Institut für Kommunikations-Technik

Welcome to the Course Exercises

Future Internet Communication Technologies

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Overview

- Types of sessions
  - Tutorials
  - Demos
  - Experiments
- Experiments
  - Max. 8 groups (8 laptops available)
  - Local or with access to the FiLab testbed of IKT
  - Some experiments require interaction between groups

Equipment

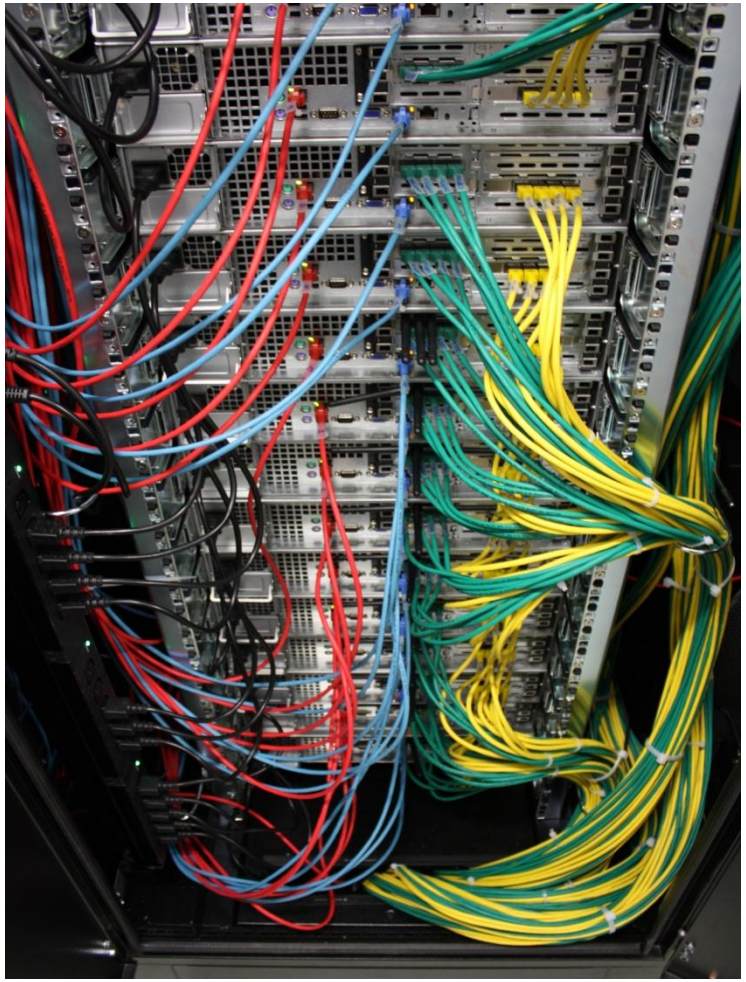
- Laptops for the class
  - Use: virtual machines or
  - … the FiLab testbed
  - OS: Ubuntu LTS
  - Preinstalled software
  - Login (if no auto-login)
    - User: *student*
    - Password: label on the top-right of your keyboard
  - Login to FiLab is different

FiLab Testbed of IKT - emulab

- Emulab is a network testbed used to investigate, develop and test network solutions and concepts as well as to verify new theoretical approaches.
- The name Emulab refers both to a facility and to a software system.
- The primary Emulab installation is run by the Flux Group, part of the School of Computing at the University of Utah.
- We built an Emulab, we call it Future Internet Lab.

