# EDA387 / DIT660 Computer Networks

Lab 3: Domain Name System (DNS) Assignment

Project Group 29

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1. **Translation between computer's host name and its IPv4 address**

   Using dig, how can you find out your computer's name according to the DNS system? If your home router has it's own DNS system going (e.g. using .local TLD) that answer is accepted, if not then you might consider viewing your home router as your computer and provide the name given by the ISP.

   Provide your computer's IPv4 address, its hostname and the dig command to translate an IP to a hostname.

   ***(i) 192.168.43.133***
   ***(ii) DESKTOP-PGT4OML***
   ***(iii) dig -x 192.168.43.133***

Consider comparing the answer to the host command of *nix or what is shown in Windows by ipconfig /all. ***The wireless LAN adapter section of ipconfig /all showed the same IP address [192.168.43.133] we obtained from the dig command.***

a. Now use ***dig*** to look up the IP address corresponding to the host name of your lab partner's computer (your neighbor will do the similar lookup about your computer). Examine the output to make sure the answer is correct.

What are the sections of the output you get? Describe with your own words and NOT copy of the outcome.

We got the following sections from the output of dig:

I. ***Global Options – shows the command/query executed, and related information such as the status of the query executed and header records. For example, the status flag NXdomain indicated that DNS server was unable to resolve my partner's IP address to a domain.***
II. ***OPT Pseudosection – returns the extension mechanism for DNS [EDNS] version, an empty flag, UDP size and the cookie session.***
III. ***Question – returns the IP address of my partner in the reverse order.***
IV. ***Authority – listed zonemaster.example.org as the authorized server to resolve DNS queries about the target domain.***
V. ***Query time – provides the query execution time and size of the query response.***

Inspect the different fields of the header, what does the flag "**ra**" indicate? ***"ra" indicates that the domain server supports recursive queries.***

Verify that you and your neighbor have gotten the right answer each. ***We got our answers right.***

What is the IP address of your neighbor's computer? ***192.168.43.216***

What is the IP address of the server that you get answer from? ***192.168.43.1***

b. Examine the content of the hosts file of your system. In nix systems it would most probably be the file ***/etc/hosts*** using any text editor or just view it by issuing the command: **cat /etc/hosts**. This file exists partly due to historical reasons, but also to help during bootstrapping.

What do the mappings in the file tell you? ***The mapping tells us that IP address and hostname were mapped together and any reference to one resolves or translates to the other.***

c. Use ***dig*** to look up a host name that does not exist in the DNS system, choose anything you want but an example would be misspelling chalmers web server (wwww.chalmers.se)

Identify the field in the header that is indicating error, which one is it? ***Status: NXdomain***

Is there any answer section? ……***No***….. Why? ***Because the domain name does not exit.***

**2. Local cache, cache-only DNS Servers**

a. How can you find out which DNS server your computer are configured to use? ***Run dig –x 192.168.43.133 and check the Query Time section of the output to see the DNS server -- 192.168.1.1. Alternatively, running cat /etc/resolv.conf at the command prompt displays the same DNS server.***

……

b. Using ***dig*** look up a well-known Chalmers computer. Give the name of the computer and its IP address. ***www.chalmers.se*** and ***129.16.71.10***.

……

What is the IP address of the server that you get answer from? …. **192.168.1.1**……

c. Is the answer authoritative? **Yes,** Why or why not and what does that mean? ***Because the authority section shows the servers authorized to resolve DNS queries.***

**3. Using Authoritative DNS Servers**

Looking at the output of previous lookups you will find that the official (authoritative) name servers for Chalmers domain are listed in the "AUTHORITY SECTION" and they are four: {**ns1**, **ns2**, **ns3**}**.chalmers.se** and **sunic.sunet.se**. These are DNS servers which give authoritative answers for Chalmers, but on the other hand they normally do not provide recursion.

