

# Lab Exercise 3: DNS & Socket Programming

zid: z5228006 name: MINGLANG XIE

## Exercise 3: Digging into DNS:

### Question 1:

The IP address of [www.eecs.berkeley.edu](http://www.eecs.berkeley.edu) is 23.185.0.1. To get this answer we sent a type A query.

### Question 2:

The CNAME is live-eecs.pantheonsite.io (canonical name is usually long and hard to remember). An alias for this server is a mnemonic that easy to remember, and it is useful when running multiple services from a single IP address.

### Question 3:

ns-233.awsdns-29.com, ns-644.awsdns-16.net, ns-2013.awsdns-59.co.uk, ns-1213.awsdns-23.org are the authoritative name serves for eecs.berkeley.edu.

The addition section contains IP address for these four authoritative name servers. The AAAA records are for IPv6 address

### Question 4:

The IP address of the local nameserver for my machine is included at the end of the output, 129.94.242.2#53. This is the local DNS server for the CSE network. It is made by connecting the CSE login servers via SSH.

### Question 5:

```
wagner % dig eecs.berkeley.edu NS
; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> eecs.berkeley.edu NS
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 61190
;; flags: qr rd ra; QUERY: 1, ANSWER: 5, AUTHORITY: 0, ADDITIONAL: 9
;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:;, udp: 4096
;; QUESTION SECTION:
;eecs.berkeley.edu.          IN      NS
;; ANSWER SECTION:
eecs.berkeley.edu.          18582   IN      NS      ns.eecs.berkeley.edu.
eecs.berkeley.edu.          18582   IN      NS      ns.cs.berkeley.edu.
eecs.berkeley.edu.          18582   IN      NS      adns3.berkeley.edu.
eecs.berkeley.edu.          18582   IN      NS      adns2.berkeley.edu.
eecs.berkeley.edu.          18582   IN      NS      adns1.berkeley.edu.
;; ADDITIONAL SECTION:
ns.cs.berkeley.edu.         62187   IN      A        169.229.60.61
ns.eecs.berkeley.edu.       62995   IN      A        169.229.60.153
adns1.berkeley.edu.         2303    IN      A        128.32.136.3
adns1.berkeley.edu.         2303    IN      AAAA     2607:f140:ffff:fffe::3
adns2.berkeley.edu.         7891    IN      A        128.32.136.14
adns2.berkeley.edu.         2303    IN      AAAA     2607:f140:ffff:fffe::e
adns3.berkeley.edu.         10379   IN      A        192.107.102.142
adns3.berkeley.edu.         48422   IN      AAAA     2607:f140:a000:d::abc
;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Fri Oct 09 17:09:16 AEDT 2020
;; MSG SIZE rcvd: 307
```

The nameservers for the “eecs.berkeley.edu” domain are ns.eecs/ns.CS/adns3/adns2/adns1.berkeley.edu, and their IP address are: 169.229.60.153, 169.229.60.61, 2607:f140:a000:d::abc, 2607:f140:ffff:ffe::e, 2607:f140:ffff:ffe::3. (Note that AAAA records are for the IPv6 address)

#### Question 6:

We use reverse DNS for this:

```
wagner % dig -x 111.68.101.54

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> -x 111.68.101.54
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 34800
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 3

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;54.101.68.111.in-addr.arpa.      IN      PTR

;; ANSWER SECTION:
54.101.68.111.in-addr.arpa. 3388 IN      PTR      webserver.seecs.nust.edu.pk.

;; AUTHORITY SECTION:
101.68.111.in-addr.arpa. 66868 IN      NS       ns2.hec.gov.pk.
101.68.111.in-addr.arpa. 66868 IN      NS       ns1.hec.gov.pk.

;; ADDITIONAL SECTION:
ns1.hec.gov.pk.           3388 IN      A        103.4.93.5
ns2.hec.gov.pk.           3388 IN      A        103.4.93.6

;; Query time: 5 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Fri Oct 09 17:44:04 AEDT 2020
;; MSG SIZE rcvd: 172
```

The hostname corresponding to 111.68.101.54 is webserver.seecs.nust.edu.pk.

