COMP3331 Lab Week 3

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z5310199, June 2021

Lab Exercise 3: DNS Socket Programming

Exercise 3

1. The IP address of www.eecs.berkeley.edu. Is 23.185.0.1. The DNS query of type A was used to get this answer.

```
z5310199@vx2:/tmp_amd/cage/export/cage/5/z5310199/COMP_stuff$ dig www.eecs.berkeley.edu

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> www.eecs.berkeley.edu
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 59838
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 4, ADDITIONAL: 9

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.eecs.berkeley.edu.         IN      A

;; ANSWER SECTION:
www.eecs.berkeley.edu.  73200   IN      CNAME   live-eecs.pantheonsite.io.
live-eecs.pantheonsite.io. 193  IN      CNAME   fe1.edge.pantheon.io.
fe1.edge.pantheon.io.   300     IN      A       23.185.0.1

;; AUTHORITY SECTION:
edge.pantheon.io.       300     IN      NS      ns-233.awsdns-29.com.
edge.pantheon.io.       300     IN      NS      ns-2013.awsdns-59.co.uk.
edge.pantheon.io.       300     IN      NS      ns-1213.awsdns-23.org.
edge.pantheon.io.       300     IN      NS      ns-644.awsdns-16.net.

;; ADDITIONAL SECTION:
ns-233.awsdns-29.com.   66365   IN      A       205.251.192.233
ns-233.awsdns-29.com.   66365   IN      AAAA    2600:9000:5300:e900::1
ns-644.awsdns-16.net.   2129    IN      A       205.251.194.132
ns-644.awsdns-16.net.   2129    IN      AAAA    2600:9000:5302:8400::1
ns-1213.awsdns-23.org.  63436   IN      A       205.251.196.189
ns-1213.awsdns-23.org.  63436   IN      AAAA    2600:9000:5304:bd00::1
ns-2013.awsdns-59.co.uk. 5581   IN      A       205.251.199.221
ns-2013.awsdns-59.co.uk. 5581   IN      AAAA    2600:9000:5307:dd00::1

;; Query time: 10 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Wed Jun 23 18:59:40 AEST 2021
;; MSG SIZE  rcvd: 453
```

2. The canonical name for www.eecs.berkeley.edu is live-eecs.pantheonsite.io. A possible reason why this server has a canonical name might be because it is utilising a CDN. CDN often use CNAME to map a web address to their own domain that hosts that address.

```
z5310199@vx2:/tmp_amd/cage/export/cage/5/z5310199/COMP_stuff$ dig www.eecs.berkeley.edu

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> www.eecs.berkeley.edu
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 59838
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 4, ADDITIONAL: 9

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.eecs.berkeley.edu.         IN      A

;; ANSWER SECTION:
www.eecs.berkeley.edu.  73200   IN      CNAME   live-eecs.pantheonsite.io.
live-eecs.pantheonsite.io. 193  IN      CNAME   fe1.edge.pantheon.io.
fe1.edge.pantheon.io.   300     IN      A       23.185.0.1
```

3. The Authority Section shows all the nameservers that has the authority to respond to queries for www.eecs.berkeley. The Additional Section contains all the IPv4 and IPv6 addresses of these nameservers (A records resolve hostname with IPv4 address whereas AAAA record resolves IPv6 addresses).

```
;; AUTHORITY SECTION:
edge.pantheon.io.       300     IN      NS      ns-233.awsdns-29.com.
edge.pantheon.io.       300     IN      NS      ns-2013.awsdns-59.co.uk.
edge.pantheon.io.       300     IN      NS      ns-1213.awsdns-23.org.
edge.pantheon.io.       300     IN      NS      ns-644.awsdns-16.net.

;; ADDITIONAL SECTION:
ns-233.awsdns-29.com.   66365   IN      A       205.251.192.233
ns-233.awsdns-29.com.   66365   IN      AAAA    2600:9000:5300:e900::1
ns-644.awsdns-16.net.   2129    IN      A       205.251.194.132
ns-644.awsdns-16.net.   2129    IN      AAAA    2600:9000:5302:8400::1
ns-1213.awsdns-23.org.  63436   IN      A       205.251.196.189
ns-1213.awsdns-23.org.  63436   IN      AAAA    2600:9000:5304:bd00::1
ns-2013.awsdns-59.co.uk. 5581   IN      A       205.251.199.221
ns-2013.awsdns-59.co.uk. 5581   IN      AAAA    2600:9000:5307:dd00::1
```