By default, you will be using your local name server for translations as you have learned in previous tasks. That is usually acceptable, but there are cases where you want to verify that a specific name server has delivered correct information. In this case, you can tell ***dig*** to use an authoritative name server.

a. Run ***dig*** to look up the IP address for any Chalmers computer of your choice by querying one of the official (authoritative) name servers of the Chalmers domain to see that you get authoritative answer.

How can you verify that the answer is authoritative? ***The output from—dig remote12.chalmers.se @ns2.chalmers.se—shows 4 authorized servers including ns2.chalmers.se.***

b. Try now to ***dig*** a name of well-known server abroad (not belonging to Chalmers) of your choice using **ns1.chalmers.se** where we need to have recursion, and note the results to verify whether recursion will be available or not. ***Recursion was not available.***

What is the response of the DNS server? ***Recursion requested but not available*** Explain why***? Because Chalmers DNS server did not support recursion.***

c. Now in order to find the authoritative DNS servers at domain **kth.se** you may perform a recursive lookup for any of the domain computers (e.g. www.kth.se). However, you can use ***dig*** to ask explicitly for the Resource Records of type **NS**.

Provide the command you used …***dig kth.se ns*** ……

What are the authoritative DNS servers of the domain **kth.se**? Make sure that the answer RR is of the expected type! **nic2.lth.se, a.ns.kth.se, ns2.chalmers.se and b.ns.kth.se**

……

d. You will now query one of these **kth.se** NS servers **ns2.chalmers.se** (which is also NS of

Chalmers). Use ***dig*** to get information about a KTH computer and compare the results with those when using one of the official name servers at Chalmers **sunic.sunet.se** to get information about the same KTH computer.
In both cases the server you ask is authoritative, are there differences? ***Yes, there are differences*** Explain. ***When we executed [dig a.ns.kth.se @ns2.chalmers.se] it returned both the NS, A and AAA records with status flag as 'noerror', while execution of [dig a.ns.kth.se @sunic.sunet.se] returned a warning that recursion requested but not available, and status as 'refused'.***
……
……
……

**4. Survival time for cached information**

a. Look up again the translation for the web server **www.kth.se** using the cache-only server and repeat few times by doing successive lookups to see that the TTL value is counted down and after few minutes it becomes zero. Then you will get a new time-to-live value since your local server has to ask the KTH name server for a new translation.
For DNS, what is the TTL value used for? **T*TL value is used to define how long the cached DNS query will live before they expire.*** What does it mean? TTL means *'**Time To Live'*** Why is it needed? ***They are needed to control the cache load on the DNS server****.*
……
b. Repeat the same command but direct the DNS question to an authoritative server of KTH. Repeat the command several times and notice the TTL value. Is there any difference? **Yes,** If so, try to give an explanation of why. ***We noticed that the TTL value of 600 [in the answer section] remained constant with authoritative server, but decreased consecutively without an authoritative server. This is because the authoritative server had cached the www.kth.se.***

## APPENDIX

1. dig –x 192.168.43.133

```
ossy@DESKTOP-PGT4OML:~$ dig -x 192.168.43.133

; <<>> DiG 9.16.1-Ubuntu <<>> -x 192.168.43.133
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 58167
;; flags: qr aa rd ra ad; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;133.43.168.192.in-addr.arpa.   IN      PTR

;; ANSWER SECTION:
133.43.168.192.in-addr.arpa. 0  IN      PTR     DESKTOP-PGT4OML.

;; Query time: 169 msec
;; SERVER: 192.168.43.1#53(192.168.43.1)
;; WHEN: Fri Oct 16 14:29:03 CEST 2020
;; MSG SIZE  rcvd: 74
```

