Question 1: Please briefly answer the role of DNS in your own words. **DNS，域名系统，就是将域名和IP建立相互映射，使得人们可以用域名来访问网页而不是记复杂的IP地址，更方便了。**

Question 2: The type field have a few different values to indicate the kind of this record. What do "A", "NS" and "CNAME" mean?

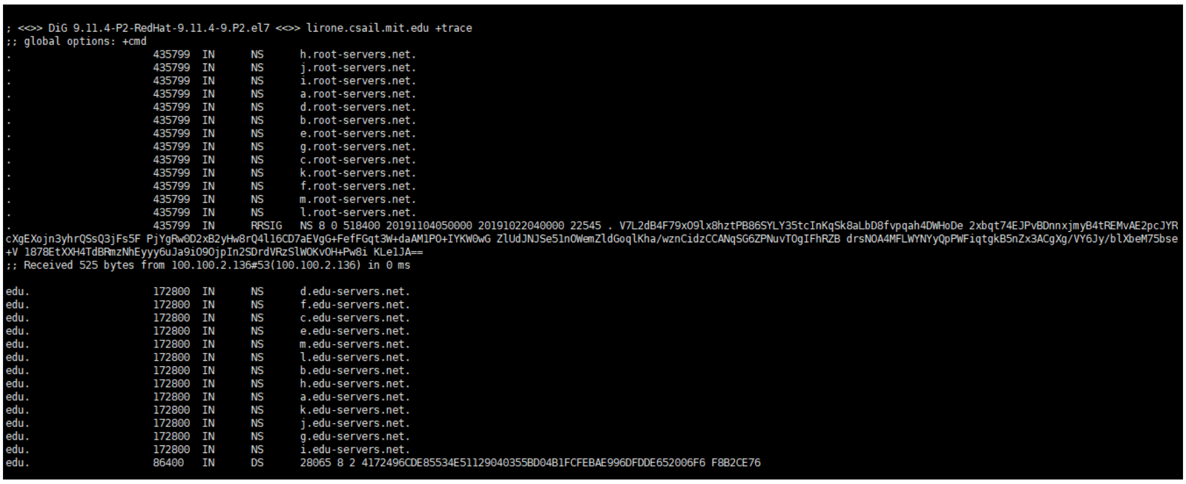
A: 主机地址资源记录，将DNS域名映射到IPv4的32位地址中 NS: Name Server，将owner中指定的DNS域名映射到name_server_domain_name字段中指定的运行DNS服务器的主机名 CNAME：规范名资源记录，将owner字段中的别名或备用的DNS域名映射到canonical_name字段中指定的标准或主要DNS域名。

Question 3: How can we ask a specific dns server (instead of the default) for information about a domain name? When I use "dig www.baidu.com",the DNS server is 192.168.110.2. However if this server crashed and I have to ask the server 8.8.8.8, what command should I use?

