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## SSC-D02

### HOMEWORK 2

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**Exercise 1** *You need to log on to a UNIX machine for this exercise. You may have to use the UNIX commands: traceroute, arp, ping, ifconfig, nslookup, netstat, nohup, whois, nohup,*

1. *Are the following machines reachable from your machine: ic.epfl.ch, www.zurich.ibm.com, www.tik.ee.ethz.ch, www.zurich.ibm.ch, www.uchile.cl, dzowo.uem.mz, www.ru.ac.za? What is the round trip time?*
2. *What are the local interfaces, their addresses, their netmasks and their MTUs on your workstation? List the routing table entries and identify the purpose of each of them.*
3. *Find out the IP addresses and names of all interfaces between your workstation and www.tik.ee.ethz.ch. Take one the systems that is reachable in the first question and is located outside europe. What countries are on the path to this destination?*
4. *What are the routers between your workstation and the SWITCH network?*
5. *Can you determine the MAC addresses of these routers? Why or why not?*
6. *What are the IP addresses of icwww.epfl.ch and www.ethz.ch? What names do you obtain with the reverse mapping?*
7. *In what country and which organizations are the machines dzowo.uem.mz and www.ru.ac.za? Who owns the IP network 193.8.232?*

**Exercise 2** *For security reasons, you need to have a special test machine be setup for this exercise. Please look on the web for more details. Call X the test machine. Log on to our workstation (which is not X).*

1. *Use tcpdump to monitor UDP traffic from your station.*
2. *Start nslookup on your station, set the server to X, generate a query for a non-existing machine, and wait until nslookup times out. How does the arrival time of the queries change?*
3. *Use traceroute to send UDP packets with 1400 and 1500 bytes of data from your station to X. Watch what arrives at X and explain.*
4. *Use ttcp and measure the throughput for TCP and UDP from your station to X. Set the number of buffers to 100 in order to reduce the load. Interpret the difference in results between UDP and TCP. Do the test in the reverse direction.*

**Exercise 3** *Elaine is sitting in front of lrcpc3 and connects to machine 'ezinfo.ethz.ch' by Telnet. A clairvoyant angel has read all the frames passing on the network. Here is the first packet resulting from this activity:*

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ETHER: ----- Ether Header -----
ETHER:
ETHER: Packet 1 arrived at 19:03:32.39
ETHER: Packet size = 60 bytes
ETHER: Destination = ff:ff:ff:ff:ff:ff
ETHER: Source      = 0:0:c0:b8:c2:8d
ETHER: Ethertype = 0806
ETHER:
ARP: ----- ARP/RARP Frame -----
ARP:
ARP: Hardware type = 1
ARP: Protocol type = 0800 (IP)
ARP: Length of hardware address = 6 bytes
ARP: Length of protocol address = 4 bytes
ARP: Opcode 1 (ARP Request)
ARP: Sender's hardware address = 0:0:c0:b8:c2:8d
ARP: Sender's protocol address = 128.178.156.7, lrcpc3.epfl.ch
ARP: Target hardware address = ?
ARP: Target protocol address = 128.178.156.1, in-inr-e4.epfl.ch

```

1. *What is this frame used for in this exchange?*
2. *What stations receive this frame? What stations reply to it?*
3. *How can we determine if a frame is an ARP frame?*

**Exercise 4** *Among the packets observed, shortly afterwards, we find the following two:*

```

ETHER: ----- Ether Header -----
ETHER:
ETHER: Packet 2 arrived at 19:03:32.39
ETHER: Packet size = 74 bytes
ETHER: Destination = 0:0:c:2:78:36
ETHER: Source      = 0:0:c0:b8:c2:8d
ETHER: Ethertype = 0800
ETHER:
IP: ----- IP Header -----
IP:
IP: Version = 4
IP: Header length = 20 bytes
IP: Type of service = 0x00
IP:      xxx. .... = 0 (precedence)
IP:      ...0 .... = normal delay
IP:      .... 0... = normal throughput
IP:      .... .0.. = normal reliability
IP: Total length = 60 bytes
IP: Identification = 2947
IP: Flags = 0x0
IP:      .0.. .... = may fragment
IP:      ..0. .... = last fragment
IP: Fragment offset = 0 bytes

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IP:   Time to live = 64 seconds/hops
IP:   Protocol = 17
IP:   Header checksum = c2ba
IP:   Source address = 128.178.156.7
IP:   Destination address = 128.178.15.8, IP:   No options
IP:
UDP:  ----- UDP Header -----
UDP:
UDP:  Source port = 1267
UDP:  Destination port = 53 (DNS)
UDP:  Length = 40
UDP:  Checksum = B672
UDP:
DNS:  ----- DNS: -----
DNS:
DNS:  " "
DNS:

```

