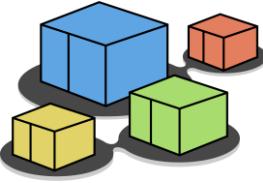




Kathará lab

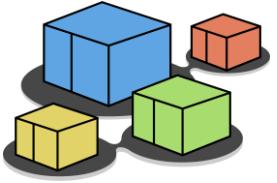
two computers

Version	2.0
Author(s)	L. Ariemma, T. Caiazzo
E-mail	contact@kathara.org
Web	http://www.kathara.org/
Description	A lab with two directly connected device with the goal of teaching how to change a MAC address and to sniff a Kathará collision domain

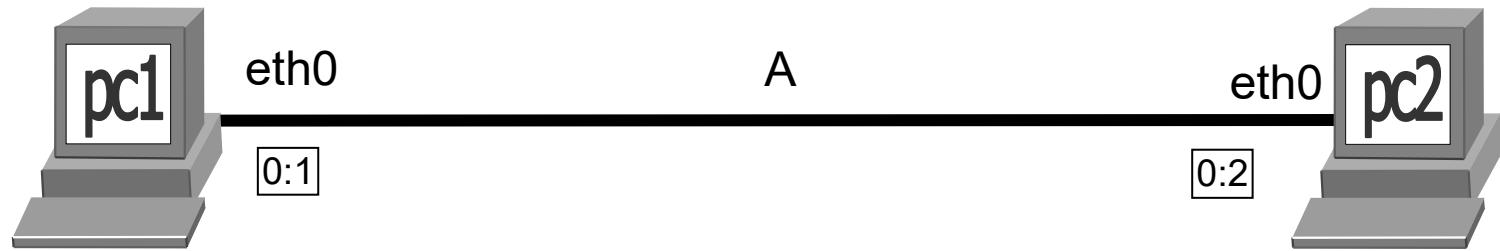


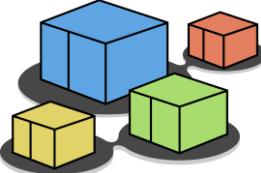
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topology



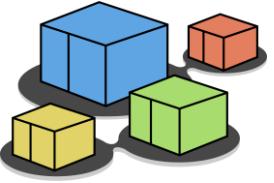


the lab.conf

```
lab.conf
pc1[0] = "A/00:00:00:00:00:01"
pc1[image] = "kathara/base"
pc1[ipv6] = "false"

pc2[0] = "A/00:00:00:00:00:02"
pc2[image] = "kathara/base"
pc2[ipv6] = "false"
```

pc1 has one interface ("eth0") connected on collision domain A.
Its MAC address is set to 00:00:00:00:00:01



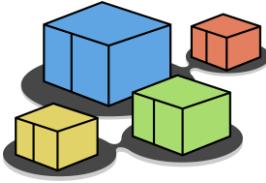
the lab.conf

lab.conf

```
pc1[0] = "A/00:00:00:00:00:01"  
pc1[image] = "kathara/base"  
pc1[ipv6] = "false"  
  
pc2[0] = "A/00:00:00:00:00:02"  
pc2[image] = "kathara/base"  
pc2[ipv6] = "false"
```

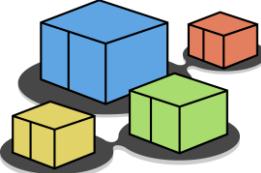
pc1 will use
image
"kathara/base"

ipv6 networking
is disabled



MAC addresses and Kathar

- In this lab the MAC addresses of interfaces are specified in the “lab.conf” file. If not specified, Kathar assigns random MAC addresses to network interfaces
 - the obtained MAC addresses are difficult to remember
 - it is possible to change the assigned MAC addresses once a device is running



change the default MAC address

- the MAC address can be changed with command

```
root@pc1:~$ ip link set dev eth0 address 00:00:00:00:00:01
```