4. The IP address of my local nameserver (currently on CSE machine) is 129.94.242.2.

```
;; Query time: 10 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Wed Jun 23 18:59:40 AEST 2021
;; MSG SIZE  rcvd: 453
```

5. The nameservers for eecs.berkeley.edu and their corresponding IPv4 and IPv6 addresses are:
   - ns.CS.berkeley.edu => IPv4: 169.229.60.61,
   - adns3.berkeley.edu => IPv4: 192.107.102.142 & IPv6: 2607:f140:a000:d::abc
   - adns1.berkeley.edu => IPv4: 128.32.136.3 & IPv6: 2607:f140:ffff:fffe::3
   - adns2.berkeley.edu => IPv4: 128.32.136.14 & IPv6: 2607:f140:ffff:fffe::e
   - ns.eecs.berkeley.edu => IPv4: 169.229.60.153.

   A DNS query of type A was used to get this answer.

```
z5310199@vx2:/tmp_amd/cage/export/cage/5/z5310199/COMP_stuff$ dig eecs.berkeley.edu

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> eecs.berkeley.edu
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 37224
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 5, ADDITIONAL: 9

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;eecs.berkeley.edu.             IN      A

;; ANSWER SECTION:
eecs.berkeley.edu.      2357    IN      A       23.185.0.1

;; AUTHORITY SECTION:
eecs.berkeley.edu.      85854   IN      NS      ns.CS.berkeley.edu.
eecs.berkeley.edu.      85854   IN      NS      adns3.berkeley.edu.
eecs.berkeley.edu.      85854   IN      NS      adns1.berkeley.edu.
eecs.berkeley.edu.      85854   IN      NS      adns2.berkeley.edu.
eecs.berkeley.edu.      85854   IN      NS      ns.eecs.berkeley.edu.

;; ADDITIONAL SECTION:
ns.CS.berkeley.edu.     5709    IN      A       169.229.60.61
ns.eecs.berkeley.edu.   70152   IN      A       169.229.60.153
adns1.berkeley.edu.     6511    IN      A       128.32.136.3
adns1.berkeley.edu.     9342    IN      AAAA    2607:f140:ffff:fffe::3
adns2.berkeley.edu.     6511    IN      A       128.32.136.14
adns2.berkeley.edu.     7264    IN      AAAA    2607:f140:ffff:fffe::e
adns3.berkeley.edu.     7151    IN      A       192.107.102.142
adns3.berkeley.edu.     9342    IN      AAAA    2607:f140:a000:d::abc

;; Query time: 0 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Wed Jun 23 19:42:02 AEST 2021
;; MSG SIZE  rcvd: 323
```

6. The DNS name that is associated with the IP address 111.68.101.54 is webserver.seecs.nust.edu.pk. A reverse DNS query was used to get this answer.

```
z5310199@vx2:/tmp_amd/cage/export/cage/5/z5310199/COMP_stuff$ 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: 23361
;; 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. 3600 IN     PTR     webserver.seecs.nust.edu.pk.

;; AUTHORITY SECTION:
101.68.111.in-addr.arpa. 2362   IN      NS      ns1.hec.gov.pk.
101.68.111.in-addr.arpa. 2362   IN      NS      ns2.hec.gov.pk.

;; ADDITIONAL SECTION:
ns1.hec.gov.pk.         3600    IN      A       103.4.93.5
ns2.hec.gov.pk.         3600    IN      A       103.4.93.6

;; Query time: 370 msec
;; SERVER: 129.94.242.2#53(129.94.242.2)
;; WHEN: Wed Jun 23 19:58:50 AEST 2021
;; MSG SIZE  rcvd: 172
```