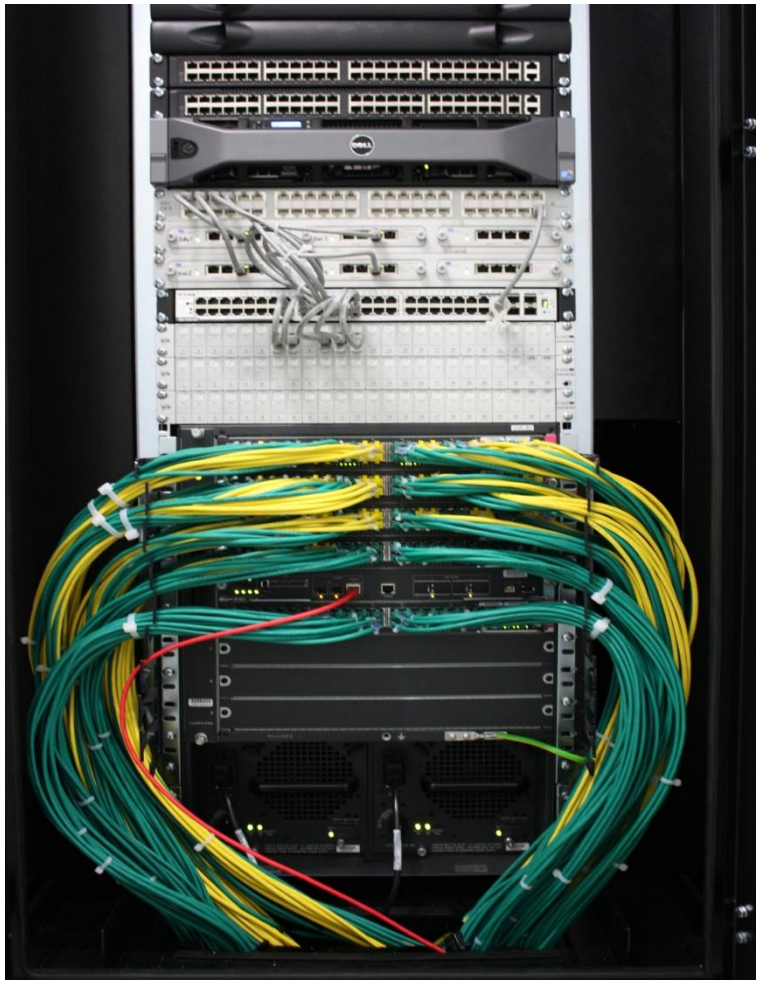
FiLab Testbed of IKT - Equipment

- 80 nodes with at least
  - 4-core Xeon CPUs 2.26GHz
  - 6 GB RAM
  - 4 or 8 NICs available for experiments
- 400 ports @ 1 Gbps
- 40 ports @ 10 Gbps
- 1 Gbps connection to the Internet



FiLab Testbed of IKT - Features

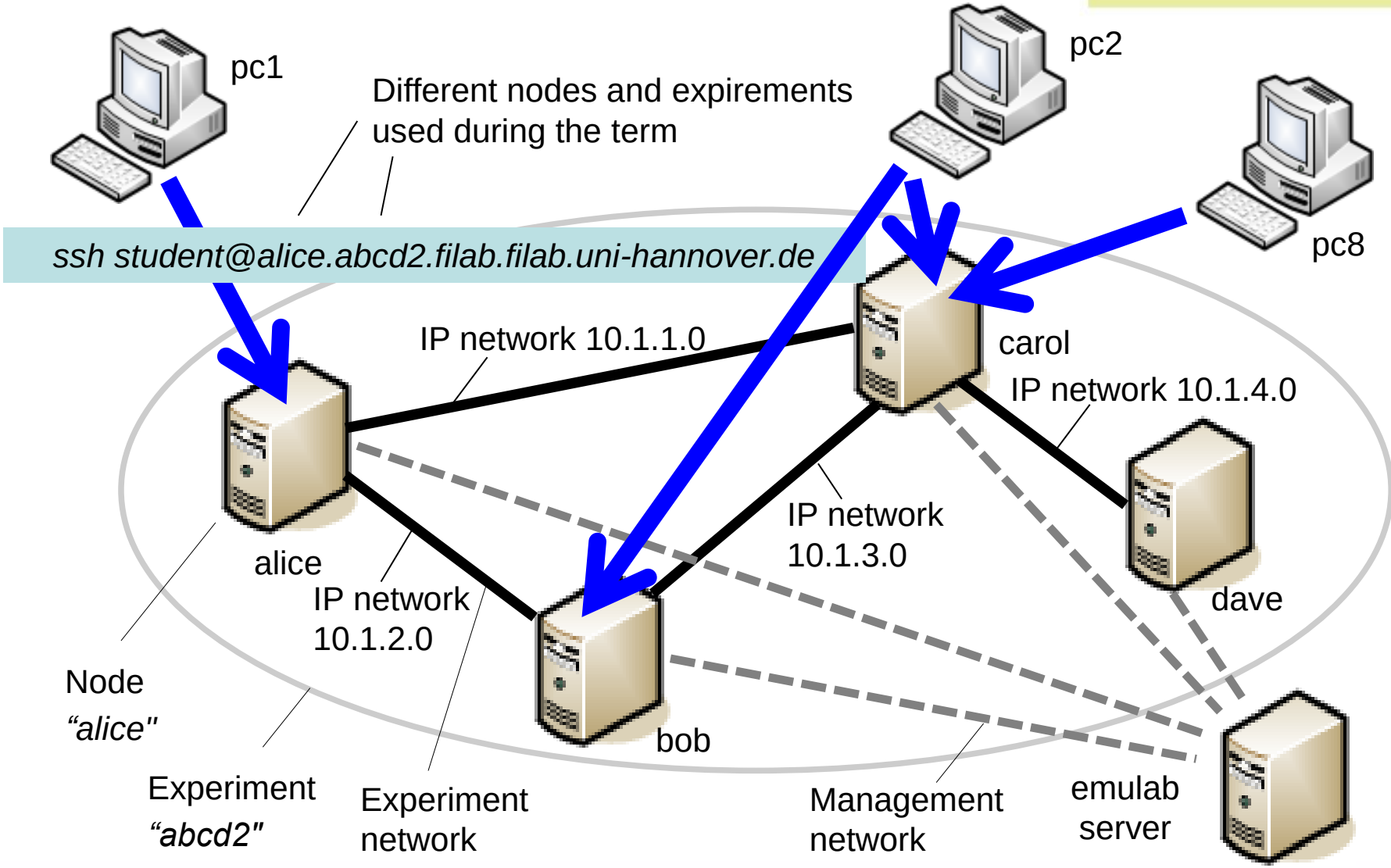
- Full exclusive access to experimental nodes
- Customized topologies without rewiring
  - CISCO 6900 switch with 720 Gbps backplane switching, 384 ports
- 20 nodes each prepared for specific purposes
  - Programable network cards (NetFPGA)
  - Wireless support