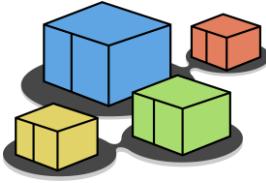
command
from iproute2

operate at
Layer 2

the device to
be set = eth0

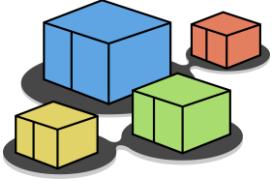
what needs to be
set: the layer 2
address (e.g., the
MAC address)

the new MAC
address



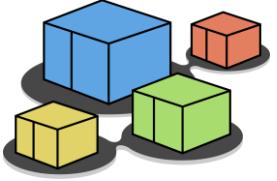
remarks

- the used image is "kathara/base"
 - contains basic networking tools
- IPv6 is used in specific labs
 - get used to add the flag so it won't create problems when IPv6 is used



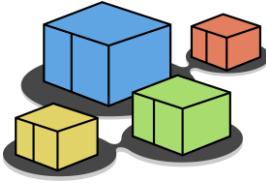
question

two computers on the same LAN; can communicate?



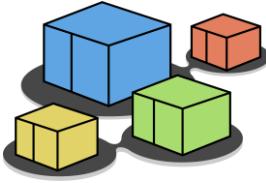
question

how?



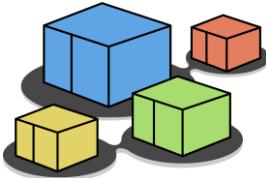
ethernet frames

- ethernet frames (Layer 2 frames) can be sent on a LAN just knowing the destination MAC address
- Linux has no default utilities for sending such packets
- we'll use the python library `scapy`



a small reminder

- the commands executed inside a console can also be inserted into the .startup file of the corresponding device
 - startup commands are executed at device startup
 - in this lab this is not needed, since we set the MAC addresses in the lab.conf file, so that interfaces are created with the assigned MAC addresses



the lab – a second version

- An example of an equivalent version of the lab where MAC addresses are set in the .startup files.
- The only difference is that interfaces are created with random MAC addresses, which are changed by startup commands when devices start up.

lab.conf

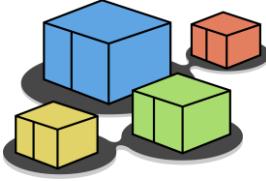
```
pc1[0]=A  
pc1[image]="kathara/base"  
pc1[ipv6]="false"  
  
pc2[0]=A  
pc2[image]="kathara/base"  
pc2[ipv6]="false"
```

pc1.startup

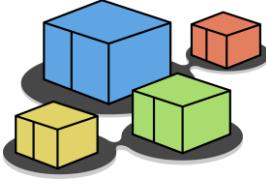
```
ip link set dev eth0 address 00:00:00:00:00:01
```

pc2.startup

```
ip link set dev eth0 address 00:00:00:00:00:02
```

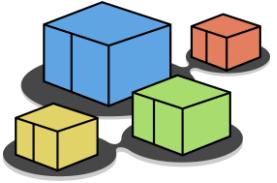


let's start the lab



scapy

- a versatile Python tool for crafting, analyzing, and sniffing network packets; it supports numerous protocols and offers an interactive shell for real-time network manipulation
- comes with an interactive shell
- allows you to craft custom packets with any field values

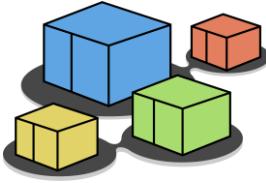


entering the scapy shell

- to enter the scapy shell use command

```
root@pc1:~$ scapy
          aSPY//YASa
          apyyyyCY//////////YCa
          sY//////YSpcs  scpCY//Pp | welcome to Scapy
          ayp ayyyyyyySCP//Pp      syY//C | Version 2.5.0
          AYASAYYYYYYYY//Ps      cY//S |
          pCCCCY//p            cSSps y//Y | https://github.com/secdev/scapy
          SPPPP//a            pP///AC//Y |
          A//A                cyP///C | Have fun!
          p///Ac              SC///a |
          P///YCpc            A//A | wanna support scapy? Star us on
          scccccp///pSP///p    p//Y | GitHub!
          sY/////////y  caa      S//P | -- Satoshi Nakamoto
          cayCyayP//Ya        pY/Ya |
          sY/PsY///YCC        aC//Yp
          sc  sccaCY//PCyapaCP//YSS
          spCPY//////YPSps
          ccaacs

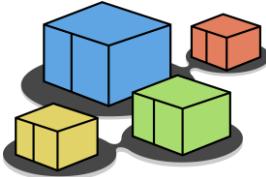
>>>
```



