



Assignments &gt; Lab 10: DNS

# Lab 10: DNS

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## Instructions

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## Instructions:

- Include an annotated screenshot of Wireshark and command windows for each answer. Do not reuse the same screenshot for two questions.
- Submissions must be through Brightspace.
- There is a 24-hour grace period after the due date without a penalty. Late submissions will not be accepted.

**Note:** This lab is mostly adapted from materials provided by the authors of *Computer Networking: A Top-Down Approach*. All rights reserved.

## Introduction

The Domain Name System (DNS) translates hostnames to IP addresses, fulfilling a critical role in the Internet infrastructure. In this lab, we will take a closer look at the client side of DNS. Recall that the client's role in the DNS is relatively simple – a client sends a *query* to its local DNS server, and receives a *response* back. Note that much can go on “under the covers,” invisible to the DNS clients, as the hierarchical DNS servers communicate with each other to either recursively or iteratively resolve the client's DNS query. From the DNS client's standpoint, however, the protocol is quite simple; a query is formulated to the local DNS server and a response is received from that server.

## nslookup Program

In this lab, we will make extensive use of the nslookup tool, which is available in most Linux/Unix and Microsoft platforms today. To run nslookup in Linux/Unix, you just type the nslookup command on the command line. To run it in Windows, open the Command Prompt and run nslookup on the command line.

In its most basic operation, nslookup tool allows the host running the tool to query any specified DNS server for a DNS record. The queried DNS server can be a root

Submit

Cancel

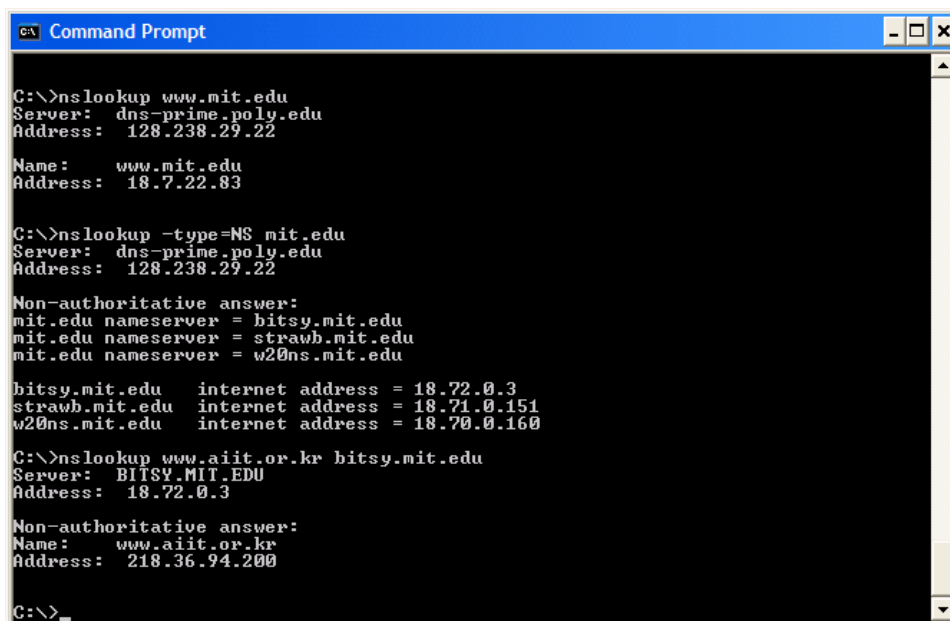
specified DNS server, receives a DNS reply from that same DNS server, and displays the result.

The screenshot below shows the results of three independent nslookup commands (displayed in the Windows Command Prompt). In this example, the client host is located on the campus of Polytechnic University in Brooklyn, where the default local DNS server is dns-prime.poly.edu. When running nslookup, if no DNS server is specified, then nslookup sends the query to the default DNS server, which in this case is dns-prime.poly.edu.

Consider the first command:

```
>nslookup www.mit.edu
```

In words, this command is saying “please send me the IP address for the host www.mit.edu”. As shown in the screenshot, the response from this command provides two pieces of information: (1) the name and IP address of the DNS server that provides the answer; and (2) the answer itself, which is the host name and IP address of www.mit.edu. Although the response came from the local DNS server at Polytechnic University, it is quite possible that this local DNS server iteratively contacted several other DNS servers to get the answer.



```
CA Command Prompt

C:\>nslookup www.mit.edu
Server: dns-prime.poly.edu
Address: 128.238.29.22

Name: www.mit.edu
Address: 18.7.22.83

C:\>nslookup -type=NS mit.edu
Server: dns-prime.poly.edu
Address: 128.238.29.22

Non-authoritative answer:
mit.edu nameserver = bitsy.mit.edu
mit.edu nameserver = strawb.mit.edu
mit.edu nameserver = w20ns.mit.edu

bitsy.mit.edu internet address = 18.72.0.3
strawb.mit.edu internet address = 18.71.0.151
w20ns.mit.edu internet address = 18.70.0.160

C:\>nslookup www.aiit.or.kr bitsy.mit.edu
Server: BITSY.MIT.EDU
Address: 18.72.0.3

Non-authoritative answer:
Name: www.aiit.or.kr
Address: 218.36.94.200

C:\>
```

Now consider the second command:

```
>nslookup --type=NS mit.edu
```

In this example, we have provided the option “-type=NS” and the domain “mit.edu”. This causes nslookup to send a query for a type-NS record to the default local DNS server. In words, the query is saying, “please send me the host names of the authoritative DNS for mit.edu”. (When the -type option is not used, nslookup uses the default, which is to query for type A records.) The answer, displayed in the above screenshot, first indicates the DNS server that is providing the answer (which is the default local DNS server) along with three MIT nameservers. Each of these servers is indeed an authoritative DNS server for the hosts on the MIT campus. However,

nslookup also indicates that the answer is “non-authoritative,” meaning that this answer came from the cache of some server rather than from an authoritative MIT DNS server. Finally, the answer also includes the IP addresses of the authoritative DNS servers at MIT. (Even though the type-NS query generated by nslookup did not explicitly ask for the IP addresses, the local DNS server returned these “for free” and nslookup displays the result.)