7. Querying Yahoo Mail from CSE nameserver, 129.94.242.33, did not receive and authoritative answer. This is because from the flag field, there is no ‘aa’ (Authoritative Answer) flag. This means that the nameservers in the Authority Section are non-authoritative nameservers for the domain and is probably because CSE servers have no authority over Yahoo.com.

```
z5310199@vx3:/tmp_amd/cage/export/cage/5/z5310199/COMP_stuff$ 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: 24919
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 5, ADDITIONAL: 8

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

;; ANSWER SECTION:
yahoo.com.              1047    IN      MX      1 mta5.am0.yahoodns.net.
yahoo.com.              1047    IN      MX      1 mta6.am0.yahoodns.net.
yahoo.com.              1047    IN      MX      1 mta7.am0.yahoodns.net.

;; AUTHORITY SECTION:
yahoo.com.              132642  IN      NS      ns3.yahoo.com.
yahoo.com.              132642  IN      NS      ns4.yahoo.com.
yahoo.com.              132642  IN      NS      ns2.yahoo.com.
yahoo.com.              132642  IN      NS      ns1.yahoo.com.
yahoo.com.              132642  IN      NS      ns5.yahoo.com.

;; ADDITIONAL SECTION:
ns1.yahoo.com.          415632  IN      A       68.180.131.16
ns1.yahoo.com.          76268   IN      AAAA    2001:4998:130::1001
ns2.yahoo.com.          60445   IN      A       68.142.255.16
ns2.yahoo.com.          84331   IN      AAAA    2001:4998:140::1002
ns4.yahoo.com.          415464  IN      A       98.138.11.157
ns5.yahoo.com.          7687    IN      A       202.165.97.53
ns5.yahoo.com.          7687    IN      AAAA    2406:2000:ff60::53

;; Query time: 0 msec
;; SERVER: 129.94.242.33#53(129.94.242.33)
;; WHEN: Wed Jun 23 21:36:35 AEST 2021
;; MSG SIZE  rcvd: 355
```

8. Querying Yahoo.com from ns.CS.berkeley.edu resulted in the query being refused. This maybe because the server has blocked DNS querying under certain circumstances such as querying from a server explicitly outside their own, authoritative servers.

```
z5310199@vx3:/tmp_amd/cage/export/cage/5/z5310199/COMP_stuff$ dig @ns.CS.berkeley.edu  yahoo.com MX

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @ns.CS.berkeley.edu yahoo.com MX
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: REFUSED, id: 32799
;; 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: 169.229.60.61#53(169.229.60.61)
;; WHEN: Wed Jun 23 21:46:50 AEST 2021
;; MSG SIZE  rcvd: 38
```

9. By querying from a Yahoo server, ns2.yahoo.com (a non-authoritative answer from Question 7), we can obtain authoritative nameservers for this domain. The ‘aa’ flag is visible which indicates that the nameservers in the Authority Section are indeed authoritative. A DNS query of type MX was used to get this answer.

```
z5310199@vx3:/tmp_amd/cage/export/cage/5/z5310199/COMP_stuff$ dig @ns2.yahoo.com yahoo.com MX

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @ns2.yahoo.com yahoo.com MX
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 15627
;; 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 mta5.am0.yahoodns.net.
yahoo.com.              1800    IN      MX      1 mta6.am0.yahoodns.net.
yahoo.com.              1800    IN      MX      1 mta7.am0.yahoodns.net.

;; AUTHORITY SECTION:
yahoo.com.              172800  IN      NS      ns2.yahoo.com.
yahoo.com.              172800  IN      NS      ns5.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: 157 msec
;; SERVER: 68.142.255.16#53(68.142.255.16)
;; WHEN: Wed Jun 23 21:56:01 AEST 2021
;; MSG SIZE  rcvd: 399
```

