

CS4457 Problem Set #5

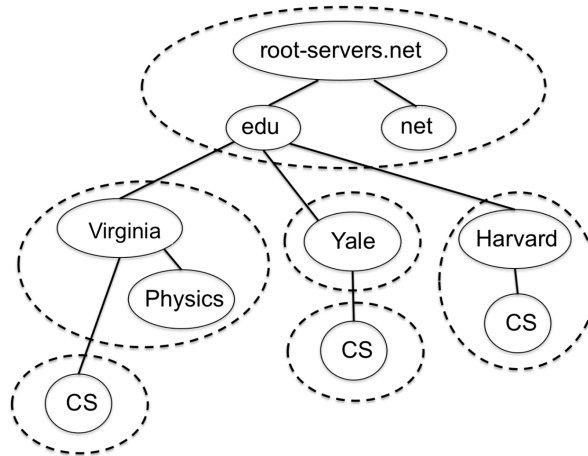
March 28, 2026

1 DNS

- (a) In this problem, we use the useful `dig` tool available on Unix and Linux hosts to explore the hierarchy of DNS servers. Recall that a DNS server higher in the DNS hierarchy delegates a DNS query to a DNS server lower in the hierarchy, by sending back to the DNS client the name of that lower-level DNS server. First read the man page for `dig`, and then answer the following questions.
- Starting with a root DNS server (from one of the root servers [a-m].root-servers.net), initiate a sequence of queries for the IP address for your department's Web server by using `dig`. Show the list of the names of DNS servers in the delegation chain in answering your query.
 - Repeat the first part for several popular Web sites, such as `google.com`, `yahoo.com`, or `amazon.com`.
- (b) Suppose you can access the caches in the local DNS servers of your department. Can you propose a way to roughly determine the Web servers (outside your department) that are most popular among the users in your department? Explain.
- (c) Suppose that your department has a local DNS server for all computers in the department. You are an ordinary user (i.e., not a network/system administrator). Can you determine if an external Web site was likely accessed from a computer in your department a couple of seconds ago? Explain.

2 DNS

Consider the DNS topology in the figure below **each DNS zone is indicated with a dashed line**. There is only one DNS server per each zone, and it happens to have the same name as the highest node in that zone: Virginia.EDU, CS.Virginia.EDU, Harvard.EDU, Yale.EDU, CS.Yale.EDU, and root-servers.net.



For each of the queries below, list in order all the DNS servers queried during the name resolution. Assume there is no caching performed at any level of the hierarchy.

- (a) A user on **john.cs.harvard.edu** launches the query:

```
dig einstein.physics.virginia.edu
```

- (b) A user on **einstein.physics.virginia.edu** launches the query:

```
dig dan.cs.yale.edu
```

3 DNS

Consider the partial output of the dig command given below:

```
; <<>> DiG 9.9.4-RedHat-9.9.4-18.el7_1.3 <<>>
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 47902

;; ANSWER SECTION:
harvard.edu. 1306 IN MX 100 b-00171101.pphosted.com.
harvard.edu. 1630 IN MX 100 a-00171101.pphosted.com.

;; AUTHORITY SECTION:
harvard.edu. 172100 IN NS ext-1.harvard.edu.

;; ADDITIONAL SECTION:
a-00171101.pphosted.com.      1313      IN A 67.231.148.27
b-00171101.pphosted.com.      1797      IN A 67.231.156.27
ext-1.harvard.edu.            172756    IN A 128.103.200.35

;; Query time: 1 msec
;; SERVER: 128.112.136.10#53(128.112.136.10)
;; WHEN: Mon Mar 07 12:49:47 EST 2016
;; MSG SIZE rcvd: 224
```

- (a) List the IP address(es) of the name server(s) of harvard.edu.

- (b) List the IP address(es) of the mail server(s) of harvard.edu.

- (c) For how many seconds are the entries for the address records of the mail and name servers valid?