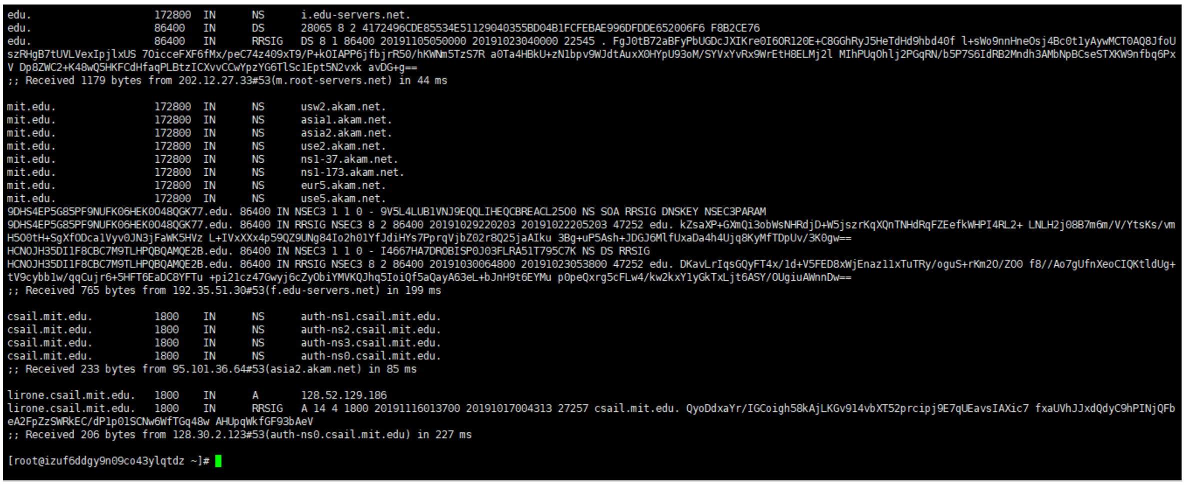
用命令dig @8.8.8.8 www.baidu.com

Question 4: Do you know the process of solving domain name "lirone.csail.mit.edu"? You need to go through the steps of resolving a particular hostname, mimicing a standard recursive query. Assuming it knows nothing else about a name, a DNS resolver will ask a well-known root server. The root servers on the Internet are in the domain root-servers.net. You can use "%dig . ns" to get the list of 13 root servers.You can show us the result of each step or briefly introduce your idea. [Hint: you should start from "edu"]

首先我用了dig lirone.csail.mit.edu +trace，结果如下：



```
; <<>> DiG 9.11.4-P2-RedHat-9.11.4-9.P2.el7 <<>> lirone.csail.mit.edu +trace
;; global options: +cmd
.                       435799  IN      NS      h.root-servers.net.
.                       435799  IN      NS      j.root-servers.net.
.                       435799  IN      NS      i.root-servers.net.
.                       435799  IN      NS      a.root-servers.net.
.                       435799  IN      NS      d.root-servers.net.
.                       435799  IN      NS      b.root-servers.net.
.                       435799  IN      NS      e.root-servers.net.
.                       435799  IN      NS      g.root-servers.net.
.                       435799  IN      NS      c.root-servers.net.
.                       435799  IN      NS      k.root-servers.net.
.                       435799  IN      NS      f.root-servers.net.
.                       435799  IN      NS      m.root-servers.net.
.                       435799  IN      NS      l.root-servers.net.
.                       435799  IN      RRSIG   NS 8 0 518400 20191104050000 20191022040000 22545 . V7L2dB4F79x09lx8hztPB86SYLY35tcInKqSk8aLbD8fvpqah4DWHoDe 2xbqt74EJPvBDnnxjmyB4tREMvAE2pcJYR
cXgEXojn3yhrQSsQ3jFs5F PjYgRw0D2xB2yHw8rQ4l16CD7aEVgG+FefFGqt3W+daAM1PO+IYKW0wG ZlUdJNJSe51nOWemZldGoqlKha/wznCidzCCANqSG6ZPNuvTOgIFhRZB drsNOA4MFLWYNYyQpPWFiqtgkB5nZx3ACgXg/VY6Jy/blXbeM75bse
+V 1878EtXXH4TdBRmzNhEyyy6uJa9iO9OjpIn2SDrdVRzSlWOKvOH+Pw8i KLe1JA==
;; Received 525 bytes from 100.100.2.136#53(100.100.2.136) in 0 ms

edu.                    172800  IN      NS      d.edu-servers.net.
edu.                    172800  IN      NS      f.edu-servers.net.
edu.                    172800  IN      NS      c.edu-servers.net.
edu.                    172800  IN      NS      e.edu-servers.net.
edu.                    172800  IN      NS      m.edu-servers.net.
edu.                    172800  IN      NS      l.edu-servers.net.
edu.                    172800  IN      NS      b.edu-servers.net.
edu.                    172800  IN      NS      h.edu-servers.net.
edu.                    172800  IN      NS      a.edu-servers.net.
edu.                    172800  IN      NS      k.edu-servers.net.
edu.                    172800  IN      NS      j.edu-servers.net.
edu.                    172800  IN      NS      g.edu-servers.net.
edu.                    172800  IN      NS      i.edu-servers.net.
edu.                    86400   IN      DS      28065 8 2 4172496CDE85534E51129040355BD04B1FCFEBAE996DFDDE652006F6 F8B2CE76
```

