Introduction to Web Science

Assignment 1

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Tutorial on:	November 4th, 2016, 12:00 p.m.
Team:	Golf
Members:	Mtarji Adam Deepak Garg Atique Baig

The main objective of this assignment is for you to use different tools with which you can understand the network that you are connected to or you are connecting to in a better sense. These tasks are not always specific to "Introduction to Web Science". For all the assignment questions that require you to write a code, make sure to include the code in the answer sheet, along with a separate python file. Where screen shots are required, please add them in the answers directly and not as separate files.

1 Ethernet Frame (5 Points)

Ethernet Frame is of the given structure:

Preamble	Destination MAC address	Source MAC address	Type/Length	User Data	Frame Check Sequence (FCS)
8	6	6	2	46 - 1500	4

Figure 1: Ethernet Frame Structure

Given below is an Ethernet frame without the Preamble and the Frame Check Sequence.

```
00 27 10 21 fa 48 00 13     10 e8 dd 52 08 06 00 01
08 00 06 04 00 01 00 13     10 e8 dd 52 c0 a8 02 01
00 00 00 00 00 00 c0 a8     02 67
```

Solution:

1. Source MAC Address
   The source MAC Address is 00 13 10 e8 dd 52

2. Destination MAC Address
   The destination MAC Address is 00 27 10 21 fa 48

3. What protocol is inside the data payload?
   The 13th and 14th bytes holds the EtherType : 08 06 -> Address Resolution Protocol (ARP)

4. Please mention what the last 2 fields hold in the above frame.
   Folowing the ARP encaspsulated packet structure, the last 4 bytes represents the last 2 fields of the ARP payload that holds the Target Protocol Address (TPA). Which in this case is c0 a8 02 67, converting to decimal gives us 192 168 2 103. This means that the target IP is 192.168.2.103.

2 Cable Issue (5 Points)

Let us consider we have two cables of 20 meters each. One of them is in a 100MBps network while the other is in a 10MBps network. If you had to transfer data through each of them, how much time it would take for the first bit to arrive in each setting? (For your calculation you can assume that the speed of light takes the same value as in the videos.) Please provide formulas and calculatoins along with your results.

Solution:
Assuming the speed of light is : 300 000 000 m/s
And cable lenth of 20m

In the case of a 100MBit/s, it takes 1 clock cycle of 10^{-8}s for 1 bit to travel 3m. Lets conider t_1 the time it takes for 1 bit to reach 20m, this gives us the following equation :

$$t_1 = 10 \times \frac{20}{3} ns \quad (1)$$
$$= 66.66ns \quad (2)$$

In the case of a 10Mbit/s, it takes 1 clock cycle of 10^{-7}s for 1 bit to travel 30m. Lets consider t_2 the time it takes for 1 bit to reach 20m, this gives us the following equation :

$$t_2 = 100 \times \frac{20}{30} ns \quad (3)$$
$$= 66.66ns \quad (4)$$

3 Basic Network Tools (10 Points)

Listed below are some of the commands which you need to ”google” to understand what they stand for:

1. *ipconfig / ifconfig*
2. *ping*
3. *traceroute*
4. *arp*
5. *dig*

Consider a situation in which you need to check if `www.wikipedia.org` is reachable or not. Using the knowledge you gained above to find the following information:

Using windows:

1. The *% packet loss* if at all it happened after sending 100 packets.
   Using the command : ping -n 100 www.wikipedia.org

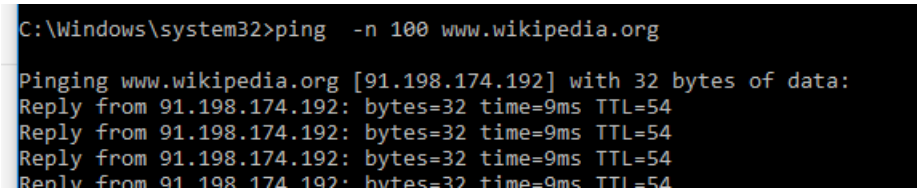

Figure 2: Pinging 100 packets

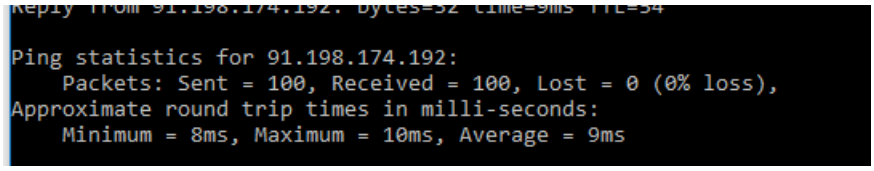

Figure 3: Result and packet loss %

2. *Size* of the packet sent to *Wikipedia* server
   The size of the packet sent to Wikipedia server can be specified by the following command (default is 32 bit) : ping -l 2000 www.wikipedia.org