dig -x 192.168.211.1

```
ossy@DESKTOP-PGT4OML:~$ dig -x 192.168.211.1

; <<>> DiG 9.16.1-Ubuntu <<>> -x 192.168.211.1
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 37223
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1280
; COOKIE: bc81ce9bb9dc38f4299c15025f8997f5fb68ff97295c3fa0 (good)
;; QUESTION SECTION:
;1.211.168.192.in-addr.arpa.    IN      PTR

;; AUTHORITY SECTION:
168.192.IN-ADDR.ARPA.   10800   IN      SOA     example.org. zonemaster.example.org. 1 3600 1200 604800 10800

;; Query time: 252 msec
;; SERVER: 192.168.43.1#53(192.168.43.1)
;; WHEN: Fri Oct 16 14:54:14 CEST 2020
;; MSG SIZE  rcvd: 161
```

```
ossy@DESKTOP-PGT4OML:~$ dig -x 192.168.43.216

; <<>> DiG 9.16.1-Ubuntu <<>> -x 192.168.43.216
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 29690
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 1280
; COOKIE: 233df82a8c346a8bdb4203675f8998849d5a4e83aba62b10 (good)
;; QUESTION SECTION:
;216.43.168.192.in-addr.arpa.   IN      PTR

;; AUTHORITY SECTION:
168.192.IN-ADDR.ARPA.   10800   IN      SOA     example.org. zonemaster.example.org. 1 3600 1200 604800 10800

;; Query time: 42 msec
;; SERVER: 192.168.43.1#53(192.168.43.1)
;; WHEN: Fri Oct 16 14:56:37 CEST 2020
;; MSG SIZE  rcvd: 162
```

dig wwww.chalmers.se

```
ossy@DESKTOP-PGT4OML:~$ dig wwww.chalmers.se

; <<>> DiG 9.16.1-Ubuntu <<>> wwww.chalmers.se
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 53418
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;wwww.chalmers.se.              IN      A

;; AUTHORITY SECTION:
chalmers.se.            600     IN      SOA     ns1.chalmers.se. cth-nic.chalmers.se. 2020102224 14400 3600 1209600 600

;; Query time: 3 msec
;; SERVER: 192.168.1.1#53(192.168.1.1)
;; WHEN: Thu Oct 22 18:16:23 CEST 2020
;; MSG SIZE  rcvd: 93

ossy@DESKTOP-PGT4OML:~$
```

dig www.chalmers.se

```
ossy@DESKTOP-PGT4OML:~$ dig www.chalmers.se

; <<>> DiG 9.16.1-Ubuntu <<>> www.chalmers.se
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 5866
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 4, ADDITIONAL: 9

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.chalmers.se.                IN      A

;; ANSWER SECTION:
www.chalmers.se.        8573    IN      A       129.16.71.10

;; AUTHORITY SECTION:
chalmers.se.            84027   IN      NS      ns1.chalmers.se.
chalmers.se.            84027   IN      NS      ns3.chalmers.se.
chalmers.se.            84027   IN      NS      ns2.chalmers.se.
chalmers.se.            84027   IN      NS      sunic.sunet.se.

;; ADDITIONAL SECTION:
ns1.chalmers.se.        84027   IN      A       129.16.2.40
ns1.chalmers.se.        84027   IN      AAAA    2001:6b0:2:10::1
ns2.chalmers.se.        83016   IN      A       129.16.253.252
ns2.chalmers.se.        83016   IN      AAAA    2001:6b0:2:20::1
ns3.chalmers.se.        84027   IN      A       192.36.120.11
ns3.chalmers.se.        84027   IN      AAAA    2001:2040:63::11
sunic.sunet.se.         83187   IN      A       192.36.125.2
sunic.sunet.se.         83187   IN      AAAA    2001:6b0:7::2

;; Query time: 3 msec
;; SERVER: 192.168.1.1#53(192.168.1.1)
;; WHEN: Thu Oct 22 18:50:32 CEST 2020
;; MSG SIZE  rcvd: 316
```

dig www.chalmers.se ns

```
ossy@DESKTOP-PGT4OML:/etc$ dig www.chalmers.se ns

; <<>> DiG 9.16.1-Ubuntu <<>> www.chalmers.se ns
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 7844
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.chalmers.se.               IN      NS

;; AUTHORITY SECTION:
chalmers.se.            600     IN      SOA     ns1.chalmers.se. cth-nic.chalmers.se. 2020102226 14400 3600 1209600 600

;; Query time: 3 msec
;; SERVER: 192.168.1.1#53(192.168.1.1)
;; WHEN: Thu Oct 22 20:17:14 CEST 2020
;; MSG SIZE  rcvd: 92
```