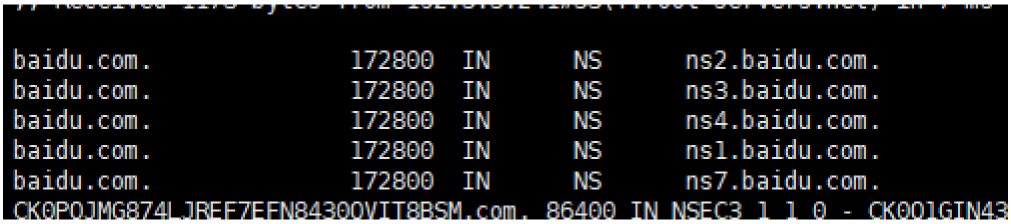


```
edu.                    172800  IN      NS      i.edu-servers.net.
edu.                    86400   IN      DS      28065 8 2 4172496CDE85534E51129040355BD04B1FCFEBAE996DFDDE652006F6 F8B2CE76
edu.                    86400   IN      RRSIG   DS 8 1 86400 20191105050000 20191023040000 22545 . FgJ0tB72aBFyPbUGDcJXIKre0I6OR120E+C8GGhRyJ5HeTdHd9hbd40f l+sWo9nnHneOsj4Bc0tlyAywMCT0AQ8JfoU
szRHgB7tUVLVexIpjlxUS 7OicceFXF6fMx/peC74z409xT9/P+kOIAPP6jfbjrR50/hKWNm5TzS7R a0Ta4HBkU+zN1bpv9WJdtAuxX0HYpU93oM/SYVxYvRx9WrEtH8ELMj2l MIhPUqOhlj2PGqRN/b5P7S6IdRB2Mndh3AMbNpBCseSTXKW9nfbq6Px
V Dp8ZWC2+K48wQ5HKFCdHfaqPLBtzICXvvCCwYpzYG6TlSc1Ept5N2vxk avDG+g==
;; Received 1179 bytes from 202.12.27.33#53(m.root-servers.net) in 44 ms

mit.edu.                172800  IN      NS      usw2.akam.net.
mit.edu.                172800  IN      NS      asia1.akam.net.
mit.edu.                172800  IN      NS      asia2.akam.net.
mit.edu.                172800  IN      NS      use2.akam.net.
mit.edu.                172800  IN      NS      ns1-37.akam.net.
mit.edu.                172800  IN      NS      ns1-173.akam.net.
mit.edu.                172800  IN      NS      eur5.akam.net.
mit.edu.                172800  IN      NS      use5.akam.net.
9DHS4EP5G85PF9NUFK06HEK0048QGK77.edu. 86400 IN NSEC3 1 1 0 - 9V5L4LUB1VNJ9EQQLIHEQCBREACL2500 NS SOA RRSIG DNSKEY NSEC3PARAM
9DHS4EP5G85PF9NUFK06HEK0048QGK77.edu. 86400 IN RRSIG NSEC3 8 2 86400 20191029220203 20191022205203 47252 edu. kZsaXP+GXmQi3obWsNHRdjD+W5jszrKqXQnTNHdRqFZEefkWHPI4RL2+ LNLH2j08B7m6m/V/YtsKs/vm
H5O0tH+SgXfODca1Vyv0JN3jFaWK5HVz L+IVxXXx4p59QZ9UNg84Io2h01YfJdiHYs7PprqVjbZ02r8Q25jaAIku 3Bg+uP5Ash+JDGJ6MlfUxaDa4h4Ujq8KyMfTDpUv/3K0gw==
HCNOJH35DI1F8CBC7M9TLHPQBQAMQE2B.edu. 86400 IN NSEC3 1 1 0 - I4667HA7DROBISP0J03FLRA51T795C7K NS DS RRSIG
HCNOJH35DI1F8CBC7M9TLHPQBQAMQE2B.edu. 86400 IN RRSIG NSEC3 8 2 86400 20191030064800 20191023053800 47252 edu. DKavLrIqsGQyFT4x/1d+V5FED8xWjEnaz1lxTuTRy/oguS+rKm2O/ZO0 f8//Ao7gUfnXeoCIQKtldUg+
tV9cybb1w/qqCujr6+5HFT6EaDC8YFTu +pi2lcz47Gwyj6cZyObiYMVKQJhq5IoiQf5aQayA63eL+bJnH9t6EYMu p0peQxrg5cFLw4/kw2kxYlyGkTxLjt6ASY/OUgiuAWnnDw==
;; Received 765 bytes from 192.35.51.30#53(f.edu-servers.net) in 199 ms

csail.mit.edu.          1800    IN      NS      auth-ns1.csail.mit.edu.
csail.mit.edu.          1800    IN      NS      auth-ns2.csail.mit.edu.
csail.mit.edu.          1800    IN      NS      auth-ns3.csail.mit.edu.
csail.mit.edu.          1800    IN      NS      auth-ns0.csail.mit.edu.
;; Received 233 bytes from 95.101.36.64#53(asia2.akam.net) in 85 ms

lirone.csail.mit.edu.   1800    IN      A       128.52.129.186
lirone.csail.mit.edu.   1800    IN      RRSIG   A 14 4 1800 20191116013700 20191017004313 27257 csail.mit.edu. QyoDdxaYr/IGCoigh58kAjLKGv914vbXT52prcipj9E7qUEavsIAXic7 fxaUVhJJxdQdyC9hPINjQFb
eA2FpZzSWRkEC/dP1p01SCNw6WfTGq48w AHUpqWkfGF93bAeV
;; Received 206 bytes from 128.30.2.123#53(auth-ns0.csail.mit.edu) in 227 ms

[root@izuf6ddgy9n09co43ylqtdz ~]# 
```