#### Question 7:

```
wagner % dig @129.94.242.33 yahoo.com MX

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @129.94.242.33 yahoo.com MX
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 15860
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 5, ADDITIONAL: 10

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

;; ANSWER SECTION:
yahoo.com.                1800    IN      MX      1 mta6.am0.yahoodns.net.
yahoo.com.                1800    IN      MX      1 mta7.am0.yahoodns.net.
yahoo.com.                1800    IN      MX      1 mta5.am0.yahoodns.net.

;; AUTHORITY SECTION:
yahoo.com.                57791   IN      NS      ns3.yahoo.com.
yahoo.com.                57791   IN      NS      ns2.yahoo.com.
yahoo.com.                57791   IN      NS      ns1.yahoo.com.
yahoo.com.                57791   IN      NS      ns5.yahoo.com.
yahoo.com.                57791   IN      NS      ns4.yahoo.com.

;; ADDITIONAL SECTION:
ns1.yahoo.com.            316950  IN      A        68.180.131.16
ns1.yahoo.com.            12556   IN      AAAA     2001:4998:130::1001
ns2.yahoo.com.            334377  IN      A        68.142.255.16
ns2.yahoo.com.            76724   IN      AAAA     2001:4998:140::1002
ns3.yahoo.com.            998      IN      A        27.123.42.42
ns3.yahoo.com.            506      IN      AAAA     2406:8600:f03f:1f8::1003
ns4.yahoo.com.            65568   IN      A        98.138.11.157
ns5.yahoo.com.            20639   IN      A        202.165.97.53
ns5.yahoo.com.            26916   IN      AAAA     2406:2000:ff60::53

;; Query time: 195 msec
;; SERVER: 129.94.242.33#53(129.94.242.33)
;; WHEN: Fri Oct 09 17:48:04 AEDT 2020
;; MSG SIZE rcvd: 399
```

We did not get an authoritative answer from the server we queried (orchestra.cse.unsw.edu.au) since the flags do not contain aa. This is because it only has authority for the cse.unsw.edu.au domain, but not for the Yahoo domain.

Question 8:

```
wagner % dig @ns.eecs.berkeley.edu yahoo.com MX

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @ns.eecs.berkeley.edu yahoo.com MX
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: REFUSED, id: 49954
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 1
;; WARNING: recursion requested but not available

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

;; Query time: 166 msec
;; SERVER: 169.229.60.153#53(169.229.60.153)
;; WHEN: Fri Oct 09 18:10:21 AEDT 2020
;; MSG SIZE rcvd: 38
```

when we try the berkeley nameservers we do not get a response. The status of the reply is REFUSED. The reason could be that these name servers do not reply to DNS queries that are sent from devices which are not part of the Berkeley network, for security measure.

#### Question 9:

We query one of the authoritative nameservers for the domain yahoo.com:

```

weber % dig @ns3.yahoo.com yahoo.com MX

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @ns3.yahoo.com yahoo.com MX
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 40975
;; flags: qr aa rd; QUERY: 1, ANSWER: 3, AUTHORITY: 5, ADDITIONAL: 10
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1272
;; QUESTION SECTION:
;yahoo.com.                IN      MX

;; ANSWER SECTION:
yahoo.com.                1800    IN      MX      1 mta6.am0.yahoodns.net.
yahoo.com.                1800    IN      MX      1 mta7.am0.yahoodns.net.
yahoo.com.                1800    IN      MX      1 mta5.am0.yahoodns.net.

;; AUTHORITY SECTION:
yahoo.com.                172800  IN      NS      ns5.yahoo.com.
yahoo.com.                172800  IN      NS      ns2.yahoo.com.
yahoo.com.                172800  IN      NS      ns1.yahoo.com.
yahoo.com.                172800  IN      NS      ns3.yahoo.com.
yahoo.com.                172800  IN      NS      ns4.yahoo.com.

;; ADDITIONAL SECTION:
ns1.yahoo.com.            1209600 IN      A       68.180.131.16
ns2.yahoo.com.            1209600 IN      A       68.142.255.16
ns3.yahoo.com.            1800    IN      A       27.123.42.42
ns4.yahoo.com.            1209600 IN      A       98.138.11.157
ns5.yahoo.com.            86400   IN      A       202.165.97.53
ns1.yahoo.com.            86400   IN      AAAA    2001:4998:130::1001
ns2.yahoo.com.            86400   IN      AAAA    2001:4998:140::1002
ns3.yahoo.com.            1800    IN      AAAA    2406:8600:f03f:1f8::1003
ns5.yahoo.com.            86400   IN      AAAA    2406:2000:ff60::53

;; Query time: 391 msec
;; SERVER: 27.123.42.42#53(27.123.42.42)
;; WHEN: Fri Oct 09 19:15:52 AEDT 2020
;; MSG SIZE rcvd: 399