3. *IP address* of your machine and the *Wikipedia* server

```
C:\Windows\system32>ping  -l 2000 www.wikipedia.org

Pinging www.wikipedia.org [91.198.174.192] with 2000 bytes of data:
Reply from 91.198.174.192: bytes=2000 time=10ms TTL=54
Reply from 91.198.174.192: bytes=2000 time=10ms TTL=54
Reply from 91.198.174.192: bytes=2000 time=9ms TTL=54
Reply from 91.198.174.192: bytes=2000 time=10ms TTL=54

Ping statistics for 91.198.174.192:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 9ms, Maximum = 10ms, Average = 9ms
```

Figure 4: Ping with packet size

localhost :
Using the command ipconfig : 172.16.5.146

```
Ethernet adapter Ethernet 2:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::bd82:3ede:bbea:460f%20
   IPv4 Address. . . . . . . . . . . : 172.16.5.146
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . : 172.16.1.1
```

Figure 5: Localhost IP address

www.wikipedia.org :
Using nslookup (dig not available for windows): 91.198.174.192

```
C:\Windows\system32>nslookup www.wikipedia.org
Server:  setup.ubnt.com
Address:  172.16.1.1

Non-authoritative answer:
Name:    www.wikipedia.org
Addresses:  2620:0:862:ed1a::1
          91.198.174.192
```

Figure 6: www.wikipedia.org IP address

4. *Query Time* for DNS query of the above url.
5. Number of *Hops* in between your machine and the server
   Using the command tracert (windows alt for traceroute) : 12

Figure 7: Number of hops

6. MAC address of the device that is acting as your network gateway.
   Using the command ipconfig /all : F0-92-1C-4E-8A-9E

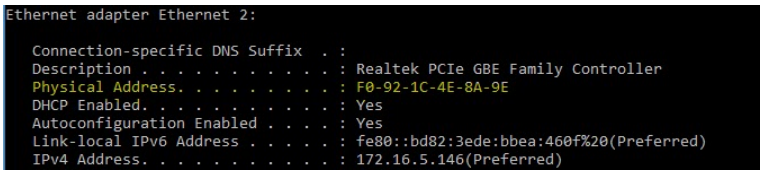

Figure 8: Network gateway MAC Address

Do this once in the university and once in your home/dormitory network. With your answers, you must paste the screen shots to validate your find.

4 Simple Python Programming (10 Points)

Write a simple python program that does the following:

1. Generate a random number sequence of 10 values between 0 to 90.
2. Perform `sine` and `cosine` operation on numbers generated.
3. Store the values in two different arrays named SIN & COSIN respectively.
4. Plot the values of SIN & COSIN in two different colors.
5. The plot should have labeled axes and legend.

Solution:

```
"""
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Team : golf
"""

# modules
import random
import math
import matplotlib.pyplot as mplot

# variables

#Array to store the 10 random numbers between 0 and 90
randomSample = []

#Arrays to store the values of sine and cosine on the sample
sin = []
cosin = []

#1. Generate a random number sequence of 10 values between 0 to 90
#initializing the sample
randomSample =  random.sample(range(0,90),10)
print("The random sample used is : %s" %randomSample)

#2. Perform Sine and Cosine operation on numbers generated
#3. Store the values in two different arrays named SIN & COSIN respectively
#calculating the sine
sin = [math.sin(i) for i in randomSample]
print("Applying sine to the sample : %s" %sin)

#calculating the cosine
cosin = [math.cos(i) for i in randomSample]
print("Applying cosine to the sample : %s" %cosin)

#4. Plot the values of SIN & COSIN in two different colors
#ploting sin in red and cosin in yellow
mplot.plot(randomSample, sin,'r',label="Calculated sine")
mplot.plot(randomSample,cosin,'b',label="Calculated cosine")

#5. The plot should have labeled axes and legend.
mplot.ylabel('Calculated value')
mplot.xlabel('Sample')
mplot.grid(True)

```

Figure 9: Python code

Important Notes

Submission

- Solutions have to be checked into the github repository. Use the directory name `groupname/assignment1/` in your group's repository.
- The name of the group and the names of all participating students must be listed on each submission.
- Solution format: all solutions as *one* PDF document. Programming code has to be submitted as Python code to the github repository. Upload *all* `.py` files of your program! Use `UTF-8` as the file encoding. *Other encodings will not be taken into account!*
- Check that your code compiles without errors.
- Make sure your code is formatted to be easy to read.
  - Make sure you code has consistent indentation.
  - Make sure you comment and document your code adequately in English.
  - Choose consistent and intuitive names for your identifiers.
- Do *not* use any accents, spaces or special characters in your filenames.

Acknowledgment

This latex template was created by Lukas Schmelzeisen for the tutorials of "Web Information Retrieval".