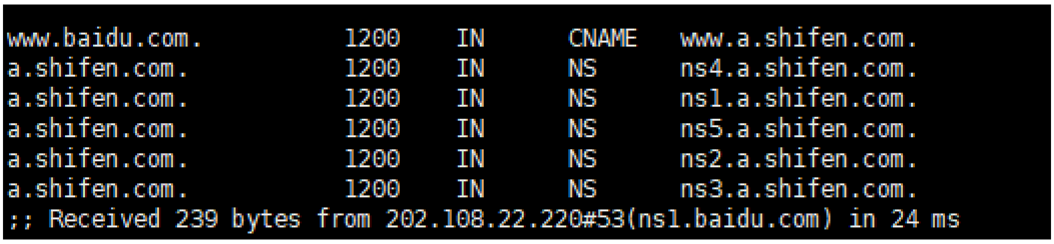
由此可以看出，首先到找到根 . 的服务器100.100.2.136，然后找到edu的服务器202.12.27.33，然后找到mit.edu的192.35.51.30，然后是csail.mit.edu的95.101.36.64，最后找到lirone.csail.mit.edu对应的服务器ip128.30.2.123

Question 5: Please explain the above phenomenon. Have a guess!

dig www.baidu.com +trace

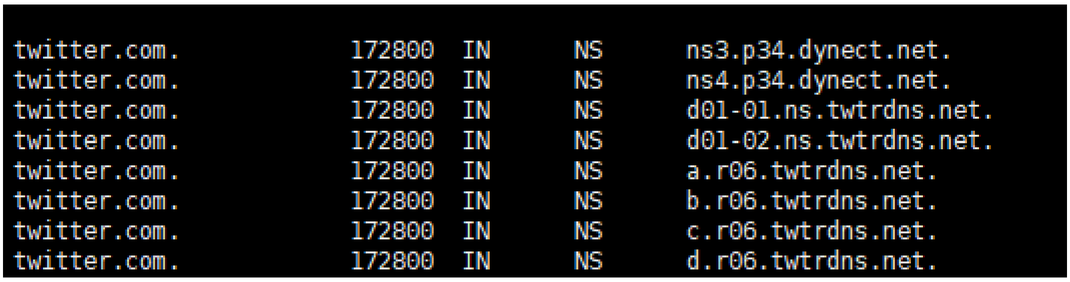


```
baidu.com.              172800  IN      NS      ns2.baidu.com.
baidu.com.              172800  IN      NS      ns3.baidu.com.
baidu.com.              172800  IN      NS      ns4.baidu.com.
baidu.com.              172800  IN      NS      ns1.baidu.com.
baidu.com.              172800  IN      NS      ns7.baidu.com.
CK0POJMG874LJREF7EFN8430QVIT8BSM.com. 86400 IN NSEC3 1 1 0 - CK0Q1GIN43
```