```

Question 10:

Assume the current hostname is lyre00.cse.unsw.edu.au. First query for the IP address of the root domain.

```

weber % dig . NS

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> . NS
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 55755
;; flags: qr rd ra; QUERY: 1, ANSWER: 13, AUTHORITY: 0, ADDITIONAL: 27

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;.                               IN      NS

;; ANSWER SECTION:
.                               51685   IN      NS      b.root-servers.net.
.                               51685   IN      NS      a.root-servers.net.
.                               51685   IN      NS      k.root-servers.net.
.                               51685   IN      NS      g.root-servers.net.
.                               51685   IN      NS      c.root-servers.net.
.                               51685   IN      NS      l.root-servers.net.
.                               51685   IN      NS      i.root-servers.net.
.                               51685   IN      NS      h.root-servers.net.
.                               51685   IN      NS      e.root-servers.net.
.                               51685   IN      NS      m.root-servers.net.
.                               51685   IN      NS      f.root-servers.net.
.                               51685   IN      NS      j.root-servers.net.
.                               51685   IN      NS      d.root-servers.net.

;; ADDITIONAL SECTION:
a.root-servers.net. 320284 IN      A       198.41.0.4
a.root-servers.net. 425083 IN      AAAA    2001:503:ba3e::2:30
b.root-servers.net. 434198 IN      A       199.9.14.201
b.root-servers.net. 155673 IN      AAAA    2001:500:200::b
c.root-servers.net. 270213 IN      A       192.33.4.12
c.root-servers.net. 270213 IN      AAAA    2001:500:2::c
d.root-servers.net. 270213 IN      A       199.7.91.13
d.root-servers.net. 270213 IN      AAAA    2001:500:2d::d
e.root-servers.net. 362092 IN      A       192.203.230.10
e.root-servers.net. 416669 IN      AAAA    2001:500:a8::e
f.root-servers.net. 487831 IN      A       192.5.5.241
f.root-servers.net. 155673 IN      AAAA    2001:500:2f::f
g.root-servers.net. 352598 IN      A       192.112.36.4
g.root-servers.net. 155673 IN      AAAA    2001:500:12::d0d
h.root-servers.net. 362092 IN      A       198.97.190.53
h.root-servers.net. 155672 IN      AAAA    2001:500:1::53
i.root-servers.net. 335851 IN      A       192.36.148.17
i.root-servers.net. 335851 IN      AAAA    2001:7fe::53
j.root-servers.net. 337717 IN      A       192.58.128.30
j.root-servers.net. 155673 IN      AAAA    2001:503:c27::2:30
k.root-servers.net. 337019 IN      A       193.0.14.129
k.root-servers.net. 506619 IN      AAAA    2001:7fd::1
l.root-servers.net. 399461 IN      A       199.7.83.42
l.root-servers.net. 155672 IN      AAAA    2001:500:9f::42
m.root-servers.net. 391683 IN      A       202.12.27.33
m.root-servers.net. 155672 IN      AAAA    2001:dc3::35

;; Query time: 1 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Fri Oct 09 19:18:38 AEDT 2020
;; MSG SIZE rcvd: 811

