

# Introduction to Web Science

## Assignment 1

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Submission until: November 2, 2016, 10:00 a.m.

Tutorial on: November 4th, 2016, 12:00 p.m.

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
```

Find:

1. Source MAC Address
2. Destination MAC Address
3. What protocol is inside the data payload?
4. Please mention what the last 2 fields hold in the above frame.
  - 00 13 10 e8 dd 52
  - 00 27 10 21 fa 48
  - ARP - Address Resolution Protocol - Used to map IP addresses to MAC addresses
  - c0 a8 02 67 - represents the IP address of the destination machine, in this 02 and 67 represents the last two bytes of IP address, 00 00 00 00 00 00 - destination mac address

## 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 calculations along with your results.

Answer:

It will take the same time for both network speed to have its 1st bit of data to reach the destination. Since the speed of the light is the same which is  $3 * 10^8$  meters per second. But it will have make a lot of difference for whole data to reach, since the encoding speed differs.

Speed = Distance / time

Speed is speed of light =  $3 * 10^8$  meters per second Distance = 20 metres

*Time = Distance/Speed =  $20/3 = 66.7nanosecond$*

### 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. *tracert*
4. *arp*
5. *dig*

Consider a situation in which you need to check if [www.wikipedia.org](http://www.wikipedia.org) is reachable or not. Using the knowledge you gained above to find the following information:

1. The *% packet loss* if at all it happened after sending 100 packets.
2. *Size* of the packet sent to *Wikipedia* server
3. *IP address* of your machine and the *Wikipedia* server
4. *Query Time* for DNS query of the above url.
5. Number of *Hops* in between your machine and the server
6. MAC address of the device that is acting as your network gateway.

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.

Ans:

From the university:

1. Packet loss - 0
2. Size - 32 bytes

```
Command Prompt

Reply from 91.198.174.192: bytes=32 time=11ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=9ms TTL=55
Reply from 91.198.174.192: bytes=32 time=13ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=9ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=11ms TTL=55
Reply from 91.198.174.192: bytes=32 time=10ms TTL=55
Reply from 91.198.174.192: bytes=32 time=13ms TTL=55
Reply from 91.198.174.192: bytes=32 time=12ms TTL=55

Ping statistics for 91.198.174.192:
    Packets: Sent = 100, Received = 100, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 9ms, Maximum = 85ms, Average = 11ms
```

### 3. IP address - my machine -141.26.179.24 wikipedia server - 91.198.174.192

```
kandy@kandy-HP-Notebook:~$ ifconfig
enp3s0    Link encap:Ethernet  HWaddr 98:e7:f4:08:0d:f2
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:5210 errors:0 dropped:0 overruns:0 frame:0
          TX packets:5210 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:955375 (955.3 KB)  TX bytes:955375 (955.3 KB)

wlo1     Link encap:Ethernet  HWaddr cc:b0:da:70:c5:2d
          inet addr:141.26.179.24  Bcast:141.26.191.255  Mask:255.255.240.0
          inet6 addr: fe80::fab3:5b13:550e:9426/64 Scope:link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1199312 errors:0 dropped:11 overruns:0 frame:0
          TX packets:184584 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:253894077 (253.0 MB)  TX bytes:18022872 (18.0 MB)

kandy@kandy-HP-Notebook:~$ ping www.wikipedia.org
PING www.wikipedia.org (91.198.174.192) 56(84) bytes of data:
64 bytes from text-lb.esams.wikimedia.org (91.198.174.192): icmp_seq=1 ttl=55 time=10.0 ms
64 bytes from text-lb.esams.wikimedia.org (91.198.174.192): icmp_seq=2 ttl=55 time=10.1 ms
64 bytes from text-lb.esams.wikimedia.org (91.198.174.192): icmp_seq=3 ttl=55 time=10.1 ms
^C
--- www.wikipedia.org ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2002ms
rtt min/avg/max/mdev = 10.003/10.115/10.162/0.040 ms
kandy@kandy-HP-Notebook:~$
```

### 4. 79 msec

```
kandy@kandy-HP-Notebook:~$ dig www.wikipedia.org

;; global options: +cd
;; Got answer:
;;->HEADER<=> opcode: QUERY, status: NXDOMAIN, id: 43291
;; flags: qr rd ra; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 1

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

;; AUTHORITY SECTION:
529      IN      SOA      a.root-servers.net. nstld.verisign-grs.com. 2016103100 1800 900 604800 66400

