Worksheet Class 6: DNS

Q1. Why do we need to map names to IP addresses? Why not route on names at the network layer?

A. Domain names are hierarchical, so we can route on domain names too.
B. Domain names are variable length, vs IP are fixed length, some changes will be required to switch.
C. With domain names we wouldn't know where to route to geographically.
D. Some other reason.

Q2. What's the biggest challenge for DNS?

A. It's old.
B. The fact that the Internet is global.
C. The fact that DNS is now critical infrastructure.
D. The sheer number of name lookups happening at any given time.
E. How and when the name -> IP address mapping should change.

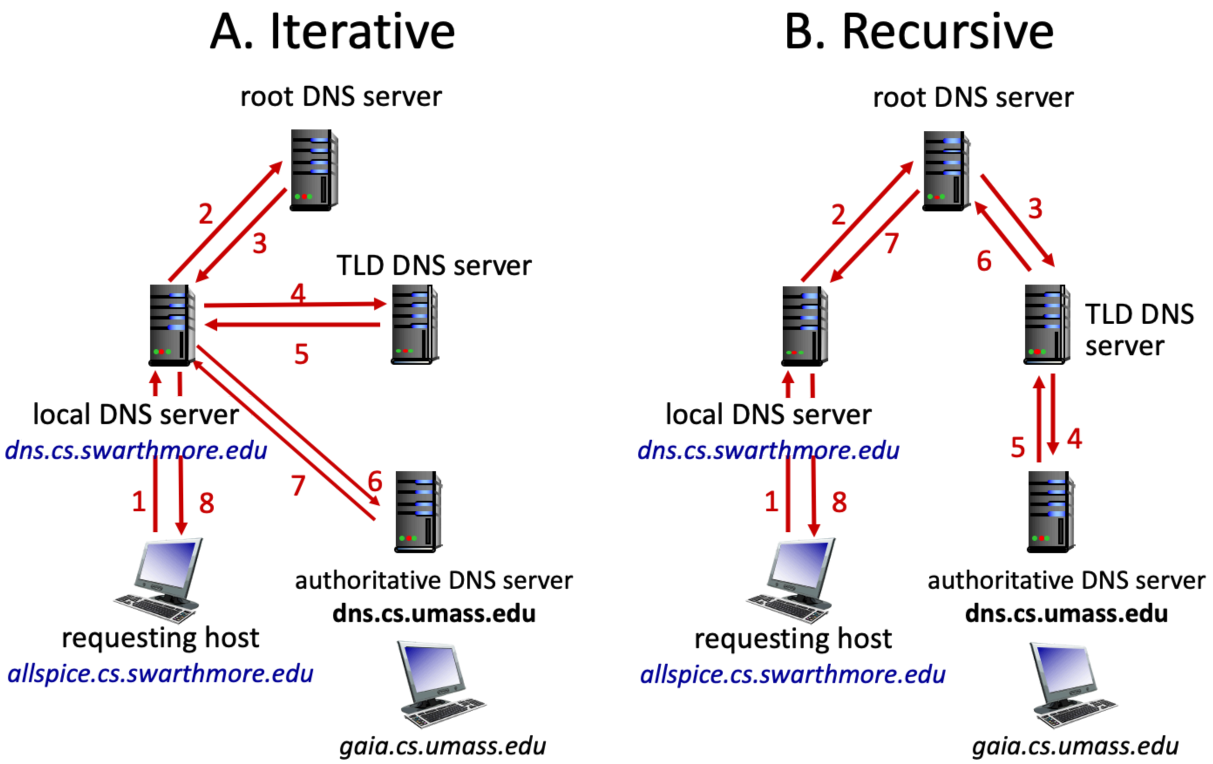
Q3. Who should control DNS?

A. US government
B. UN / International government
C. A Private corporation
D. Someone else

Q4. Why do we structure DNS hierarchically? Which of these helps the most? Drawbacks?

A. It divides up responsibility among parties.
B. It improves performance of the system.
C. It reduces the size of the state that a server needs to store.
D. Some other reason.

Q5. Which of the two DNS query models would you use to resolve a hostname to an IP address? Why?



Q1. Caching DNS Responses: The TTL (Time-to-live) values for Resource Records in the DNS should be..(provide your reasons)

A. Short, to make sure that changes are accurately reflected
B. Long, to avoid re-queries of higher-level DNS servers
C. Some combination depending on certain parameters (explain which)
D. Some other reason.