Exiting the Scapy Shell

- To quit the Scapy shell use command

```
>>> exit()
```



crafting an ethernet frame

- to craft a layer 2 frame, use command

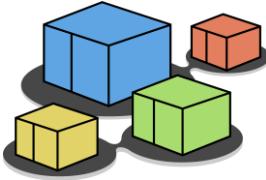
```
>>> p=Ether(dst='00:00:00:00:00:0B', src='00:00:00:00:00:0A')
```

save this
packet into a
variable p

create a new
instance of the
Ether class (used
to craft Ethernet
frames)

destination
MAC address

source MAC
address



sending an ethernet frame

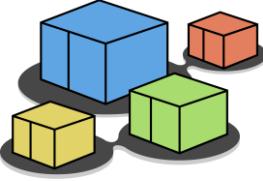
- to send a layer 2 frame, use command

```
>>> sendp(p, iface='eth0')
```

send a packet

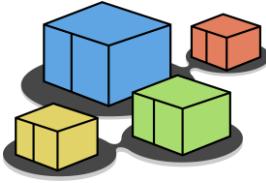
the name of the
variable holding
the packet

the network interface
through which the
packet will be sent



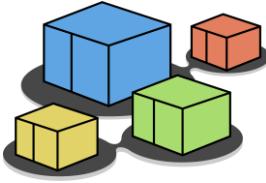
BEWARE

- these commands are typed into the scapy interactive shell
- those are NOT system commands; this means that can NOT be written into a .startup file
- moreover, it doesn't make sense to automate the sending



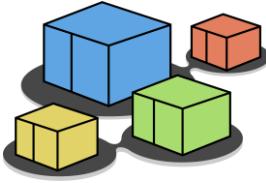
what after sending?

- the frame has been sent, but a few questions arise:
 - how do we know if it was received?
 - how do we know if the data we set (src and dest MAC addresses) were correctly written?
 - how do we know if Kathar is not a complete scam?



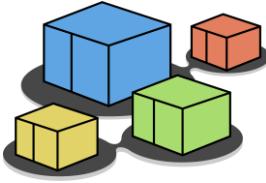
a packet sniffer

- A packet sniffer, a.k.a. network analyzer, is a tool that captures ("sniffs") network traffic as it transits over a network segment
- It allows users to see the content of packets being transmitted or received over a network
- Packet sniffers are used for network diagnostics, performance analysis, and cybersecurity purposes to detect vulnerabilities or malicious activities



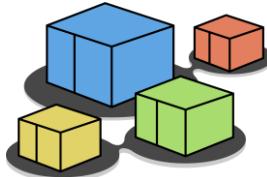
wireshark

- A widely-used, open-source packet analyzer
- It captures and displays the data traveling into and out of network devices in real-time
- With its powerful filtering and analysis tools, Wireshark is invaluable for network troubleshooting, protocol development, and cybersecurity investigations



using wireshark in Kathar

- is it very easy to use Wireshark inside a Kathar lab
- there is an official guide available here
 - <https://github.com/KatharaFramework/Kathara-Labs/tree/main/tutorials/capture-packets>
- we need to add a dedicated device with the sole goal of running wireshark



add the wireshark device to a lab

- to add a device (called wireshark) running Wireshark to a Kathará lab, add the following lines to the lab.conf file

lab.conf

....

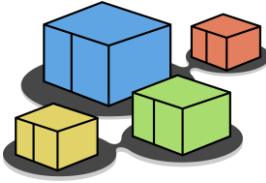
```
wireshark[bridged]=true  
wireshark[port]="3000:3000"  
wireshark[image]="lscr.io/linuxserver/wireshark"  
wireshark[num_terms]=0
```

