1. How does DNS work? Describe its framework.

> Distributed database implemented in hierarchy of many name servers
>
> Application-layer protocol host, routers, name servers to communicate to resolve names(address/ name translation)
>
> Client wants IP for www.xxxx.com:
>
> > client queries a root server to find com DNS server
> > client queries com DNS server to get xxxx.com DNS server
> > client queries xxxx.com DNS server to get IP address for www.xxxx.com

2. What are the functions of four types of DNS servers? (重要！！)

> - Root name servers
>   - contacted by local name server that can not resolve name
>   - contacts authoritative name server if name mapping not known
>   - gets mapping
>   - returns mapping to local name server
> - Top-level domain (TLD) servers
>   - responsible for com, org, net, edu, etc, and all top-level country domains uk, fr, ca, jp.
>   - Network Solutions maintains servers for com TLD
>   - Educause for edu TLD
> - Authoritative DNS servers
>   - organization's DNS servers, providing authoritative hostname to IP mappings for organization's servers (e.g., Web, mail)
>   - can be maintained by organization or service provider
> - Local Name Server
>   - does not strictly belong to hierarchy
>   - each ISP (residential ISP, company, university) has one.
>   - also called "default name server"
>   - when host makes DNS query, query is sent to its local DNS server

- acts as proxy, forwards query into hierarchy

3. How does DNS iterated query and recursive query work? (重要！！)

iterated query: contacted server replies with name of server to contact
recursive query: puts burden of name resolution on contacted name server

4. How do DNS servers reduce their work load?

once (any) name server learns mapping, it caches mapping

- cache entries timeout (disappear) after some time
- TLD servers typically cached in local name servers
  - Thus root name servers not often visited

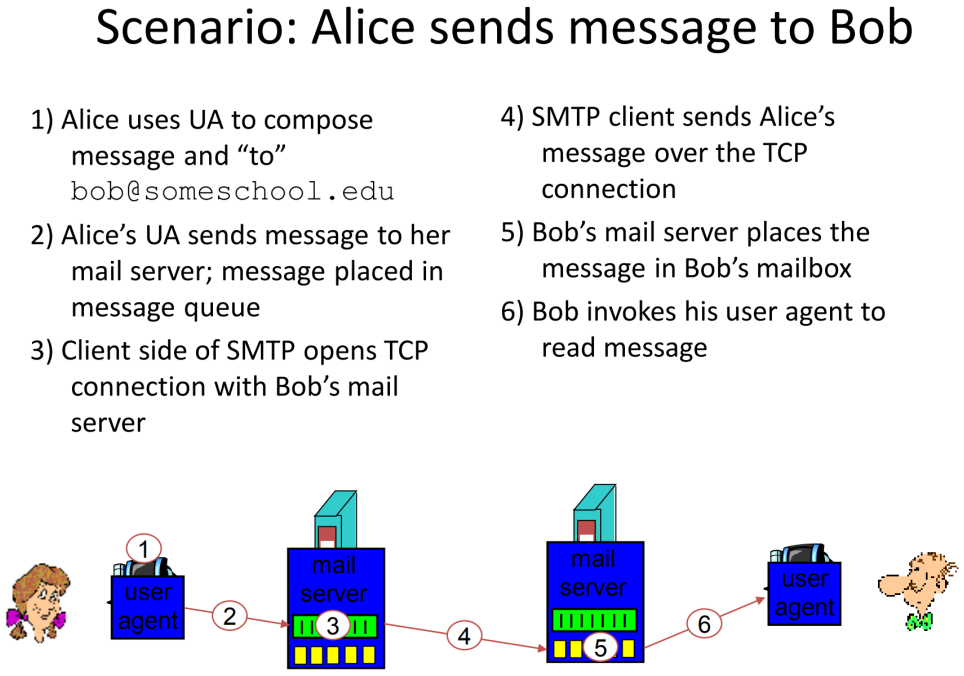
update/notify mechanisms under design by IETF

5. What are functionalities of DNS RR four types? (重要！！)

RR format: **(name, value, type, ttl)**

- Type=A: The record that holds the IP address of a domain (hostname -> IP)
  - **name** is hostname
  - **value** is IP address
- Type=NS: Stores the name server for a DNS entry (domain -> hostname of authoritative name server for this domain)
  - **name** is domain (e.g. foo.com)
  - **value** is hostname of authoritative name server for this domain
- Type=CNAME: Forwards one domain or subdomain to another domain, does NOT provide an IP address (alias name -> real name)
  - **name** is alias name for some 'canonical' (the real) name (www.ibm.com is really servereast.backup2.ibm.com)
  - **value** is canonical name
- Type=MX: Directs mail to an email server (mail domain -> mail server)
  - **value** is name of mailserver associated with **name**

6. How does SMTP work? Describe its framework.



7. What are the functionalities of five SMTP basic commands? (重要！！)

- HELO : 發出「Hello」訊息，並開始在client和server之間建立 SMTP 連線。
- MAIL FROM : 告訴server是誰在傳送mail，也就是告訴server sender是誰
- RCPT TO : 用於列出mail的receiver
- DATA : pecifies the beginning of the mail
- QUIT : close the TCP connection

8. How does SMTP describe the end of Data?

Use "." on a line itself

9. What are the functionalities of six POP3 basic commands? Describe which phase they belong to. (重要！！)

authorization phase

- **user** : declare username
- **pass** : password

transaction phase

- **list** : list message numbers

- **retr** : retrieve message by number
- **dele** : delete message
- **quit** : close server

10. What is the difference between POP two basic modes?

- "download and delete": User cannot re-read e-mail if he/she changes client
- "download-and-keep": It copies of messages on different clients