```

Next query one of the root nameservers:

```

weber % dig @198.41.0.4 lyre00.cse.unsw.edu.au NS

; <<> DiG 9.9.5-9+deb8u19-Debian <<> @198.41.0.4 lyre00.cse.unsw.edu.au NS
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 4595
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 9, ADDITIONAL: 19
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1472
;; QUESTION SECTION:
;lyre00.cse.unsw.edu.au.                IN      NS

;; AUTHORITY SECTION:
au.                172800 IN      NS      a.au.
au.                172800 IN      NS      c.au.
au.                172800 IN      NS      d.au.
au.                172800 IN      NS      m.au.
au.                172800 IN      NS      n.au.
au.                172800 IN      NS      q.au.
au.                172800 IN      NS      r.au.
au.                172800 IN      NS      s.au.
au.                172800 IN      NS      t.au.

;; ADDITIONAL SECTION:
a.au.                172800 IN      A       58.65.254.73
c.au.                172800 IN      A       162.159.24.179
d.au.                172800 IN      A       162.159.25.38
m.au.                172800 IN      A       156.154.100.24
n.au.                172800 IN      A       156.154.101.24
q.au.                172800 IN      A       65.22.196.1
r.au.                172800 IN      A       65.22.197.1
s.au.                172800 IN      A       65.22.198.1
t.au.                172800 IN      A       65.22.199.1
a.au.                172800 IN      AAAA    2407:6e00:254:306::73
c.au.                172800 IN      AAAA    2400:cb00:2049:1::a29f:18b3
d.au.                172800 IN      AAAA    2400:cb00:2049:1::a29f:1926
m.au.                172800 IN      AAAA    2001:502:2eda::24
n.au.                172800 IN      AAAA    2001:502:ad09::24
q.au.                172800 IN      AAAA    2a01:8840:be::1
r.au.                172800 IN      AAAA    2a01:8840:bf::1
s.au.                172800 IN      AAAA    2a01:8840:c0::1
t.au.                172800 IN      AAAA    2a01:8840:c1::1

;; Query time: 117 msec
;; SERVER: 198.41.0.4#53(198.41.0.4)
;; WHEN: Fri Oct 09 19:24:21 AEDT 2020
;; MSG SIZE rcvd: 591

```

Next query to one of the au. nameservers:

```

weber % dig @58.65.254.73 lyre00.cse.unsw.edu.au NS

; <<> DiG 9.9.5-9+deb8u19-Debian <<> @58.65.254.73 lyre00.cse.unsw.edu.au NS
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 37846
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 4, ADDITIONAL: 9
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags::; udp: 4096
;; QUESTION SECTION:
;lyre00.cse.unsw.edu.au.          IN      NS

;; AUTHORITY SECTION:
edu.au.      86400    IN      NS      q.au.
edu.au.      86400    IN      NS      t.au.
edu.au.      86400    IN      NS      s.au.
edu.au.      86400    IN      NS      r.au.

;; ADDITIONAL SECTION:
q.au.        86400    IN      A        65.22.196.1
r.au.        86400    IN      A        65.22.197.1
s.au.        86400    IN      A        65.22.198.1
t.au.        86400    IN      A        65.22.199.1
q.au.        86400    IN      AAAA     2a01:8840:be::1
r.au.        86400    IN      AAAA     2a01:8840:bf::1
s.au.        86400    IN      AAAA     2a01:8840:c0::1
t.au.        86400    IN      AAAA     2a01:8840:c1::1

;; Query time: 159 msec
;; SERVER: 58.65.254.73#53(58.65.254.73)
;; WHEN: Fri Oct 09 19:27:19 AEDT 2020
;; MSG SIZE rcvd: 291