10. Simulating iterative DNS query for lyre00.cse.unsw.edu.au:

    First iteration - finding the root server:

```
z5310199@vx3:/tmp_amd/cage/export/cage/5/z5310199/COMP_stuff$ dig . NS

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> . NS
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 6910
;; 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:
.                       124157  IN      NS      e.root-servers.net.
.                       124157  IN      NS      f.root-servers.net.
.                       124157  IN      NS      b.root-servers.net.
.                       124157  IN      NS      j.root-servers.net.
.                       124157  IN      NS      k.root-servers.net.
.                       124157  IN      NS      m.root-servers.net.
.                       124157  IN      NS      i.root-servers.net.
.                       124157  IN      NS      a.root-servers.net.
.                       124157  IN      NS      h.root-servers.net.
.                       124157  IN      NS      d.root-servers.net.
.                       124157  IN      NS      c.root-servers.net.
.                       124157  IN      NS      l.root-servers.net.
.                       124157  IN      NS      g.root-servers.net.

;; ADDITIONAL SECTION:
a.root-servers.net.     478317  IN      A       198.41.0.4
a.root-servers.net.     38623   IN      AAAA    2001:503:ba3e::2:30
b.root-servers.net.     148892  IN      A       199.9.14.201
b.root-servers.net.     148892  IN      AAAA    2001:500:200::b
c.root-servers.net.     147455  IN      A       192.33.4.12
c.root-servers.net.     81263   IN      AAAA    2001:500:2::c
d.root-servers.net.     487201  IN      A       199.7.91.13
d.root-servers.net.     513264  IN      AAAA    2001:500:2d::d
e.root-servers.net.     324629  IN      A       192.203.230.10
```

    We can choose an IP address of root server from the additional section (198.41.0.4).

    Second iteration – finding the authoritative nameserver for .au:

```
z5310199@vx3:/tmp_amd/cage/export/cage/5/z5310199/COMP_stuff$ 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: 35225
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 9, ADDITIONAL: 19
;; 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:
au.                     172800  IN      NS      m.au.
au.                     172800  IN      NS      d.au.
au.                     172800  IN      NS      q.au.
au.                     172800  IN      NS      t.au.
au.                     172800  IN      NS      s.au.
au.                     172800  IN      NS      r.au.
au.                     172800  IN      NS      n.au.
au.                     172800  IN      NS      a.au.
au.                     172800  IN      NS      c.au.

;; ADDITIONAL SECTION:
m.au.                   172800  IN      A       37.209.192.5
m.au.                   172800  IN      AAAA    2001:502:2eda::24
d.au.                   172800  IN      A       162.159.25.38
d.au.                   172800  IN      AAAA    2400:cb00:2049:1::a29f:1926
q.au.                   172800  IN      A       65.22.196.1
```

    We can choose the IP address of m.au (37.209.192.5) for the next iteration.

Third iteration – finding the authoritative nameserver for edu.au:

```
z5310199@vx3:/tmp_amd/cage/export/cage/5/z5310199/COMP_stuff$ dig @37.209.192.5 lyre00.cse.unsw.edu.au NS

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @37.209.192.5 lyre00.cse.unsw.edu.au NS
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 7744
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 4, ADDITIONAL: 1
;; 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      t.au.
edu.au.                 86400   IN      NS      s.au.
edu.au.                 86400   IN      NS      q.au.
edu.au.                 86400   IN      NS      r.au.
```

We can choose t.au as the address for next iteration (no additional information is provided).