Now finally consider the third command:

```
>nslookup www.aiit.or.kr bitsy.mit.edu
```

In this example, we indicate that we want the query sent to the DNS server bitsy.mit.edu rather than to the default DNS server (i.e., dns-prime.poly.edu). Thus, the query and reply transaction takes place directly between our querying host and bitsy.mit.edu. In this example, the DNS server bitsy.mit.edu provides the IP address of the host www.aiit.or.kr, which is a web server at the Advanced Institute of Information Technology (in Korea).

Now that we have gone through a few illustrative examples, you are perhaps wondering about the general syntax of nslookup commands. The syntax is:

```
>nslookup --option1 --option2 host-to-find dns-server
```

In general, nslookup can be run with zero, one, two, or more options. And as we have seen in the above examples, the dns-server is optional as well; if it is not supplied, the query is sent to the default local DNS server.

## Questions

**Now answer the following questions:**

1. Run nslookup to obtain the IP address of a Web server in Asia. What is the IP address of that server?
2. Run nslookup to determine the authoritative DNS servers for a university in Europe.
3. Run nslookup so that one of the DNS servers obtained in Question 2 is queried for the mail servers for Yahoo! mail. What is its IP address?

## ipconfig Program

ipconfig (for Windows) and ifconfig (for Linux/Unix) are among the most useful little utilities in your host, especially for debugging network issues. Here we will only describe ipconfig, although the Linux/Unix ifconfig is very similar. ipconfig can be used to show your current TCP/IP information, including your address, DNS server addresses, adapter type and so on. For example, if you all this information about your host simply by entering

```
>ipconfig /all
```

into the Command Prompt, as shown in the following screenshot.

```

C:\>ipconfig /all

Windows IP Configuration

    Host Name . . . . . : USG11631-ZMWQA6
    Primary Dns Suffix . . . . . :
    Node Type . . . . . : Hybrid
    IP Routing Enabled. . . . . : No
    WINS Proxy Enabled. . . . . : No

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  : poly.edu
    Description . . . . . : Intel(R) PRO/100 UE Network Connecti
on
    Physical Address. . . . . : 00-09-6B-10-60-99
    Dhcp Enabled. . . . . : Yes
    Autoconfiguration Enabled . . . . : Yes
    IP Address. . . . . : 128.238.38.160
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 128.238.38.1
    DHCP Server . . . . . : 128.238.29.25
    DNS Servers . . . . . : 128.238.29.22
                           128.238.29.23
                           128.238.2.38
                           128.238.32.22
    Primary WINS Server . . . . . : 128.238.29.23
    Secondary WINS Server . . . . . : 128.238.29.22
    Lease Obtained. . . . . : Monday, August 30, 2004 1:30:50 PM
    Lease Expires . . . . . : Monday, August 30, 2004 7:30:50 PM
  
```

ipconfig is also very useful for managing the DNS information stored in your host. Recall that a host can cache DNS records it recently obtained. To see these cached records, enter the following command:

```
>ipconfig /displaydns
```

Each entry shows the remaining Time to Live (TTL) in seconds. To clear the cache, enter the following command:

```
>ipconfig /flushdns
```

## Tracing DNS with Wireshark

Now that we are familiar with nslookup and ipconfig, let's capture the DNS packets that are generated by ordinary Web-surfing activity. Do the following:

- Use ipconfig to empty the DNS cache in your host.
- Open your browser and empty your browser cache.
- Open Wireshark and enter "ip.addr == your\_IP\_address" into the filter, where you obtain your\_IP\_address with ipconfig. This filter removes all packets that neither originate nor are destined to your host.
- Start packet capture in Wireshark.
- With your browser, visit the Web page: <http://www.ietf.org>
- Stop packet capture.

**Now answer the following questions:** Support all answers by a screenshot of Wireshark window as needed. Annotate screenshots to explain your answer. You should also include in a screenshot of the Command Prompt window.

4. Locate the DNS query and response messages. Are then sent over UDP or TCP?
5. What is the destination port for the DNS query message? What is the source port of DNS response message?
6. To what IP address is the DNS query message sent? Use ipconfig to determine the IP address of your local DNS server. Are these two IP addresses

the same?

7. Examine the DNS query message. What “Type” of DNS query is it? Does the query message contain any “answers”?
8. Examine the DNS response message. How many “answers” are provided? What do each of these answers contain?
9. Consider the subsequent TCP SYN packet sent by your host. Does the destination IP address of the SYN packet correspond to any of the IP addresses provided in the DNS response message?
10. This web page contains images. Before retrieving each image, does your host issue new DNS queries?

Due on Nov 30, 2023 11:59 PM

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Available until Dec 1, 2023 11:59 PM. **Access restricted after availability ends.**

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