Cat /etc/resolv.conf

```
ossy@DESKTOP-PGT4OML:/etc$ cat /etc/resolv.conf
# This file was automatically generated by WSL. To stop automatic generation of this file, add the following entry to /etc/wsl.conf
# [network]
# generateResolvConf = false
nameserver 192.168.1.1
nameserver fec0:0:0:ffff::1
nameserver fec0:0:0:ffff::2
ossy@DESKTOP-PGT4OML:/etc$
```

dig remote12.chalmers.se @ns2.chalmers.se

```
ossy@DESKTOP-PGT4OML:/etc$ dig remote12.chalmers.se @ns2.chalmers.se

; <<>> DiG 9.16.1-Ubuntu <<>> remote12.chalmers.se @ns2.chalmers.se
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 54653
;; flags: qr aa rd; QUERY: 1, ANSWER: 1, AUTHORITY: 4, ADDITIONAL: 7
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
; COOKIE: e0a96c1966d68ec295f39d985f91c31ad7855cd839bbdae3 (good)
;; QUESTION SECTION:
;remote12.chalmers.se.          IN      A

;; ANSWER SECTION:
remote12.chalmers.se.   14400   IN      A       129.16.29.51

;; AUTHORITY SECTION:
chalmers.se.            172800  IN      NS      ns3.chalmers.se.
chalmers.se.            172800  IN      NS      ns1.chalmers.se.
chalmers.se.            172800  IN      NS      sunic.sunet.se.
chalmers.se.            172800  IN      NS      ns2.chalmers.se.

;; ADDITIONAL SECTION:
ns1.chalmers.se.        172800  IN      A       129.16.2.40
ns2.chalmers.se.        172800  IN      A       129.16.253.252
ns3.chalmers.se.        172800  IN      A       192.36.120.11
ns1.chalmers.se.        172800  IN      AAAA    2001:6b0:2:10::1
ns2.chalmers.se.        172800  IN      AAAA    2001:6b0:2:20::1
ns3.chalmers.se.        172800  IN      AAAA    2001:2040:63::11

;; Query time: 1 msec
;; SERVER: 129.16.253.252#53(129.16.253.252)
;; WHEN: Thu Oct 22 19:36:26 CEST 2020
;; MSG SIZE  rcvd: 305
```

dig ns1.chalmers.se www.google.com

```
ossy@DESKTOP-PGT4OML:~$ dig ns1.chalmers.se www.google.com

; <<>> DiG 9.16.1-Ubuntu <<>> ns1.chalmers.se www.google.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 93
;; flags: qr rd ra ad; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;ns1.chalmers.se.               IN      A

;; ANSWER SECTION:
ns1.chalmers.se.        72542   IN      A       129.16.2.40

;; Query time: 6 msec
;; SERVER: 10.0.0.2#53(10.0.0.2)
;; WHEN: Fri Oct 16 17:43:20 CEST 2020
;; MSG SIZE  rcvd: 60

;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 4195
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.google.com.                IN      A

;; ANSWER SECTION:
www.google.com.         122     IN      A       216.58.211.132

;; Query time: 3 msec
;; SERVER: 10.0.0.2#53(10.0.0.2)
;; WHEN: Fri Oct 16 17:43:20 CEST 2020
;; MSG SIZE  rcvd: 59
```