```

Next query to one of the edu.au. nameservers:

```

weber % dig @65.22.196.1 lyre00.cse.unsw.edu.au NS

; <<> DiG 9.9.5-9+deb8u19-Debian <<> @65.22.196.1 lyre00.cse.unsw.edu.au NS
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 10652
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 3, ADDITIONAL: 6
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags::; udp: 4096
;; QUESTION SECTION:
;lyre00.cse.unsw.edu.au.          IN      NS

;; AUTHORITY SECTION:
unsw.edu.au. 900      IN      NS      ns1.unsw.edu.au.
unsw.edu.au. 900      IN      NS      ns3.unsw.edu.au.
unsw.edu.au. 900      IN      NS      ns2.unsw.edu.au.

;; ADDITIONAL SECTION:
ns1.unsw.edu.au. 900    IN      A        129.94.0.192
ns2.unsw.edu.au. 900    IN      A        129.94.0.193
ns3.unsw.edu.au. 900    IN      A        192.155.82.178
ns1.unsw.edu.au. 900    IN      AAAA     2001:388:c:35::1
ns2.unsw.edu.au. 900    IN      AAAA     2001:388:c:35::2

;; Query time: 24 msec
;; SERVER: 65.22.196.1#53(65.22.196.1)
;; WHEN: Fri Oct 09 19:29:19 AEDT 2020
;; MSG SIZE rcvd: 209

```

Next query to one of the unsw.edu.au. nameservers:



```

weber % dig @129.94.0.192 lyre00.cse.unsw.edu.au NS

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @129.94.0.192 lyre00.cse.unsw.edu.au NS
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 29298
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 2, ADDITIONAL: 5
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:: udp: 4096
;; QUESTION SECTION:
;lyre00.cse.unsw.edu.au.                IN      NS

;; AUTHORITY SECTION:
cse.unsw.edu.au.          10800    IN      NS      beethoven.orchestra.cse.unsw.edu.au.
cse.unsw.edu.au.          10800    IN      NS      maestro.orchestra.cse.unsw.edu.au.

;; ADDITIONAL SECTION:
beethoven.orchestra.cse.unsw.edu.au. 10800 IN A 129.94.242.2
beethoven.orchestra.cse.unsw.edu.au. 10800 IN A 129.94.172.11
beethoven.orchestra.cse.unsw.edu.au. 10800 IN A 129.94.208.3
maestro.orchestra.cse.unsw.edu.au. 10800 IN A 129.94.242.33

;; Query time: 4 msec
;; SERVER: 129.94.0.192#53(129.94.0.192)
;; WHEN: Fri Oct 09 19:30:21 AEDT 2020
;; MSG SIZE rcvd: 171

```

Next query to one of the cse.unsw.edu.au. nameservers (However, we use type A for this query):

```

weber % dig @129.94.242.2 lyre00.cse.unsw.edu.au A

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @129.94.242.2 lyre00.cse.unsw.edu.au A
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 2421
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 2, ADDITIONAL: 3

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:: udp: 4096
;; QUESTION SECTION:
;lyre00.cse.unsw.edu.au.                IN      A

;; ANSWER SECTION:
lyre00.cse.unsw.edu.au. 3600    IN      A      129.94.210.20

;; AUTHORITY SECTION:
cse.unsw.edu.au.          3600    IN      NS      maestro.orchestra.cse.unsw.edu.au.
cse.unsw.edu.au.          3600    IN      NS      beethoven.orchestra.cse.unsw.edu.au.

;; ADDITIONAL SECTION:
maestro.orchestra.cse.unsw.edu.au. 3600 IN A 129.94.242.33
beethoven.orchestra.cse.unsw.edu.au. 3600 IN A 129.94.242.2

;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Fri Oct 09 19:32:20 AEDT 2020
;; MSG SIZE rcvd: 155

```

The IP address for lyre00.cse.unsw.edu.au is 129.94.210.20. Starting from the root name server, 5 DNS servers need to be queried.

#### Question 11:

Yes, a physical machine can have several names and/or IP addresses, and a IP address may have been associated with several hostname.