Fourth iteration - finding the authoritative nameserver for unsw.edu.au:

```
z5310199@vx3:/tmp_amd/cage/export/cage/5/z5310199/COMP_stuff$ dig @t.au. lyre00.cse.unsw.edu.au NS

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @t.au. lyre00.cse.unsw.edu.au NS
; (2 servers found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 18712
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 3, ADDITIONAL: 6
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1232
;; 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      ns2.unsw.edu.au.
unsw.edu.au.            900     IN      NS      ns3.unsw.edu.au.

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

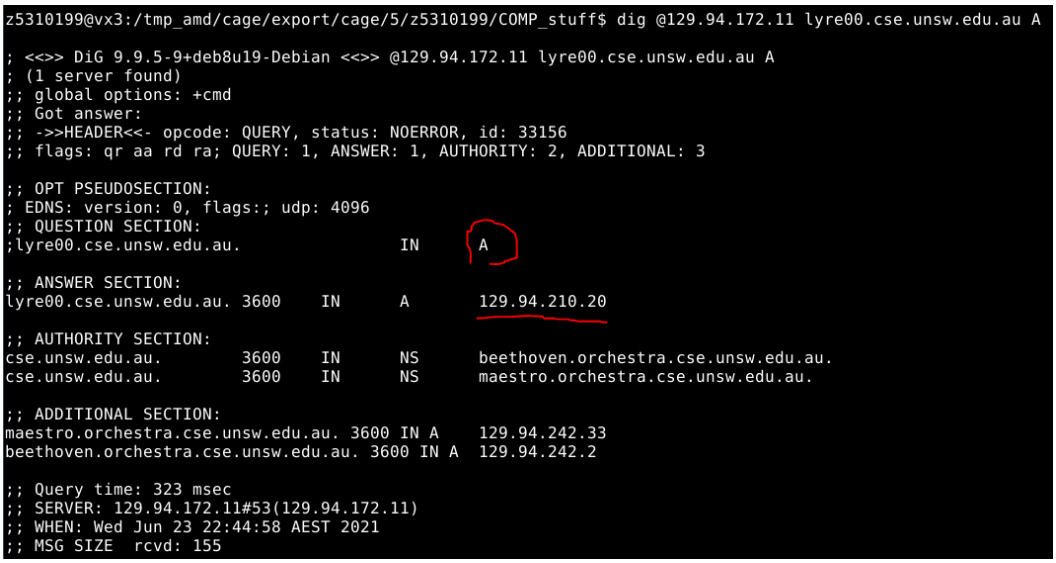
We can choose the IP address of ns1.unsw.edu.au (129.94.0.192) for the next iteration.

Fifth iteration - finding the authoritative nameserver for cse.unsw.edu.au:

```
z5310199@vx3:/tmp_amd/cage/export/cage/5/z5310199/COMP_stuff$ 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: 513
;; 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.        300     IN      NS      beethoven.orchestra.cse.unsw.edu.au.
cse.unsw.edu.au.        300     IN      NS      maestro.orchestra.cse.unsw.edu.au.

;; ADDITIONAL SECTION:
beethoven.orchestra.cse.unsw.edu.au. 300 IN A   129.94.172.11
beethoven.orchestra.cse.unsw.edu.au. 300 IN A   129.94.208.3
beethoven.orchestra.cse.unsw.edu.au. 300 IN A   129.94.242.2
maestro.orchestra.cse.unsw.edu.au. 300 IN A     129.94.242.33

;; Query time: 4 msec
```

We can choose the IP address of beethoven.orchestra.unsw.edu.au (129.94.172.11) for the next iteration.

Sixth iteration - finding the IP address of lyre00.cse.unsw.edu.au:



```
z5310199@vx3:/tmp_amd/cage/export/cage/5/z5310199/COMP_stuff$ dig @129.94.172.11 lyre00.cse.unsw.edu.au A

; <<>> DiG 9.9.5-9+deb8u19-Debian <<>> @129.94.172.11 lyre00.cse.unsw.edu.au A
; (1 server found)
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 33156
;; 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      beethoven.orchestra.cse.unsw.edu.au.
cse.unsw.edu.au.        3600    IN      NS      maestro.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: 323 msec
;; SERVER: 129.94.172.11#53(129.94.172.11)
;; WHEN: Wed Jun 23 22:44:58 AEST 2021
;; MSG SIZE  rcvd: 155
```

Hence, the IP address of lyre00.cse.unsw.edu.au is 129.94.210.20 and the whole process took six queries.

11. Yes, a single machine can have multiple names and IP addresses associated with it and this can usually be achieved by configuring the network settings on most machines. Otherwise, a machine can have IP/host aliases through the use of CDN which allows multiple IP address and names to point to that single machine.