connect a device called wireshark to the host network

map *port* 3000 of the host to *port* 3000 of the guest

do not open any terminals

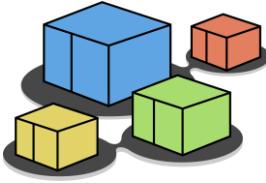
use a dedicated image



restart the lab

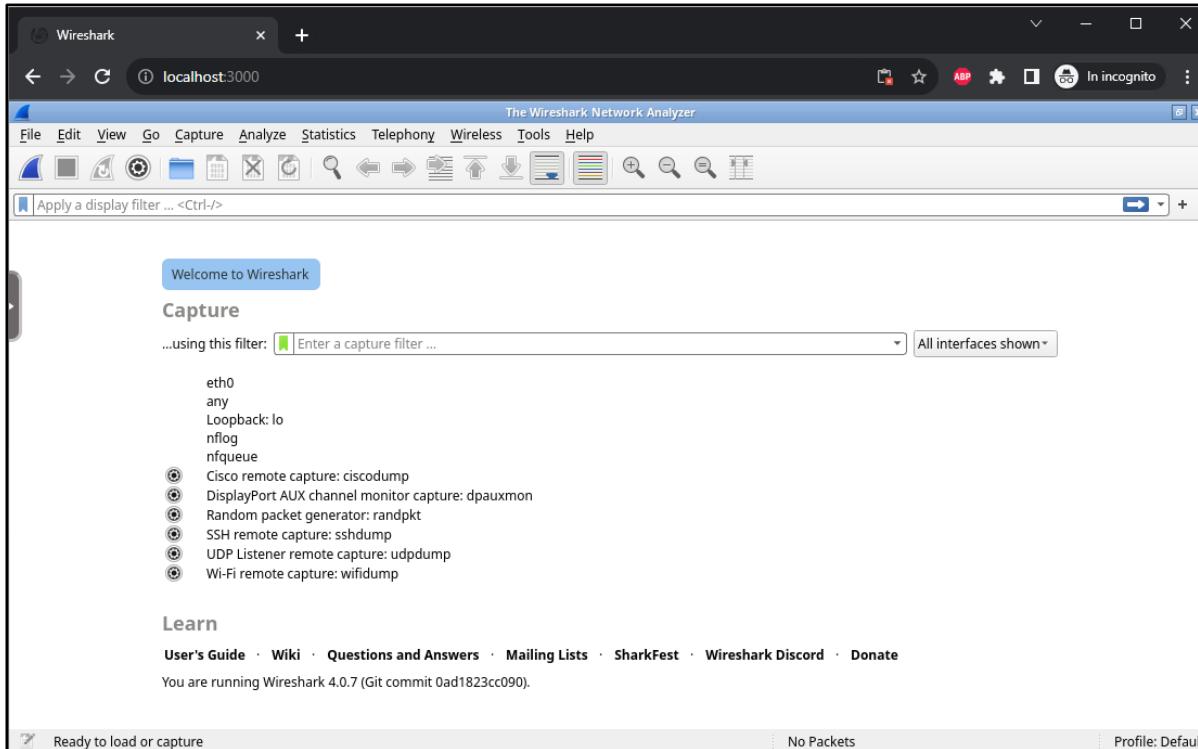
- after the lab.conf is changed, the lab needs to be restarted in order to apply the new configuration

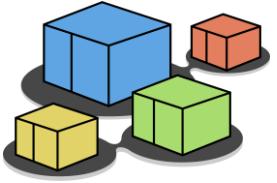
```
user@localhost:kathara-lab_two-computers$ kathara lrestart
```



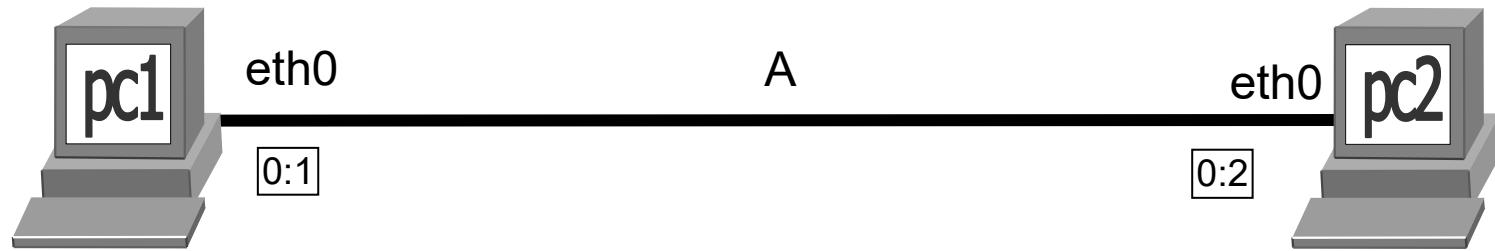
open Wireshark

- open a browser in your host and go to
 - <http://localhost:3000>

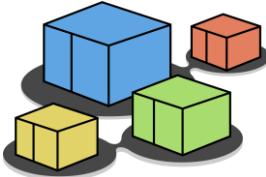




topology with Wireshark



wireshark



connect wireshark to the CD

- to connect the wireshark device to the collision domain to be sniffed, use this command

