# Activity 2.1.3b Protocols and Bandwidth

## Part II: Explain how the Domain Name System works

7. What domain is this name server in charge of?

8. Name servers delegate autonomous authority to servers below them. For example, the `.org` name server doesn't keep track of IP addresses for all computers using domain names within `.org`.

   Why is this delegation of authority necessary?

9. The six computers involved in the diagram are listed A–F. Record who says each of the messages 1–8 below, and to whom.

**Teacher Only**

1. Your computer:
2. Your name server:
3. root name server:
4. `.org` name server:
5. `example.org` name server:
6. `www.example.org` web server:

1. from____to____: What is the IP address of www.example.org?
2. from____to____: What is the IP address of www.example.org?
3. from____to____: Ask 204.74.112.1
4. from____to____: What is the IP address of www.example.org?
5. from____to____: Ask 93.184.216.119
6. from____to____: What is the IP address of www.example.org?
7. from____to____: The IP# of www.example.org is 93.184.216.119
8. from____to____: The IP# of www.example.org is 93.184.216.119

## Part III: Get situated on a server

13. Review the vocabulary in the Lesson 2.1 Key Terms and examine the commands in Section 1 of the Lesson 2.1 Reference Card.

    One strategy to improve reading comprehension is to create a graphic organizer connecting the main ideas. Another strategy is to create a sentence describing the relationships that connect the main ideas. For example, write one or more sentences that describe how you use the command “pwd” and what it tells you, using the terms “operating system”, “application”, “shell”, and “command line interface.”

## Part IV: Examine how the NIC gets you onto the Internet

15. Identify three pieces of information from the output.
    - Recall that data on the Internet is always sent in numbered packets, sent from one IP address to another IP address. Version 4 of the IP address protocol uses “dotted decimal” notation: four decimals between 0 and 255, separated by dots. The output shown above says that the Ethernet card has the IPv4 address `172.17.27.123`.

      What is the IP version 4 address of the NIC your Cloud9 machine?

    - Every network interface card has a Media Access Control address (**MAC address**, no special relationship to Macintosh computers) built into the card hardware when it is manufactured. Most NICs connect to the Internet by Ethernet over copper wires. Ethernet uses one or more shorter packets called frames to send each IP packet to the other devices connected to the copper wires, and the frames include the sender’s MAC address and the target recipient’s MAC address. Each MAC address has six 2-digit hexadecimal numbers separated by colons. The MAC address shown in the output above is `02:42:ac:11:1b:7b`.

      What is the MAC address of the NIC on your Cloud9 machine?

**Teacher Only**

Answers vary.

- There were only `256·256·256·256` addresses possible with IP version 4. (Can you explain why?) In 2012, the Internet ran out of addresses. For that reason, gradually, Internet traffic is shifting to IP version 6, and most NICs can use either version. IPv6 addresses are written in colon-hexadecimal notation: eight 4-digit hexadecimal numbers separated with colons. Leading zeros are left out, so a number like 0c4f is written as c4f. If one or more of the 4-digit numbers is zero, the 0 or 0's are replaced with a double colon. The output above shows that the Ethernet NIC has IPv6 address `fe80::42:acff:fe11:1b7b`, which is shorthand for `fe80:0000:0000:0042:acff:fe11:1b7b`.

  What is the IPv6 address of the NIC on your Cloud9 machine?

**Teacher Only**

Answers vary.