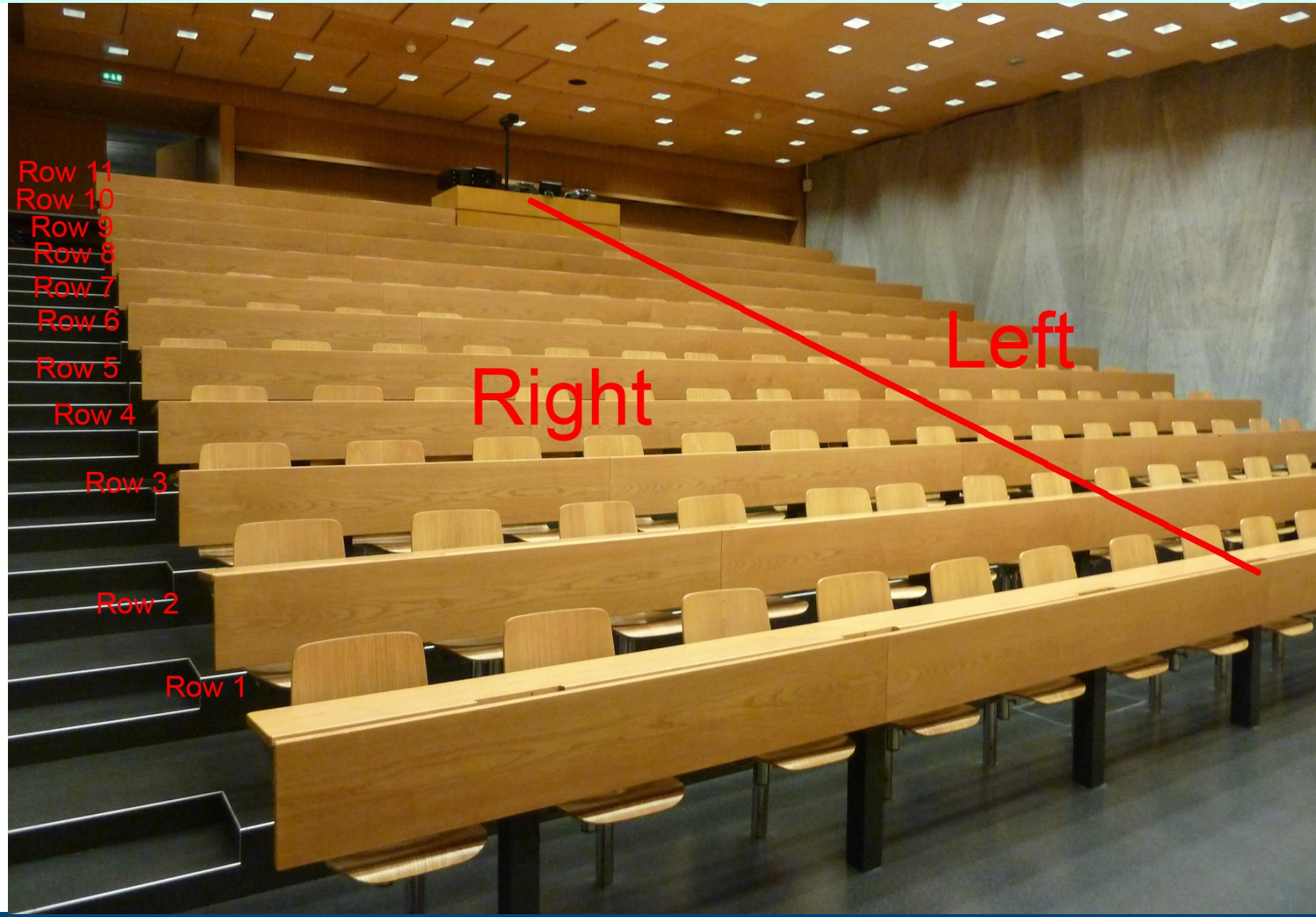
# Remote questions: https://course.netsec.inf.ethz.ch/questions