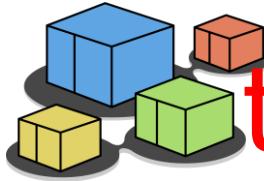
```
user@localhost:kathara-lab_two-computers$ kathara lconfig -n wireshark --add A
```

manage the
network
interfaces of a
running lab

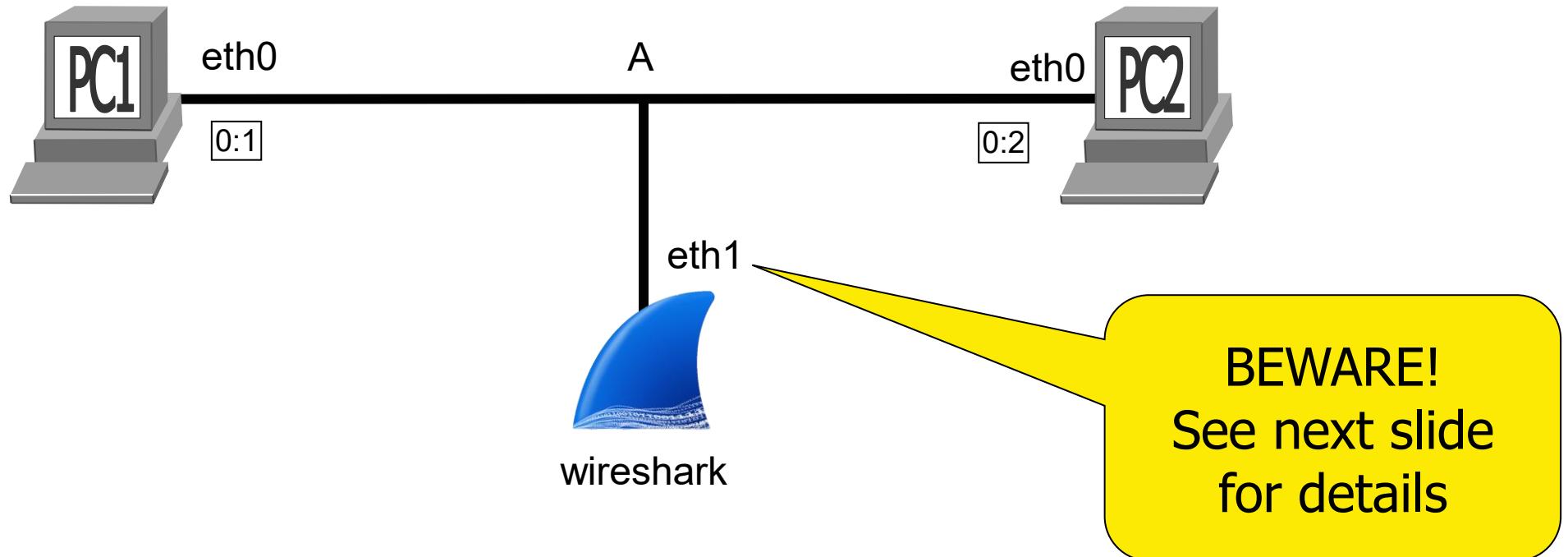
specify the name
(n) of the device
to modify