FiLab Testbed of IKT

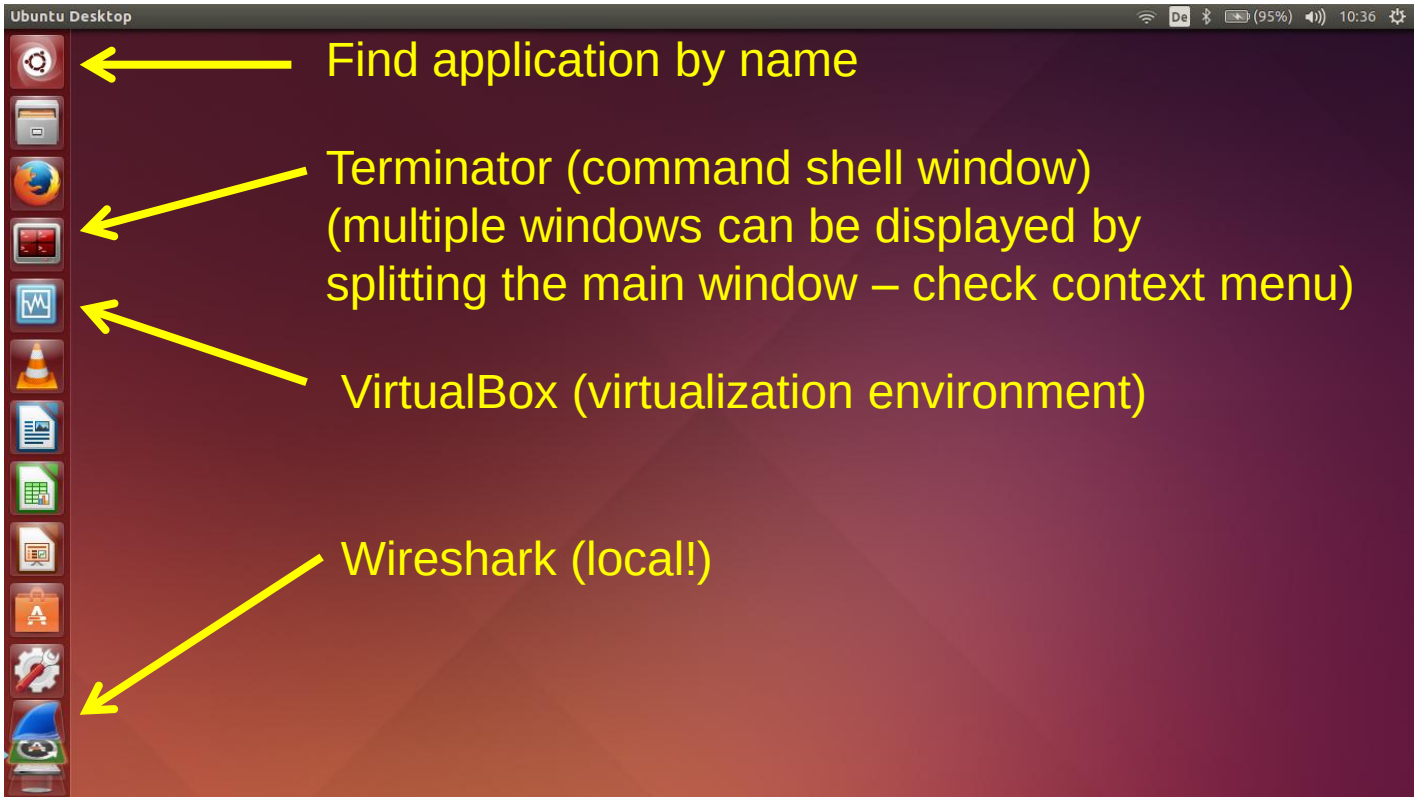
- Lets have an excursion to the FiLab server rooms – after the session today

