
com.   172800 IN   NS   k.gtld-servers.net.
com.   172800 IN   NS   c.gtld-servers.net.
com.   172800 IN   NS   d.gtld-servers.net.

;; ADDITIONAL SECTION:
e.gtld-servers.net.   172800 IN   A   **192.12.94.30**
e.gtld-servers.net.   172800 IN   AAAA   2001:502:1ca1::30
b.gtld-servers.net.   172800 IN   A   192.33.14.30
b.gtld-servers.net.   172800 IN   AAAA   2001:503:231d::2:30
j.gtld-servers.net.   172800 IN   A   192.48.79.30
j.gtld-servers.net.   172800 IN   AAAA   2001:502:7094::30
m.gtld-servers.net.   172800 IN   A   192.55.83.30
m.gtld-servers.net.   172800 IN   AAAA   2001:501:b1f9::30
i.gtld-servers.net.   172800 IN   A   192.43.172.30
i.gtld-servers.net.   172800 IN   AAAA   2001:503:39c1::30
f.gtld-servers.net.   172800 IN   A   192.35.51.30
f.gtld-servers.net.   172800 IN   AAAA   2001:503:d414::30

```
a.gtld-servers.net.    172800  IN     A      192.5.6.30
a.gtld-servers.net.    172800  IN     AAAA   2001:503:a83e::2:30
g.gtld-servers.net.    172800  IN     A      192.42.93.30
g.gtld-servers.net.    172800  IN     AAAA   2001:503:eea3::30
h.gtld-servers.net.    172800  IN     A      192.54.112.30
h.gtld-servers.net.    172800  IN     AAAA   2001:502:8cc::30
l.gtld-servers.net.    172800  IN     A      192.41.162.30
l.gtld-servers.net.    172800  IN     AAAA   2001:500:d937::30
k.gtld-servers.net.    172800  IN     A      192.52.178.30
k.gtld-servers.net.    172800  IN     AAAA   2001:503:d2d::30
c.gtld-servers.net.    172800  IN     A      192.26.92.30
c.gtld-servers.net.    172800  IN     AAAA   2001:503:83eb::30
d.gtld-servers.net.    172800  IN     A      192.31.80.30
d.gtld-servers.net.    172800  IN     AAAA   2001:500:856e::30

;; Query time: 30 msec
;; SERVER: 192.58.128.30#53(192.58.128.30)
;; WHEN: Sun Oct 02 19:00:54 EDT 2022
;; MSG SIZE  rcvd: 839
```

rskelly@Jon-Snow:~$ dig ryanskelly.com @192.12.94.30

```
; <<>> DiG 9.16.1-Ubuntu <<>> ryanskelly.com @192.12.94.30
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 57493
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 2, ADDITIONAL: 3
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;ryanskelly.com.                 IN     A

;; AUTHORITY SECTION:
ryanskelly.com.      172800  IN     NS     ns1.dotster.com.
ryanskelly.com.      172800  IN     NS     ns2.dotster.com.

;; ADDITIONAL SECTION:
ns1.dotster.com.       172800  IN     A      66.96.142.146
ns2.dotster.com.       172800  IN     A      65.254.254.170

;; Query time: 20 msec
;; SERVER: 192.12.94.30#53(192.12.94.30)
```

;; WHEN: Sun Oct 02 19:01:26 EDT 2022
;; MSG SIZE rcvd: 119

rskelly@Jon-Snow:~$ dig ryanskelly.com @66.96.142.146

; <<>> DiG 9.16.1-Ubuntu <<>> ryanskelly.com @66.96.142.146
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 15639
;; flags: qr aa rd; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
;; QUESTION SECTION:
;ryanskelly.com.   IN   A