;; Query time: 134 msec
;; SERVER: 127.0.1.1#53(127.0.1.1)
;; WHEN: Mon Oct 31 17:30:06 CET 2016
;; MSG SIZE rcvd: 122

kandy@kandy-HP-Notebook:~$ dig www.wikipedia.org

<==> Dlg 9.10.3-P4-Ubuntu <==> www.wikipedia.org
;; global options: +cd
;; Got answer:
;;->HEADER<=> opcode: QUERY, status: NXERROR, id: 53147
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 13

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

;; ANSWER SECTION:
www.wikipedia.org.      599      IN      A      91.198.174.192

;; AUTHORITY SECTION:
org.      152042   IN      NS      c0.org.afllas-nst.info.
org.      152042   IN      NS      b2.org.afllas-nst.org.
org.      152042   IN      NS      a2.org.afllas-nst.info.
org.      152042   IN      NS      a0.org.afllas-nst.info.
org.      152042   IN      NS      d0.org.afllas-nst.org.
org.      152042   IN      NS      b0.org.afllas-nst.org.

;; ADDITIONAL SECTION:
a0.org.afllas-nst.info. 152042   IN      A      199.19.56.1
a0.org.afllas-nst.info. 152042   IN      AAAA   2001:500:e0:1
a2.org.afllas-nst.info. 152042   IN      A      199.249.112.1
a2.org.afllas-nst.info. 152042   IN      AAAA   2001:500:40:1
b0.org.afllas-nst.org. 152042   IN      A      199.19.54.1
b0.org.afllas-nst.org. 152042   IN      AAAA   2001:500:c1:1
b2.org.afllas-nst.org. 152042   IN      AAAA   199.249.120.1
b2.org.afllas-nst.org. 152042   IN      AAAA   2001:500:48:1
c0.org.afllas-nst.info. 152042   IN      A      199.19.23.1
c0.org.afllas-nst.info. 152042   IN      AAAA   2001:500:b1:1
d0.org.afllas-nst.org. 152042   IN      A      199.19.57.1
d0.org.afllas-nst.org. 152042   IN      AAAA   2001:500:f1:1

;; Query time: 79 msec
;; SERVER: 127.0.1.1#53(127.0.1.1)
;; WHEN: Mon Oct 31 17:30:12 CET 2016
;; MSG SIZE rcvd: 464

kandy@kandy-HP-Notebook:~$
```

5. 11 hops

```

C:\Command Prompt

Tracing route to wikipedia.org [91.198.174.192]
over a maximum of 30 hops:

  1    2 ms    1 ms    1 ms    wlanrouter.uni-koblenz.de [141.26.176.1]
  2    6 ms    6 ms    2 ms    g-uni-ko-1.rlp-net.net [217.198.241.129]
  3    4 ms    2 ms    2 ms    g-hbf-ko-1.rlp-net.net [217.198.240.69]
  4    4 ms    3 ms    3 ms    217.198.247.117
  5    5 ms    7 ms    404 ms  g-interxion-1.rlp-net.net [217.198.240.13]
  6    4 ms    5 ms    3 ms    r1fra3.core.init7.net [80.81.192.67]
  7   12 ms   12 ms   12 ms   r1ams1.core.init7.net [77.109.128.154]
  8   12 ms   12 ms   13 ms   r1ams2.core.init7.net [77.109.128.146]
  9   11 ms   10 ms   10 ms   gw-wikimedia.init7.net [77.109.134.114]
 10  10 ms   10 ms   10 ms   ae1-403.cr2-esams.wikimedia.org [91.198.174.254]
 11  10 ms   10 ms   10 ms   text-lb.esams.wikimedia.org [91.198.174.192]

Trace complete.

C:\Users\Daniel>

```

6. Gateway Mac address - 14:18:77:45:b1:bd

```
kandy@kandy-HP-Notebook:~$ traceroute www.wikipedia.org
traceroute to www.wikipedia.org (91.198.174.192), 30 hops max, 60 byte packets
 1 wlanrouter.uni-koblenz.de (141.26.176.1) 1.579 ms 2.254 ms 1.537 ms
 2 g-uni-ko-1.rlp-net.net (217.198.240.125) 2.269 ms 3.385 ms 3.014 ms
 3 g-hbf-ko-1.rlp-net.net (217.198.240.69) 2.644 ms 3.382 ms 3.028 ms
 4 217.198.247.117 (217.198.247.117) 5.219 ms g-hbf-mz-2.rlp-net.net (217.198.240.21) 4.943 ms 4.594 ms
 5 g-interxion-1.rlp-net.net (217.198.240.13) 4.179 ms 3.824 ms 3.448 ms
 6 r1fra3.core.int7.net (80.81.192.67) 5.538 ms 3.517 ms 3.049 ms
 7 r1ams1.core.int7.net (77.189.128.154) 13.229 ms 12.861 ms 12.816 ms
 8 r1ams2.core.int7.net (77.189.128.146) 12.440 ms 12.062 ms 12.010 ms
kandy@kandy-HP-Notebook:~$ arp 141.26.176.1
Address      Hwtype      Hwaddress    Flags Mask          Iface
-----
wlanrouter.uni-koblenz. ether 14:18:77:45:b1:bd C          wlan0
```

From home:

1. Packet loss - 0
2. Size - 32 bytes