Using FiLab Testbed



Getting Ready for the Exercises

- Booting up the laptop
  - Make sure that the power supply is connected properly
  - Press the corresponding icon on the menu bar to start the installed applications:



Getting Ready for the Exercises

- For experiments in the FiLab testbed
  - Experiments will already be configured and started
  - Open a command shell window
  - Login to the experimental nodes (**password: fi2016**)
    - **-X** allows working with graphical user interface of remote applications (Wireshark, Firefox)
    - The prompt will display the name of the experimental node
    - “student-laptopX“ indicates that you work locally

ssh [-X] student@[node].[experiment].filab.filab.uni-hannover.de

Directories

- One home directory for the entire class
  - Subdirectories for each group
  - Accessible from any FiLab experimental node

- Accessing a directory
  - Accessing group 3‘s home directory

    ```
    cd ~/group3
    ```

  - Accessing the parent directory or a child directory

    ```
    cd .. ; cd child_directory
    ```

  - List files (-a: all files, -l: details)

    ```
    ls [-al]
    ```

Editing Files

- Display file content

  ```
  cat file_name
  more file_name
  ```

- File editor, for example *nano*

  ```
  nano file_name
  ```

- Alternative file editor if display is available: *gedit*

  ```
  gedit file_name &
  ```

The Super User

- Limited access for the user
  - Sufficient for many cases, e.g. sending pings
- Privileged access for the super user (root)
  - Required for critical tasks, e.g. host configuration

- The shell prompt indicates the current user type

```
$ <user command>
# <super user command>
```

  - Do not type in “$“ or “#“
  - Use *sudo* to temporary become a super user

```
sudo <super user command>
```

- Starting Firefox

`firefox`

- Current command shell window is blocked till Firefox has been closed
- Terminate with <Ctrl>-<C> or start a new command shell

`firefox &`

- Firefox runs as background process
- Current command shell is not blocked and can be used further

Common Networking Commands

- List interfaces (IP, MAC addresses, …)