**Seat nr:**

**4L (3)**

**Ignore**

**Left side of row 4**



**Remote questions: https://course.netsec.inf.ethz.ch/questions**

# Network Security
# Autumn Semester 2020

Introduction and Organization

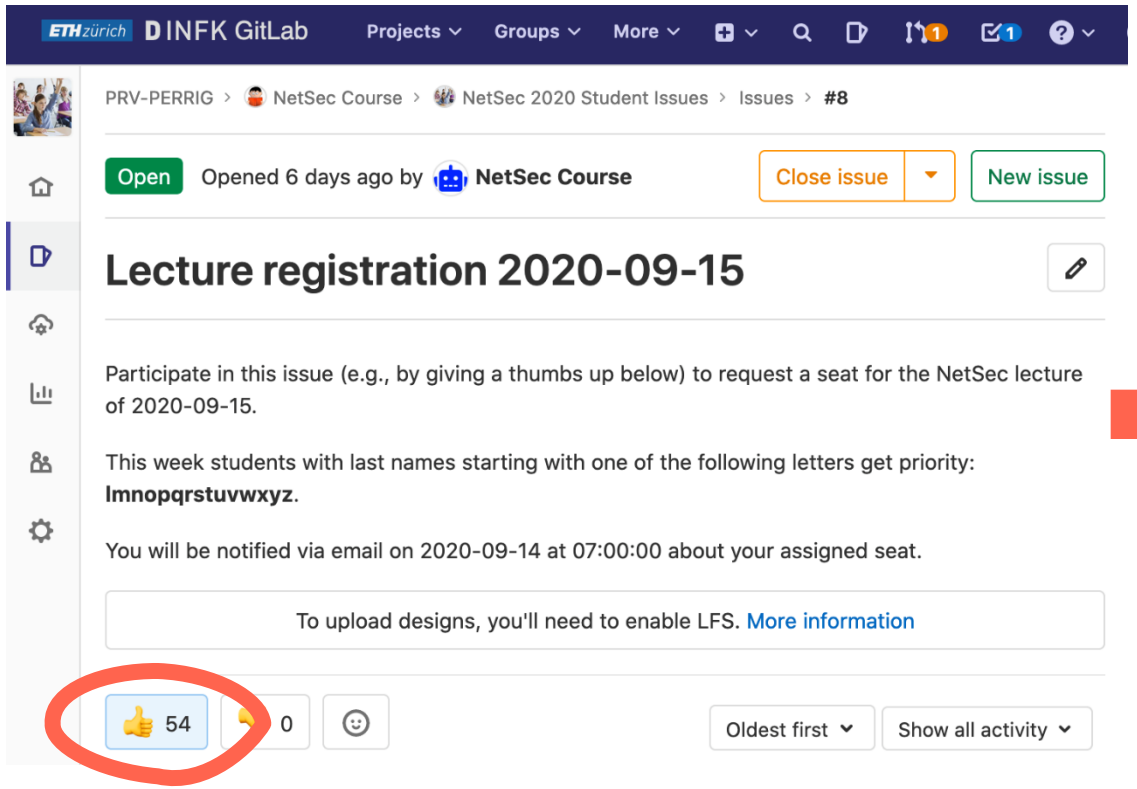
*15 September 2020*

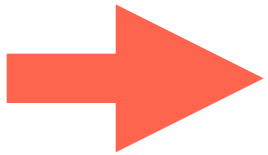
Prof. Dr. Adrian Perrig
Dr. Markus Legner
Dr. Stefan Frei

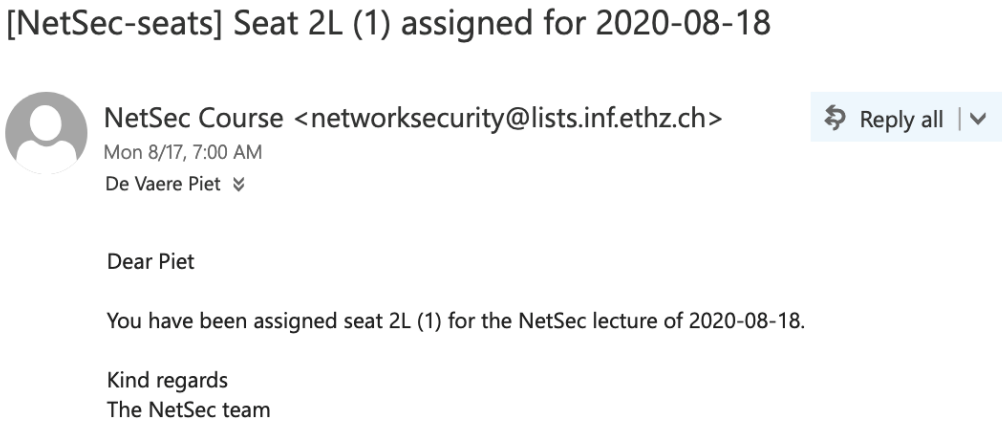
ETH zürich

# Lecture Tickets

In order to attend the lecture in person,
you must obtain a *lecture ticket* through GitLab