```
C:\Windows\System32\cmd.exe
Reply from 91.198.174.192: bytes=32 time=52ms TTL=57
Reply from 91.198.174.192: bytes=32 time=49ms TTL=57
Reply from 91.198.174.192: bytes=32 time=46ms TTL=57
Reply from 91.198.174.192: bytes=32 time=65ms TTL=57
Reply from 91.198.174.192: bytes=32 time=44ms TTL=57
Reply from 91.198.174.192: bytes=32 time=110ms TTL=57
Reply from 91.198.174.192: bytes=32 time=48ms TTL=57
Reply from 91.198.174.192: bytes=32 time=70ms TTL=57
Reply from 91.198.174.192: bytes=32 time=443ms TTL=57
Reply from 91.198.174.192: bytes=32 time=49ms TTL=57
Reply from 91.198.174.192: bytes=32 time=45ms TTL=57
Reply from 91.198.174.192: bytes=32 time=50ms TTL=57
Reply from 91.198.174.192: bytes=32 time=46ms TTL=57
Reply from 91.198.174.192: bytes=32 time=52ms TTL=57
Reply from 91.198.174.192: bytes=32 time=77ms TTL=57
Reply from 91.198.174.192: bytes=32 time=261ms TTL=57
Reply from 91.198.174.192: bytes=32 time=83ms TTL=57
Reply from 91.198.174.192: bytes=32 time=47ms TTL=57
Reply from 91.198.174.192: bytes=32 time=405ms TTL=57
Reply from 91.198.174.192: bytes=32 time=49ms TTL=57
Reply from 91.198.174.192: bytes=32 time=79ms TTL=57
Reply from 91.198.174.192: bytes=32 time=46ms TTL=57
Reply from 91.198.174.192: bytes=32 time=54ms TTL=57

Ping statistics for 91.198.174.192:
    Packets: Sent = 100, Received = 100, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 43ms, Maximum = 529ms, Average = 83ms

C:\WINDOWS\system32>
```

3. IP address - my machine - 192.168.2.105 wikipedia server - 91.198.174.192

```
kandy@kandy-HP-Notebook:~$ sudo ifconfig
enp1s0 Link encap:Ethernet HWaddr 98:c7:f4:88:0d:f2
        UP BROADCAST MULTICAST  MTU:1500  Metric:1
        RX packets:0 errors:0 dropped:0 overruns:0 frame:0
        TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

to Link encap:Local Loopback
    inet addr:127.0.0.1  Mask:255.0.0.0
    inet6 addr: ::1/128 Scope:Host
        UP LOOPBACK RUNNING  MTU:65536  Metric:1
        RX packets:10410 errors:0 dropped:0 overruns:0 frame:0
        TX packets:10410 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1
        RX bytes:792587 (792.5 KB)  TX bytes:792587 (792.5 KB)

wlo1 Link encap:Ethernet HWaddr cc:b0:da:70:c5:2d
    inet addr:192.168.2.105  Bcast:192.168.2.255  Mask:255.255.255.0
    inet6 addr: fe80::7087:77a1:6389:d4dd/64 Scope:link
        UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
        RX packets:222948 errors:0 dropped:0 overruns:0 frame:0
        TX packets:127971 errors:0 dropped:0 overruns:0 carrier:0
        collisions:0 txqueuelen:1000
        RX bytes:282630248 (282.6 MB)  TX bytes:17146744 (17.1 MB)

kandy@kandy-HP-Notebook:~$ ping www.wikipedia.org
PING www.wikipedia.org (91.198.174.192) 56(84) bytes of data:
64 bytes from text:ib.esams.wiki-media.org (91.198.174.192): icmp_seq=1 ttl=60 time=87.1 ms
64 bytes from text:ib.esams.wiki-media.org (91.198.174.192): icmp_seq=2 ttl=60 time=87.7 ms
64 bytes from text:ib.esams.wiki-media.org (91.198.174.192): icmp_seq=3 ttl=60 time=79.0 ms
64 bytes from text:ib.esams.wiki-media.org (91.198.174.192): icmp_seq=4 ttl=60 time=74.4 ms
^C
^-- www.wikipedia.org ping statistics --
5 packets transmitted, 4 received, 20% packet loss, time 4014ms
rtt min/avg/max/mdev = 74.464/79.800/87.158/4.601 ms
kandy@kandy-HP-Notebook:~$
```

4. 42msec