  `ifconfig`
- List routes

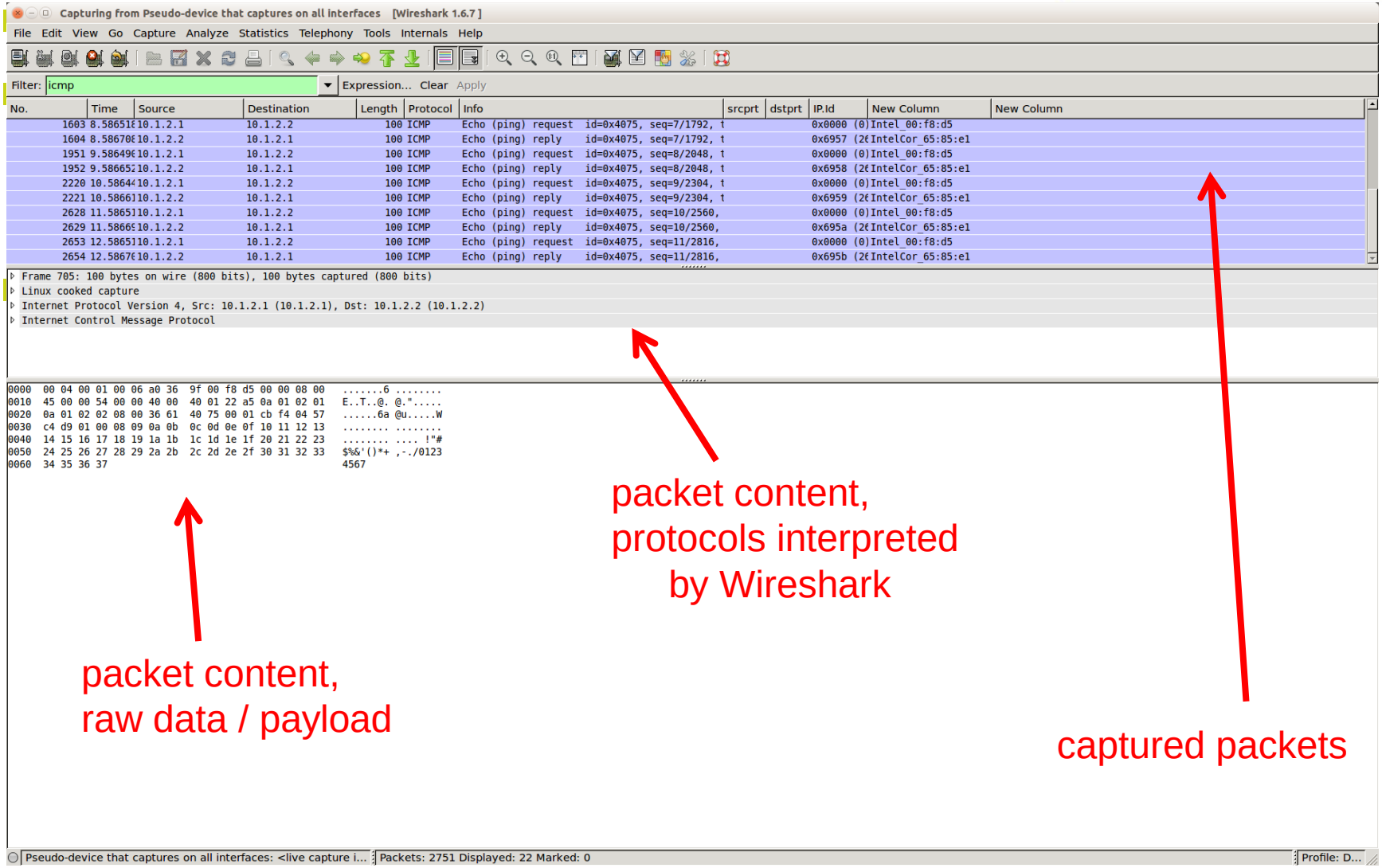
  `route`
- Tracing route to a remote host, e.g. www.uni-hannover.de

  `traceroute www.uni-hannover.de`
- Round-trip time - ping a remote PC, e.g.