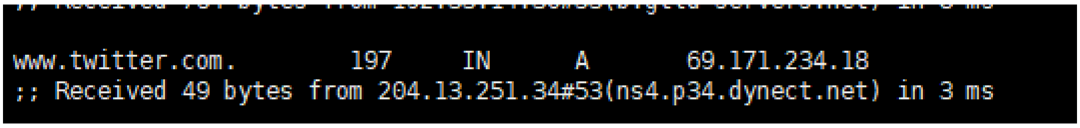


```
www.baidu.com.          1200    IN      CNAME   www.a.shifen.com.
a.shifen.com.           1200    IN      NS      ns4.a.shifen.com.
a.shifen.com.           1200    IN      NS      ns1.a.shifen.com.
a.shifen.com.           1200    IN      NS      ns5.a.shifen.com.
a.shifen.com.           1200    IN      NS      ns2.a.shifen.com.
a.shifen.com.           1200    IN      NS      ns3.a.shifen.com.
;; Received 239 bytes from 202.108.22.220#53(ns1.baidu.com) in 24 ms
```

dig www.twitter.com +trace



```
twitter.com.            172800  IN      NS      ns3.p34.dynect.net.
twitter.com.            172800  IN      NS      ns4.p34.dynect.net.
twitter.com.            172800  IN      NS      d01-01.ns.twtrdns.net.
twitter.com.            172800  IN      NS      d01-02.ns.twtrdns.net.
twitter.com.            172800  IN      NS      a.r06.twtrdns.net.
twitter.com.            172800  IN      NS      b.r06.twtrdns.net.
twitter.com.            172800  IN      NS      c.r06.twtrdns.net.
twitter.com.            172800  IN      NS      d.r06.twtrdns.net.
```



```
www.twitter.com.        197     IN      A       69.171.234.18
;; Received 49 bytes from 204.13.251.34#53(ns4.p34.dynect.net) in 3 ms
```

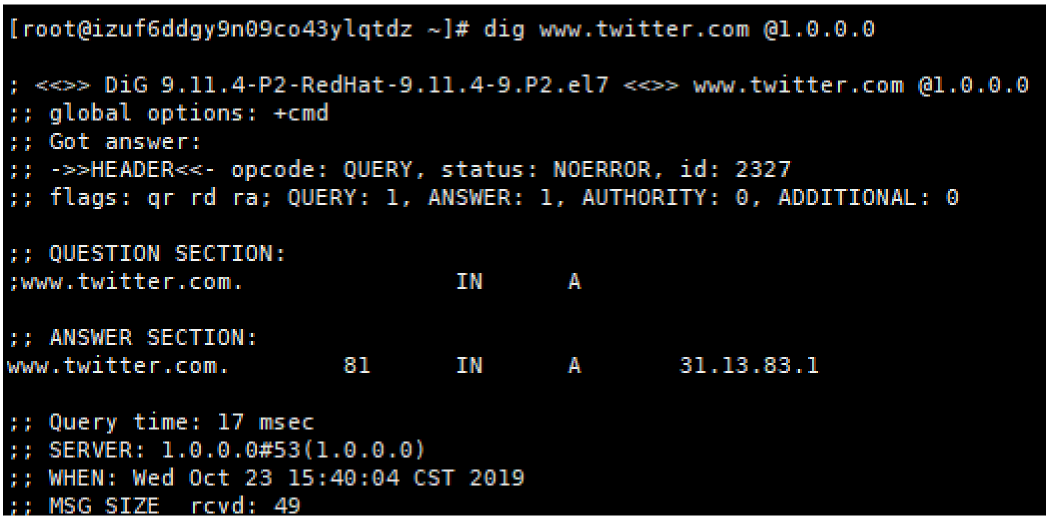
发现在baidu.com和twitter.com这一步右边都是没有问题的（用whois查了一下都是对的），但是在www.baidu.com这一步百度会返回很多地址；而twitter后就只返回一个ip地址69.171.234.18,又用ip查询发现他是一个来自美国俄勒冈州普赖恩维尔的地址。但是我经过多次测试后发现，每次他都返回一个不一样的地址，有美国的，有爱尔兰的。。。猜测他是返回一个假的ip给我