```

ETHER: ----- Ether Header -----
ETHER:
ETHER:  Packet 3 arrived at 19:03:32.40
ETHER:  Packet size = 202 bytes
ETHER:  Destination = 0:0:c0:b8:c2:8d, Western Digital
ETHER:  Source      = 0:0:c:2:78:36, Cisco
ETHER:  Ethertype = 0800
ETHER:
IP:   ----- IP Header -----
IP:
IP:   Version = 4
IP:   Header length = 20 bytes
IP:   Type of service = 0x00
IP:       xxx. .... = 0 (precedence)
IP:       ...0 .... = normal delay
IP:       .... 0... = normal throughput
IP:       .... .0.. = normal reliability
IP:   Total length = 188 bytes
IP:   Identification = 38579
IP:   Flags = 0x0
IP:       .0.. .... = may fragment
IP:       ..0. .... = last fragment
IP:   Fragment offset = 0 bytes
IP:   Time to live = 58 seconds/hops
IP:   Protocol = 17
IP:   Header checksum = 3d0a
IP:   Source address = 128.178.15.8,
IP:   Destination address = 128.178.156.7,
IP:   No options
IP:

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UDP:  ----- UDP Header -----
UDP:
UDP:  Source port = 53
UDP:  Destination port = 1267
UDP:  Length = 168
UDP:  Checksum = 0000
UDP:
DNS:  ----- DNS: -----
DNS:
DNS:  " "
DNS:

```

1. *What has happened?*
2. *What is lrcpc3's IP address? and ezinfo.ethz.ch's? What is the source IP address of packet 3. Which is the source MAC?*
3. *What is UDP port 53 reserved for? 1267? How can a UDP packet be recognised?*
4. *Comment on the value of the TTL fields.*
5. *Comment on the UDP checksum.*

**Exercise 5** *The following packets are then observed.*

1. *What has happened?*
2. *What is the length of the TCP payload contained in packets 5 to 9?*
3. *What will the value of the sequence and acknowledgement fields be in the next packet sent by lrcpc3?*

```

ETHER:  ----- Ether Header -----
ETHER:
ETHER:  Packet 4 arrived at 19:03:32.40
ETHER:  Packet size = 60 bytes
ETHER:  Destination = 0:0:c:2:78:36, Cisco
ETHER:  Source      = 0:0:c0:b8:c2:8d, Western Digital
ETHER:  Ethertype = 0800 (IP)
ETHER:
IP:  ----- IP Header -----
IP:
IP:  Version = 4
IP:  Header length = 20 bytes
IP:  Type of service = 0x00
IP:      xxx. .... = 0 (precedence)
IP:      ...0 .... = normal delay
IP:      .... 0... = normal throughput
IP:      .... .0.. = normal reliability
IP:  Total length = 44 bytes
IP:  Identification = 2948
IP:  Flags = 0x0
IP:      .0.. .... = may fragment
IP:      ..0. .... = last fragment
IP:  Fragment offset = 0 bytes
IP:  Time to live = 64 seconds/hops

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IP: Protocol = 6 (TCP)
IP: Header checksum = cec2
IP: Source address = 128.178.156.7, lrcpc3.epfl.ch
IP: Destination address = 129.132.2.72, ezinfo.ethz.ch
IP: No options
IP:
TCP: ----- TCP Header -----
TCP:
TCP: Source port = 1268
TCP: Destination port = 23 (TELNET)
TCP: Sequence number = 2591304273
TCP: Acknowledgement number = 0
TCP: Data offset = 24 bytes
TCP: Flags = 0x02
TCP:      ..0. .... = No urgent pointer
TCP:      ...0 .... = No acknowledgement
TCP:      .... 0... = No push
TCP:      .... .0.. = No reset
TCP:      .... ..1. = Syn
TCP:      .... ...0 = No Fin
TCP: Window = 512
TCP: Checksum = 0x2fc4
TCP: Urgent pointer = 0
TCP: Options: (4 bytes)
TCP:   - Maximum segment size = 448 bytes
TCP:
TELNET: ----- TELNET: -----
TELNET:
TELNET:  " "
TELNET:

ETHER: ----- Ether Header -----
ETHER:
ETHER: Packet 5 arrived at 19:03:32.50
ETHER: Packet size = 60 bytes
ETHER: Destination = 0:0:c0:b8:c2:8d, Western Digital
ETHER: Source      = 0:0:c:2:78:36, Cisco
ETHER: Ethertype = 0800 (IP)
ETHER:
IP: ----- IP Header -----
IP:
IP: Version = 4
IP: Header length = 20 bytes
IP: Type of service = 0x00
IP:      xxx. .... = 0 (precedence)
IP:      ...0 .... = normal delay
IP:      .... 0... = normal throughput
IP:      .... .0.. = normal reliability
IP: Total length = 40 bytes
IP: Identification = 33316