  `ping 192.168.1.7`
- Wireshark – traffic capturing software

  `wireshark`

Wireshark – GUI

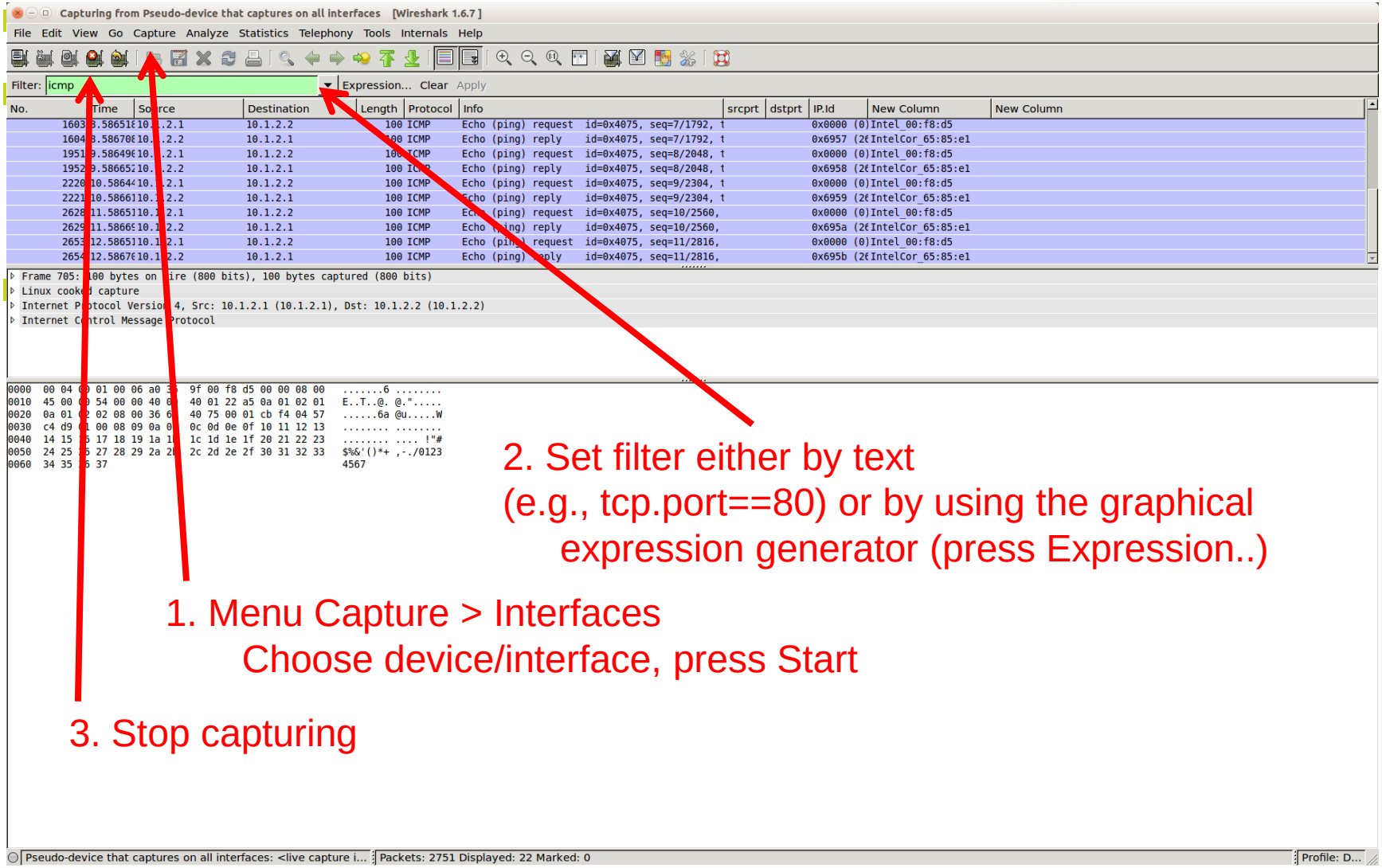


packet content,
raw data / payload

packet content,
protocols interpreted
by Wireshark

captured packets

Wireshark – Start Capturing



2. Set filter either by text
(e.g., tcp.port==80) or by using the graphical
expression generator (press Expression..)

1. Menu Capture > Interfaces
Choose device/interface, press Start

3. Stop capturing

Exercises

- 8 Laptops – 8 groups (today)

Laptop ID	Group	Node	Workdir
..11	1	alice	~/group1
..12	2	bob	~/group2
..13	3	carol	~/group3
..14	4	dave	~/group4
..15	5	alice	~/group5
..16	6	bob	~/group6
..17	7	carol	~/group7
..18	8	dave	~/group8

- Login using SSH

ssh -X student@[alice|bob|carol|dave].abcd2.filab.filab.uni-hannover.de

Exercise 1

- Login to your experimental node using SSH
- Create a new text file and place it in the group directory of another group (group1 -> group2, …, group8 -> group1)
- Browse your own group directory and find a “message“ from another group
  - Are the home directories of all experimental nodes mapped to a shared file system? ____

Exercise 2

- Use *ifconfig* to identify the network interfaces that connect your node with other experimental nodes
  - See page 8 for IP network address ranges
  - Not all nodes are directly connected
- My node: _____ (alice, bob, carol, dave)

Link to node:	Interface name	IP address	MAC (HWaddr)
alice	eth___	10. . .	: : : : :
bob	eth___	10. . .	: : : : :
carol	eth___	10. . .	: : : : :
dave	eth___	10. . .	: : : : :

Exercise 3

- Start wireshark
  - Are you able to capture any interface?
  - Are you able to execute commands in the shell from where you launched wireshark?
- Start wireshark with root privileges (sudo) and as background process (&)
  - Start capturing on Device “any“
  - Apply filter “icmp“

Exercise 3

- In the shell, ping to any other experimental node
- Look at the first 4 packets and complete the following table

No.	Source IP	Dest. IP	ICMP type
	10. . .	10. . .	
	10. . .	10. . .	
	10. . .	10. . .	
	10. . .	10. . .	