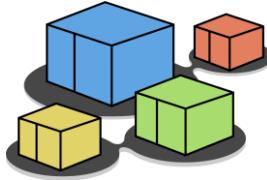
add a network
interface

....
connected
to collision
domain A



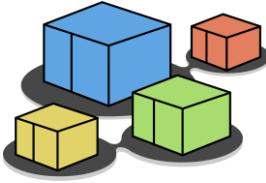
topology with Wireshark – 2nd version





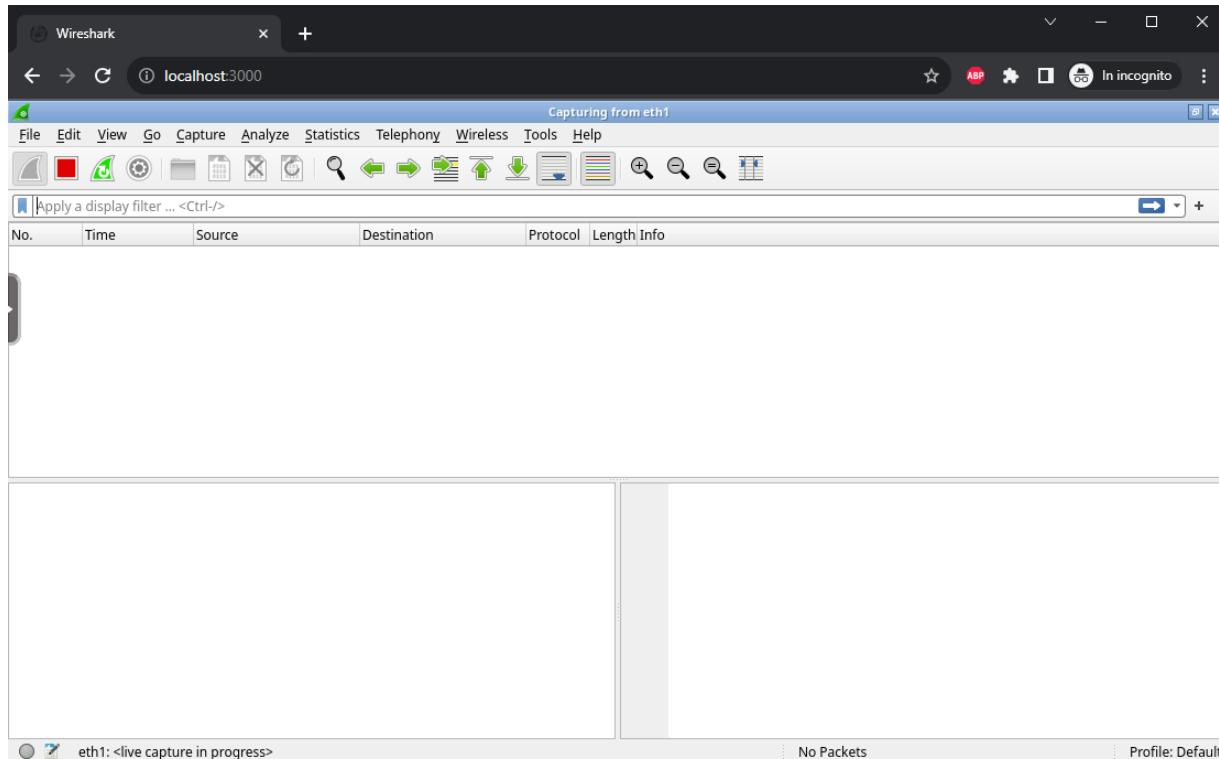
notice about the wireshark device

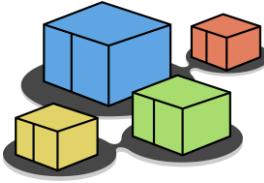
- the wireshark device is created connected to the host
 - the eth0 interface is connected to the host
- when it is connected to a collision domain to be sniffed, an interface is added
 - the interface connected to the collision domain will be eth1