Q2. Answer the following questions in context of the DNS response (a.k.a, Resource Record RR) below:

A. How many answers were returned? What does it mean if the answer section is empty?
B. What is the time-to-live in this RR in seconds?
C. How many additional records are present?

```
$ dig @a.root-servers.net www.freebsd.org +norecurse
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 57494
;; QUERY: 1, ANSWER: 0, AUTHORITY: 2, ADDITIONAL: 2

;; QUESTION SECTION:
;www.freebsd.org.  IN  A

;; AUTHORITY SECTION:
org.  172800  IN  NS  b0.org.afilias-nst.org.
org.  172800  IN  NS  d0.org.afilias-nst.org.

;; ADDITIONAL SECTION:
b0.org.afilias-nst.org.  172800  IN  A  199.19.54.1
d0.org.afilias-nst.org.  172800  IN  A  199.19.57.1
```

Q3. Answer the following questions in context of the DNS response (a.k.a, Resource Record RR) below:, The dig query is asking a (.org server at 199.19.54.1) for the IP address of www.freebsd.org. How many answers were returned?

A. What do the authoritative records and additional records tell us?

```
$ dig @199.19.54.1 www.freebsd.org +norecurse
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 39912
;; QUERY: 1, ANSWER: 0, AUTHORITY: 3, ADDITIONAL: 0

;; QUESTION SECTION:
;www.freebsd.org.  IN  A

;; AUTHORITY SECTION:
freebsd.org.  86400  IN  NS  ns1.isc-sns.net.
freebsd.org.  86400  IN  NS  ns2.isc-sns.com.
freebsd.org.  86400  IN  NS  ns3.isc-sns.info.
```

Q4. Answer the following questions in context of the DNS response (a.k.a, Resource Record RR) below:

A. Assuming this is the next DNS query we do, following the query in Q3; list the server being contacted here, and whether this is an authoritative name server, top-level domain or the root server.

```
$ dig @ns1.isc-sns.net www.freebsd.org +norecurse
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 17037
;; QUERY: 1, ANSWER: 1, AUTHORITY: 3, ADDITIONAL: 3

;; QUESTION SECTION:
;www.freebsd.org.  IN  A

;; ANSWER SECTION:
www.freebsd.org.  3600  IN  A  69.147.83.33

;; AUTHORITY SECTION:
freebsd.org.  3600  IN  NS  ns2.isc-sns.com.
freebsd.org.  3600  IN  NS  ns1.isc-sns.net.
freebsd.org.  3600  IN  NS  ns3.isc-sns.info.

;; ADDITIONAL SECTION:
ns1.isc-sns.net.  3600  IN  A  72.52.71.1
ns2.isc-sns.com.  3600  IN  A  38.103.2.1
ns3.isc-sns.info.  3600  IN  A  63.243.194.1
```

Attacking DNS

Security risk #1: malicious DNS server

- So far from what we have seen it seems as though if *any* of the DNS servers queried are malicious, they can lie to us and fool us about the answer to our DNS query.
- What are the potential consequences?
- Consider the following legitimate DNS response for eecs.mit.edu followed by a poisoned response. What are the consequences to www.swarthmore.edu with the poisoned DNS response?

Legitimate Response:

```
; ; <<>> DiG 9.6.0-APPLE-P2 <<>> eecs.mit.edu a
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 19901
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 3,
ADDITIONAL: 3

;; QUESTION SECTION:
;eecs.mit.edu.                IN   A

;; ANSWER SECTION:
eecs.mit.edu.          21600  IN   A    18.62.1.6
;; AUTHORITY SECTION:
mit.edu.               11088   IN  NS   BITSY.mit.edu.
mit.edu.               11088   IN  NS   W20NS.mit.edu.
mit.edu.               11088   IN  NS   STRAWB.mit.edu.

;; ADDITIONAL SECTION:
STRAWB.mit.edu.        126738  IN  A    18.6.6.6
BITSY.mit.edu.         166408  IN       A    18.72.0.3
W20NS.mit.edu.         126738  IN       A    18.70.0.160
```

Poisoned DNS Response

```
; ; <<>> DiG 9.6.0-APPLE-P2 <<>> eecs.mit.edu a
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 19901
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 3,
ADDITIONAL: 3

;; QUESTION SECTION:
;eecs.mit.edu.                IN   A

;; ANSWER SECTION:
eecs.mit.edu.          21600  IN   A    18.62.1.6

;; AUTHORITY SECTION:
mit.edu.               11088   IN  NS   BITSY.mit.edu.
mit.edu.               11088   IN  NS   W20NS.mit.edu.
mit.edu.               30000   IN  NS   www.swarthmore.edu

;; ADDITIONAL SECTION:
www.swarthmore.edu.    30000   IN  A    18.6.6.6
BITSY.mit.edu.         166408  IN       A    18.72.0.3
W20NS.mit.edu.         126738  IN       A    18.70.0.160
```