;; ANSWER SECTION:
ryanskelly.com.   3600   IN   A   **66.96.149.25**

;; Query time: 20 msec
;; SERVER: **66.96.142.146**#53(66.96.142.146)
;; WHEN: Sun Oct 02 19:02:17 EDT 2022
;; MSG SIZE rcvd: 59

rskelly@Jon-Snow:~$

2)
.   518400   IN   NS   j.root-servers.net.
Initial Host name

j.root-servers.net.   518400   IN   A   192.58.128.30
TLD IP

e.gtld-servers.net.   172800   IN   A   192.12.94.30
Next under 192.58.128.30

This was where my search concluded as there wasn't a listing for ns1.dotster.com. under the root.zone file

3)
root@Jon-Snow:/home/rskelly# traceroute 192.58.128.30
traceroute to 192.58.128.30 (192.58.128.30), 30 hops max, 60 byte packets
 1 Jon-Snow.mshome.net (172.31.128.1) 0.278 ms 0.259 ms 0.251 ms

 2 10.0.0.1 (10.0.0.1) 5.663 ms 6.725 ms 10.918 ms
 3 96.120.70.25 (96.120.70.25) 21.142 ms 25.175 ms 24.447 ms
 4 96.108.59.177 (96.108.59.177) 21.919 ms 23.309 ms 23.728 ms
 5 96.108.158.197 (96.108.158.197) 27.488 ms 28.006 ms 24.079 ms
 6 162.151.151.225 (162.151.151.225) 22.380 ms 27.976 ms 27.315 ms
 7 162.151.150.125 (162.151.150.125) 31.315 ms * *
 8 162.151.52.34 (162.151.52.34) 21.359 ms 162.151.52.50 (162.151.52.50) 21.733 ms
20.851 ms
 9 * * *
10 4.69.148.33 (4.69.148.33) 27.866 ms 33.426 ms 32.976 ms
11 4.7.5.174 (4.7.5.174) 37.308 ms 94.436 ms 93.923 ms

^^^This traceroute was run on my local machine, using:
Jon-Snow.mshome.net (172.31.128.1) -> 10.0.0.1 (10.0.0.1) -> 96.120.70.25 (96.120.70.25)

core2.abq1.he.net> traceroute 192.58.128.30 source 216.218.252.70
 traceroute to 192.58.128.30 (192.58.128.30), 30 hops max, 60 byte packets

 1 * * *

 2 * * *

 3 192.58.128.30 (192.58.128.30) 10.988 ms 11.158 ms 11.281 ms

^^^This traceroute was run using Hurricane Electric's [H5 Data Centers ABQ 1, Albuquerque]
host, as you can see, this location was able to find a host with that address(although its not a
listing with the corresponding 'j.root-servers.net' HN), another odd effect is it getting the listing
on the first hop

core2.bos1.he.net> traceroute 192.58.128.30 source 216.218.253.32
 traceroute to 192.58.128.30 (192.58.128.30), 30 hops max, 60 byte packets

 1 * * *

 2 * * *

 3 ge-0-1-0.r1.bb-fo.nyc3.vrsn.net (198.32.160.193) 6.602 ms 7.398 ms 7.468 ms

 4 209.131.139.127 (209.131.139.127) 18.518 ms 18.650 ms 18.775 ms

 5 j.root-servers.net (192.58.128.30) 6.625 ms 7.948 ms 7.732 ms

^^^This traceroute was run Hurricane Electric's [One Summer Boston] host and this host
successfully resolved the j.root-servers.net in 3 hops

4)
1. What is the name of the program that initiated the network traffic captured in the trace?
    a. This was done by a web browser, resolving and fetching resources from unh.edu
2. What is the hostname of the machine where the command was executed?
    a. unh.edu
3. What type of a query did the client make? Was an IPv6 address requested?
    a. No, in the capture the client requested the HTTP webpage from the nginx server, and it performed a HEAD request
4. How long did the name resolution (DNS) take?
    a. ~0.0005s or 5.82ms
5. Was the DNS response authoritative?
    a. No, it was non-authoritative judging by the A bit in the response
6. Was the client successful in retrieving the content?
    a. No, the resource that was requested was permanently moved, based on the HTTP 301 response code