

Communication Networks

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Exercise 12 – Domain Name System (DNS)

12.1 Name it or Route it: pick one



Any clear winner?

In the course, we saw two ways to replicate and load-balance content: (i) using Anycast routing; or (ii) using DNS.

- a) List and briefly justify three pros and cons of each.

- b) We saw that CDNs often rely on DNS for distributing their load. Could they also use Anycast routing instead? Explain why or why not.

12.2 Local DNS server

On Linux and Mac computers you can use the command line tool `dig` to perform DNS lookups. The corresponding tool for Windows is `nslookup`. First, perform a lookup for `nyu.edu` using your default DNS server by running the command `dig nyu.edu` or `nslookup nyu.edu`.

- What is the IP address of the server behind `nyu.edu`?

Now, perform the same lookup, but use one of the DNS root servers (e.g., `a.root-servers.net`) by running^a

```
dig @a.root-servers.net nyu.edu
nslookup nyu.edu a.root-servers.net
```

^aIf the `nslookup` command does not yield helpful output for you, try adding `-type=soa` after `nslookup`. (For some, it may be the other way round—adding this option may hide the relevant part in the output.)

- Why does the answer differ compared to the one from your local DNS server?
- How would you proceed with this answer to find the IP address behind `nyu.edu`?

12.3 DNS Setup (Exam Question Summer 2021)

Assume you are the operator for the DNS sub-domain `ee.ethz.ch`. The responsible of the Networked Systems Group (NSG) reaches out to you as they want to create and independently maintain their own DNS sub-domain `nsg.ee.ethz.ch`. Among others, they want to create DNS names for:

- their group webpage `www.nsg.ee.ethz.ch`, pointing at `129.132.30.1`;
- a project webpage `fun.nsg.ee.ethz.ch`, also pointing at `129.132.30.1`;
- their chat room `chat.nsg.ee.ethz.ch`, pointing at `129.132.30.2`; and
- a mail server `mail.nsg.ee.ethz.ch`, pointing at `129.132.30.3` and which should receive any email sent to a `@nsg.ee.ethz.ch` email address.

Unfortunately, the responsible of NSG does not seem to understand much about DNS. He needs your help to set this up.

You start by setting up two DNS name servers `ns1.nsg.ee.ethz.ch` and `ns2.nsg.ee.ethz.ch` which you host on `129.132.20.1` and `129.132.20.2`, respectively.

- a) Indicate the resource records that these two DNS servers should store. For each record, indicate its corresponding name, type, and value. *Note you might not need all 6 records.*

Record #1. Name: _____ Type: _____ Value: _____

Record #2. Name: _____ Type: _____ Value: _____

Record #3. Name: _____ Type: _____ Value: _____

Record #4. Name: _____ Type: _____ Value: _____

Record #5. Name: _____ Type: _____ Value: _____

Record #6. Name: _____ Type: _____ Value: _____

- b) Indicate the resource records that need to be added (if any) to the name servers responsible for `ee.ethz.ch`. Briefly explain the usage of these extra records or why no such extra record is needed. *Note you might not need all 4 records.*

Record #1. Name: _____ Type: _____ Value: _____

Record #2. Name: _____ Type: _____ Value: _____

Record #3. Name: _____ Type: _____ Value: _____

Record #4. Name: _____ Type: _____ Value: _____

- c) Indicate the resource records that need to be added (if any) to the name servers responsible for `ethz.ch`. Briefly explain the usage of these extra records or why no such extra record is needed. *Note you might not need all 4 records.*

Record #1. Name: _____ Type: _____ Value: _____

Record #2. Name: _____ Type: _____ Value: _____

Record #3. Name: _____ Type: _____ Value: _____

Record #4. Name: _____ Type: _____ Value: _____

d) While setting up the records, you observe that NSG wants to host two webservers (for `www` and `fun`) on the same IP address (`129.132.30.1`). Is that possible? If so, briefly explain how this works. If not, briefly explain why.

e) It looks like you underestimated NSG's popularity! It appears the two name servers `ns1.nsg.ee.ethz.ch` and `ns2.nsg.ee.ethz.ch` are completely overloaded with (legitimate) DNS requests.

Explain two *distinct* techniques you could use to scale the system further.

12.4 Local vs. authoritative DNS server

Perform a DNS query for `uzh.ch` using first the authoritative DNS server (`ns1.uzh.ch`) and then your local server.

Note: When using `nslookup` on Windows, you need to specify the `-debug` flag to get the relevant information for this task. For example:

```
nslookup -debug <Domain Name> <DNS-Server>
```

- Compare the ANSWER SECTION of the responses. Can you see differences between the answers from your local DNS server and the authoritative server? Run the query to your local server multiple times to make the differences more obvious.
- What is the reason for this difference?
- As you have seen in the lecture, DNS can be used to balance the incoming load. What are the considerations one has to make when using DNS load balancing with respect to the TTL?