dig kth.se ns

```
ossy@DESKTOP-PGT4OML:/etc$ dig kth.se ns

; <<>> DiG 9.16.1-Ubuntu <<>> kth.se ns
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 34556
;; flags: qr rd ra; QUERY: 1, ANSWER: 4, AUTHORITY: 0, ADDITIONAL: 8

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;kth.se.                                IN      NS

;; ANSWER SECTION:
kth.se.                 1772    IN      NS      a.ns.kth.se.
kth.se.                 1772    IN      NS      b.ns.kth.se.
kth.se.                 1772    IN      NS      ns2.chalmers.se.
kth.se.                 1772    IN      NS      nic2.lth.se.

;; ADDITIONAL SECTION:
a.ns.kth.se.            8968    IN      A       130.237.72.246
a.ns.kth.se.            8968    IN      AAAA    2001:6b0:1::246
b.ns.kth.se.            8968    IN      A       130.237.72.250
b.ns.kth.se.            8968    IN      AAAA    2001:6b0:1::250
ns2.chalmers.se.        79603   IN      A       129.16.253.252
ns2.chalmers.se.        79603   IN      AAAA    2001:6b0:2:20::1
nic2.lth.se.            77893   IN      A       130.235.20.5

;; Query time: 5 msec
;; SERVER: 192.168.1.1#53(192.168.1.1)
;; WHEN: Thu Oct 22 19:47:25 CEST 2020
;; MSG SIZE  rcvd: 268
```

dig www.kth.se @ns2.chalmers.se

```
ossy@DESKTOP-PGT4OML:/etc$ dig www.kth.se @ns2.chalmers.se

; <<>> DiG 9.16.1-Ubuntu <<>> www.kth.se @ns2.chalmers.se
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 41756
;; flags: qr aa rd; QUERY: 1, ANSWER: 1, AUTHORITY: 4, ADDITIONAL: 7
;; WARNING: recursion requested but not available

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
; COOKIE: e5ec749c0278b7d6cc0336a05f91cabb25e608a977a8014d (good)
;; QUESTION SECTION:
;www.kth.se.                    IN      A

;; ANSWER SECTION:
www.kth.se.             600     IN      A       130.237.28.40

;; AUTHORITY SECTION:
kth.se.                 1800    IN      NS      b.ns.kth.se.
kth.se.                 1800    IN      NS      a.ns.kth.se.
kth.se.                 1800    IN      NS      ns2.chalmers.se.
kth.se.                 1800    IN      NS      nic2.lth.se.

;; ADDITIONAL SECTION:
a.ns.kth.se.            1800    IN      A       130.237.72.246
b.ns.kth.se.            1800    IN      A       130.237.72.250
ns2.chalmers.se.        172800  IN      A       129.16.253.252
a.ns.kth.se.            1800    IN      AAAA    2001:6b0:1::246
b.ns.kth.se.            1800    IN      AAAA    2001:6b0:1::250
ns2.chalmers.se.        172800  IN      AAAA    2001:6b0:2:20::1

;; Query time: 2 msec
;; SERVER: 129.16.253.252#53(129.16.253.252)
;; WHEN: Thu Oct 22 20:09:00 CEST 2020
;; MSG SIZE  rcvd: 300
```

dig www.kth.se

```
ossy@DESKTOP-PGT4OML:/etc$ dig www.kth.se

; <<>> DiG 9.16.1-Ubuntu <<>> www.kth.se
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 26696
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 4096
;; QUESTION SECTION:
;www.kth.se.                    IN      A

;; ANSWER SECTION:
www.kth.se.             587     IN      A       130.237.28.40

;; Query time: 1 msec
;; SERVER: 192.168.1.1#53(192.168.1.1)
;; WHEN: Thu Oct 22 20:11:14 CEST 2020
;; MSG SIZE  rcvd: 55

ossy@DESKTOP-PGT4OML:/etc$
```