```
C:\Users\ShreeH>dig wikipedia.org

; <<>> DiG 9.9.5-W1 <<>> wikipedia.org
;; global options: +cmd
;; Got answer:
;; ->HEADER<- opcode: QUERY, status: NOERROR, id: 24472
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:;, udp: 1460
;; QUESTION SECTION:
;wikipedia.org.                IN      A

;; ANSWER SECTION:
wikipedia.org.                483     IN      A           91.198.174.192

;; Query time: 42 msec
;; SERVER: 192.168.2.1#53(192.168.2.1)
;; WHEN: Tue Nov 01 18:48:32 India Standard Time 2016
;; MSG SIZE rcvd: 58
```

5. 13 hops



```
Command Prompt
C:\Users\Daniel>tracert wikipedia.org

Tracing route to wikipedia.org [91.198.174.192]
over a maximum of 30 hops:

  0  4 ms  1 ms  2 ms  192.168.5.1
  1  3 ms  2 ms  2 ms  192.168.2.1
  2  *      *      *      Request timed out.
  3  39 ms  34 ms  30 ms  217.7.143.157
  4  25 ms  24 ms  22 ms  62.157.248.165
  5  23 ms  22 ms  24 ms  f-ee7-i.F.DE.NET.DTAG.DE [62.156.131.154]
  6  24 ms  23 ms  24 ms  87.190.232.158
  7  151 ms  23 ms  24 ms  ffm-bb4-link.telia.net [62.115.116.161]
  8  98 ms  99 ms  53 ms  hbg-bb1-link.telia.net [213.155.135.225]
  9  42 ms  36 ms  34 ms  adm-bb3-link.telia.net [62.115.112.10]
 10  35 ms  32 ms  33 ms  adm-b3-link.telia.net [62.115.136.93]
 11  36 ms  33 ms  34 ms  wikimedia-ic-316335-adm-b3.c.telia.net [62.115.145.25]
 12 133 ms  90 ms  57 ms  text-lb.esams.wikimedia.org [91.198.174.192]

Trace complete.

C:\Users\Daniel>
```

6. Gateway Mac address - b4:a5:ef:2d:0d:40

```
C:\Users\ShreeH>arp -a

Interface: 192.168.2.103 --- 0xd
Internet Address      Physical Address      Type
192.168.2.1           b4-a5-ef-2d-0d-40    dynamic
192.168.2.106         4c-eb-42-69-df-25    dynamic
192.168.2.109         5c-c5-d4-80-d9-fa    dynamic
192.168.2.255         ff-ff-ff-ff-ff-ff    static
224.0.0.22            01-00-5e-00-00-16    static
224.0.0.251           01-00-5e-00-00-fb    static
224.0.0.252           01-00-5e-00-00-fc    static
239.255.255.250       01-00-5e-7f-ff-fa    static
255.255.255.255       ff-ff-ff-ff-ff-ff    static
```

## 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.

Python program

---

```
1: # -*- coding: utf-8 -*-
2: """
3: Team Bravo
4: Daniyal Akbari (akbari@uni-koblenz.de)
5: Shriharsh Ambhore (ashriharsh@uni-koblenz.de)
6: Kandhasamy Rajasekaran (kandhasamy@uni-koblenz.de)
7: """
8:
9: import random , numpy as np, matplotlib.pyplot as plt
10:
11: list=[]
12: sin=[]
13: cosin=[]
14: for i in range(0,10):
15:     x = random.randint(0,90)
16:     list.append(x)
17:     sin.append(np.sin(x))
18:     cosin.append(np.cos(x))
19:
20: # Create a figure of size 8x6 inches, 80 dots per inch
21: plt.figure(figsize=(8, 6), dpi=80)
22: # Create a new subplot from a grid of 1x1
23: plt.subplot(1, 1, 1)
24:
25: plt.title('Sine & Cosine')
26: plt.xlabel('t (radians)')
27: plt.ylabel('red: sin (t), blue: cos (t)')
28: plt.grid(True)
29:
30: plt.scatter(list,sin, color="red", label="sine")
31: plt.scatter(list,cosin, color="blue", label="cosine")
32: plt.legend()
33:
34: plt.show()
```

---

## 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".