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IP:   Flags = 0x0
IP:   .0.. .... = may fragment
IP:   ..0. .... = last fragment
IP:   Fragment offset = 0 bytes
IP:   Time to live = 119 seconds/hops
IP:   Protocol = 6 (TCP)
IP:   Header checksum = 2126
IP:   Source address = 129.132.2.72, ezinfo.ethz.ch
IP:   Destination address = 128.178.156.7, lrcpc3.epfl.ch
IP:   No options
IP:
TCP:  ----- TCP Header -----
TCP:
TCP:  Source port = 23
TCP:  Destination port = 1268
TCP:  Sequence number = 2068544000
TCP:  Acknowledgement number = 2591304274
TCP:  Data offset = 20 bytes
TCP:  Flags = 0x12
TCP:  ..0. .... = No urgent pointer
TCP:  ...1 .... = Acknowledgement
TCP:  .... 0... = No push
TCP:  .... .0.. = No reset
TCP:  .... ..1. = Syn
TCP:  .... ...0 = No Fin
TCP:  Window = 3000
TCP:  Checksum = 0x4477
TCP:  Urgent pointer = 0
TCP:  No options
TCP:
TELNET:  ----- TELNET:  -----
TELNET:  ""
TELNET:

ETHER:  ----- Ether Header -----
ETHER:
ETHER:  Packet 6 arrived at 19:03:32.50
ETHER:  Packet size = 60 bytes
ETHER:  Destination = 0:0:c:2:78:36, Cisco
ETHER:  Source      = 0:0:c0:b8:c2:8d, Western Digital
ETHER:  Ethertype = 0800 (IP)
ETHER:
IP:  ----- IP Header -----
IP:
IP:  Version = 4
IP:  Header length = 20 bytes
IP:  Type of service = 0x00
IP:  xxx. .... = 0 (precedence)
IP:  ...0 .... = normal delay
IP:  .... 0... = normal throughput

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IP:      .... .0.. = normal reliability
IP: Total length = 40 bytes
IP: Identification = 2949
IP: Flags = 0x0
IP:      .0.. .... = may fragment
IP:      ..0. .... = last fragment
IP: Fragment offset = 0 bytes
IP: Time to live = 64 seconds/hops
IP: Protocol = 6 (TCP)
IP: Header checksum = cec5
IP: Source address = 128.178.156.7, lrcpc3.epfl.ch
IP: Destination address = 129.132.2.72, ezinfo.ethz.ch
IP: No options
IP:
TCP: ----- TCP Header -----
TCP:
TCP: Source port = 1268
TCP: Destination port = 23 (TELNET)
TCP: Sequence number = 2591304274
TCP: Acknowledgement number = 2068544001
TCP: Data offset = 20 bytes
TCP: Flags = 0x10
TCP:      ..0. .... = No urgent pointer
TCP:      ...1 .... = Acknowledgement
TCP:      .... 0... = No push
TCP:      .... .0.. = No reset
TCP:      .... ..0. = No Syn
TCP:      .... ...0 = No Fin
TCP: Window = 30619
TCP: Checksum = 0xd894
TCP: Urgent pointer = 0
TCP: No options
TCP:
TELNET: ----- TELNET: -----
TELNET:
TELNET:  " "
TELNET:

ETHER: ----- Ether Header -----
ETHER:
ETHER: Packet 7 arrived at 19:03:32.56
ETHER: Packet size = 78 bytes
ETHER: Destination = 0:0:c:2:78:36, Cisco
ETHER: Source      = 0:0:c0:b8:c2:8d, Western Digital
ETHER: Ethertype = 0800 (IP)
ETHER:
IP:      ----- IP Header -----
IP:
IP: Version = 4
IP: Header length = 20 bytes

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IP:   Type of service = 0x00
IP:       xxx. .... = 0 (precedence)
IP:       ...0 .... = normal delay
IP:       .... 0... = normal throughput
IP:       .... .0.. = normal reliability
IP:   Total length = 64 bytes
IP:   Identification = 2950
IP:   Flags = 0x0
IP:       .0.. .... = may fragment
IP:       ..0. .... = last fragment
IP:   Fragment offset = 0 bytes
IP:   Time to live = 64 seconds/hops
IP:   Protocol = 6 (TCP)
IP:   Header checksum = ceac
IP:   Source address = 128.178.156.7, lrcpc3.epfl.ch
IP:   Destination address = 129.132.2.72, ezinfo.ethz.ch
IP:   No options
IP:
TCP:   ----- TCP Header -----
TCP:
TCP:   Source port = 1268
TCP:   Destination port = 23 (TELNET)
TCP:   Sequence number = 2591304274
TCP:   Acknowledgement number = 2068544001
TCP:   Data offset = 20 bytes
TCP:   Flags = 0x18
TCP:       ..0. .... = No urgent pointer
TCP:       ...1 .... = Acknowledgement
TCP:       .... 1... = Push
TCP:       .... .0.. = No reset
TCP:       .... ..0. = No Syn
TCP:       .... ...0 = No Fin
TCP:   Window = 30719
TCP:   Checksum = 0x7ebf
TCP:   Urgent pointer = 0
TCP:   No options
TCP:
TELNET:   ----- TELNET:   -----
TELNET:
TELNET:   " "
TELNET:

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ETHER:   ----- Ether Header -----
ETHER:
ETHER:   Packet 8 arrived at 19:03:32.67
ETHER:   Packet size = 60 bytes
ETHER:   Destination = 0:0:c0:b8:c2:8d, Western Digital
ETHER:   Source       = 0:0:c:2:78:36, Cisco
ETHER:   Ethertype = 0800 (IP)

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```

ETHER:
IP:  ----- IP Header -----
IP:
IP:  Version = 4
IP:  Header length = 20 bytes
IP:  Type of service = 0x00
IP:      xxx. .... = 0 (precedence)
IP:      ...0 .... = normal delay
IP:      .... 0... = normal throughput
IP:      .... .0.. = normal reliability
IP:  Total length = 40 bytes
IP:  Identification = 33319
IP:  Flags = 0x0
IP:      .0.. .... = may fragment
IP:      ..0. .... = last fragment
IP:  Fragment offset = 0 bytes
IP:  Time to live = 119 seconds/hops
IP:  Protocol = 6 (TCP)
IP:  Header checksum = 2123
IP:  Source address = 129.132.2.72, ezinfo.ethz.ch
IP:  Destination address = 128.178.156.7, lrcpc3.epfl.ch
IP:  No options
IP:
TCP:  ----- TCP Header -----
TCP:
TCP:  Source port = 23
TCP:  Destination port = 1268
TCP:  Sequence number = 2068544001
TCP:  Acknowledgement number = 2591304298
TCP:  Data offset = 20 bytes
TCP:  Flags = 0x10
TCP:      ..0. .... = No urgent pointer
TCP:      ...1 .... = Acknowledgement
TCP:      .... 0... = No push
TCP:      .... .0.. = No reset
TCP:      .... ..0. = No Syn
TCP:      .... ...0 = No Fin
TCP:  Window = 2976
TCP:  Checksum = 0x4478
TCP:  Urgent pointer = 0
TCP:  No options
TCP:
TELNET:  ----- TELNET:  -----
TELNET:
TELNET:  " "
TELNET:

ETHER:  ----- Ether Header -----
ETHER:

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ETHER: Packet 9 arrived at 19:03:32.72
ETHER: Packet size = 84 bytes
ETHER: Destination = 0:0:c0:b8:c2:8d, Western Digital
ETHER: Source      = 0:0:c:2:78:36, Cisco
ETHER: Ethertype = 0800 (IP)
ETHER:
IP:  ----- IP Header -----
IP:
IP:  Version = 4
IP:  Header length = 20 bytes
IP:  Type of service = 0x00
IP:      xxx. .... = 0 (precedence)
IP:      ...0 .... = normal delay
IP:      .... 0... = normal throughput
IP:      .... .0.. = normal reliability
IP:  Total length = 70 bytes
IP:  Identification = 33322
IP:  Flags = 0x0
IP:      .0.. .... = may fragment
IP:      ..0. .... = last fragment
IP:  Fragment offset = 0 bytes
IP:  Time to live = 119 seconds/hops
IP:  Protocol = 6 (TCP)
IP:  Header checksum = 2102
IP:  Source address = 129.132.2.72, ezinfo.ethz.ch
IP:  Destination address = 128.178.156.7, lrcpc3.epfl.ch
IP:  No options
IP:
TCP:  ----- TCP Header -----
TCP:
TCP:  Source port = 23
TCP:  Destination port = 1268
TCP:  Sequence number = 2068544001
TCP:  Acknowledgement number = 2591304298
TCP:  Data offset = 20 bytes
TCP:  Flags = 0x18
TCP:      ..0. .... = No urgent pointer
TCP:      ...1 .... = Acknowledgement
TCP:      .... 1... = Push
TCP:      .... .0.. = No reset
TCP:      .... ..0. = No Syn
TCP:      .... ...0 = No Fin
TCP:  Window = 3000
TCP:  Checksum = 0xb907
TCP:  Urgent pointer = 0
TCP:  No options
TCP:
TELNET:  ----- TELNET: -----
TELNET:
TELNET:  " "

```

TELNET :