多次dig www.twitter.com +trace的返回结果

- 69.171.248.112

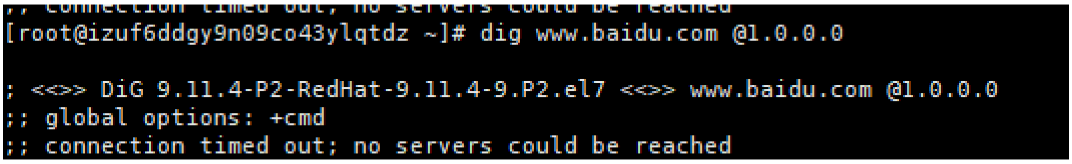
- 69.171.247.20
- 31.13.74.1
- 31.13.72.54

dig www.twitter.com @1.0.0.0



```
[root@izuf6ddgy9n09co43ylqtdz ~]# dig www.twitter.com @1.0.0.0

; <<>> DiG 9.11.4-P2-RedHat-9.11.4-9.P2.el7 <<>> www.twitter.com @1.0.0.0
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 2327
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;www.twitter.com.               IN      A

;; ANSWER SECTION:
www.twitter.com.        81      IN      A       31.13.83.1

;; Query time: 17 msec
;; SERVER: 1.0.0.0#53(1.0.0.0)
;; WHEN: Wed Oct 23 15:40:04 CST 2019
;; MSG SIZE  rcvd: 49
```

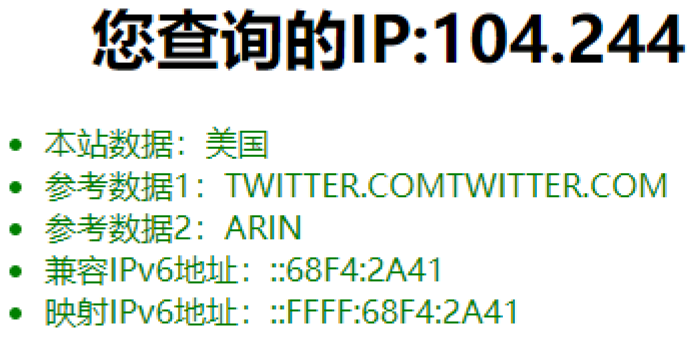
dig www.baidu.com @1.0.0.0



```
;; connection timed out; no servers could be reached
[root@izuf6ddgy9n09co43ylqtdz ~]# dig www.baidu.com @1.0.0.0

; <<>> DiG 9.11.4-P2-RedHat-9.11.4-9.P2.el7 <<>> www.baidu.com @1.0.0.0
;; global options: +cmd
;; connection timed out; no servers could be reached
```

ping 1.0.0.0发现并不存在，再在一台日本的服务器上dig twitter,发现真正的地址应该是

- 104.244.42.129
- 104.244.42.65



您查询的IP:104.244.42.65

- 本站数据：美国
- 参考数据1：TWITTER.COMTWITTER.COM
- 参考数据2：ARIN
- 兼容IPv6地址：::68F4:2A41
- 映射IPv6地址：::FFFF:68F4:2A41

之类的。。。实锤了。

Question 6: The ips which dig returns to you belong to google indeed. Give the reason for the above phenomenon.

ip是正确的却连不上谷歌，可能是发包的时候经过路由器网关发到国外时，数据包被破坏了。