sniffing the first packet – part 1

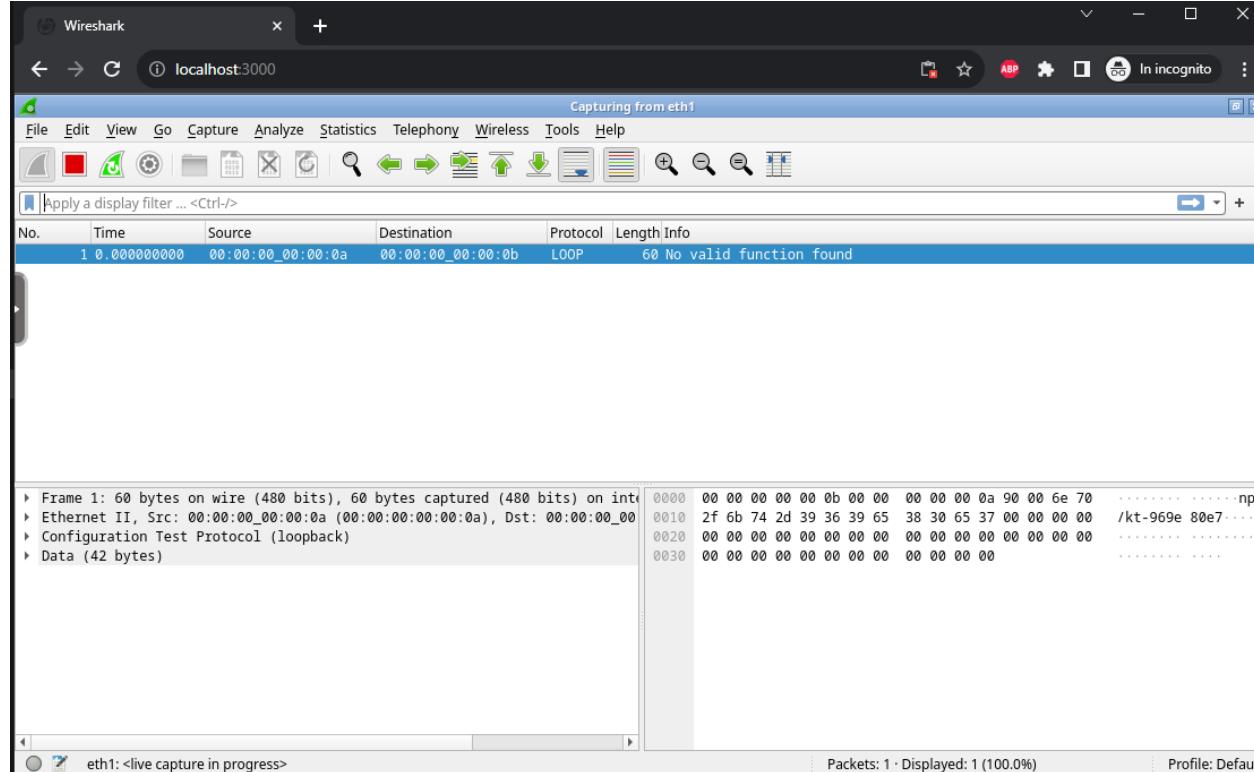
- reload the wireshark web page
- open the eth1 interface by double clicking on it

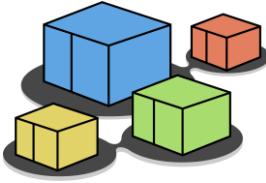




sniffing the first packet – part 2

- send a new packet with `scapy`
- a wild packet appeared

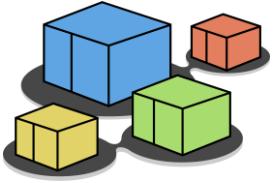




sniffing the packet – part 3

- use the wireshark functions to see the packet contents

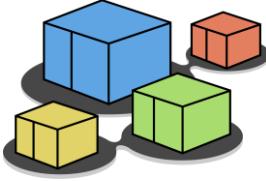
```
› Frame 1: 60 bytes on wire (480 bits), 60 bytes captured (480 bits)...  
- Ethernet II, Src: 00:00:00_00:00:0a (00:00:00:00:00:0a), Dst: 00:0...  
  › Destination: 00:00:00_00:00:0b (00:00:00:00:00:0b)  
  › Source: 00:00:00_00:00:0a (00:00:00:00:00:0a)  
    Type: Loopback (0x9000)  
  › Configuration Test Protocol (loopback)  
  › Data (42 bytes)
```



sniffing the packet – part 4

- give a look also at the hex dump of the packet
- why it ends with a lot of zeros?

0000	00 00 00 00 00 0b 00 00 00 00 00 00 0a 90 00 6e 70
0010	2f 6b 74 2d 39 36 39 65 38 30 65 37 00 00 00 00 00
0020	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0030	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00



exercises

- try to send different ethernet frames and sniff them
 - try to send a frame from pc2 to pc1
 - try to send a frame to a MAC address that's not on the LAN
 - try to add other devices to the LAN