# COVID-19 Measures

- Follow the general safety guidelines.
- **Always** wear a face mask over mouth and nose.
- **Do *not* attend the lecture if you have illness symptoms!**

# Remote questions: https://course.netsec.inf.ethz.ch/questions

**Seat nr:**

**4L (3)**

**Ignore**

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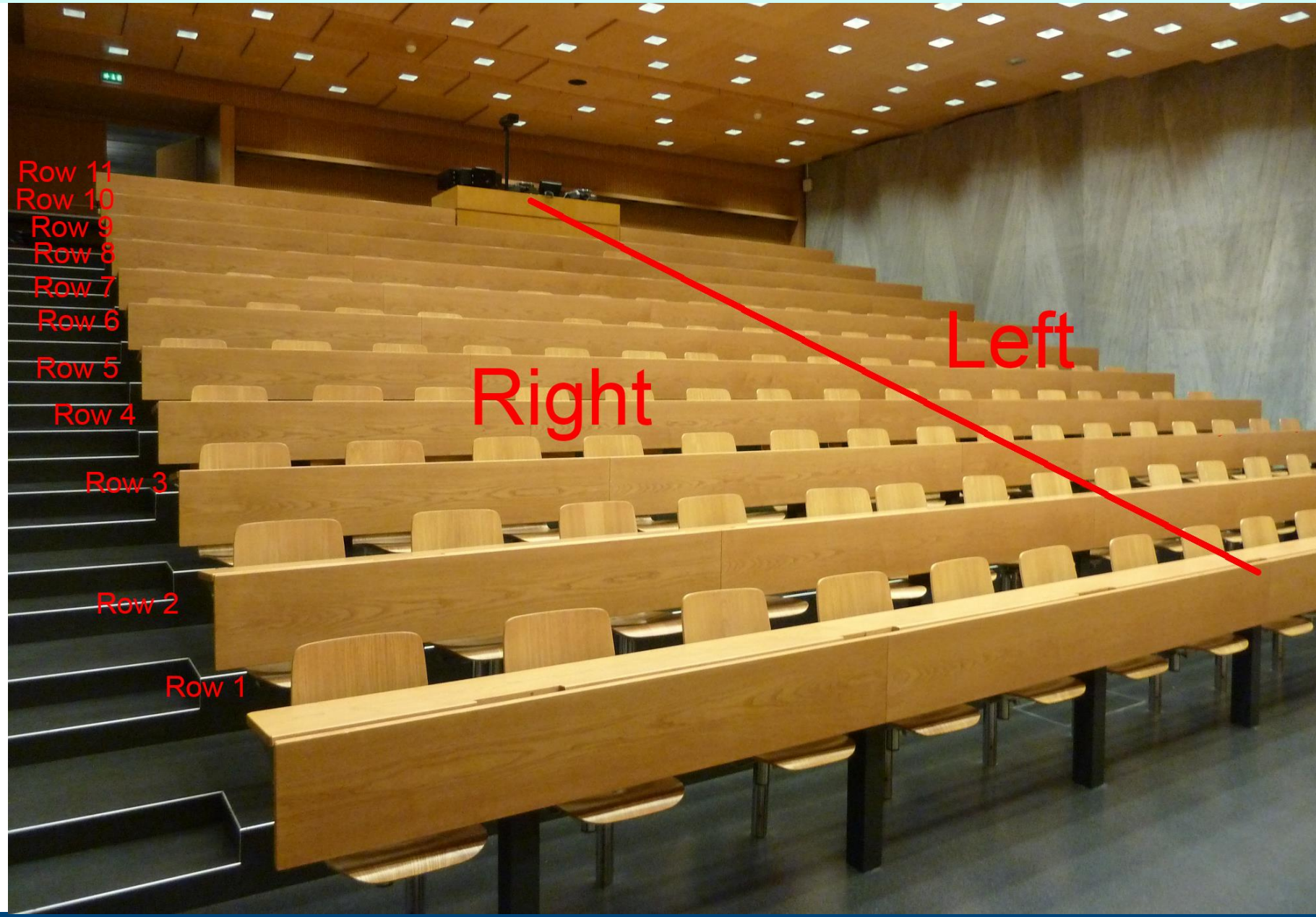
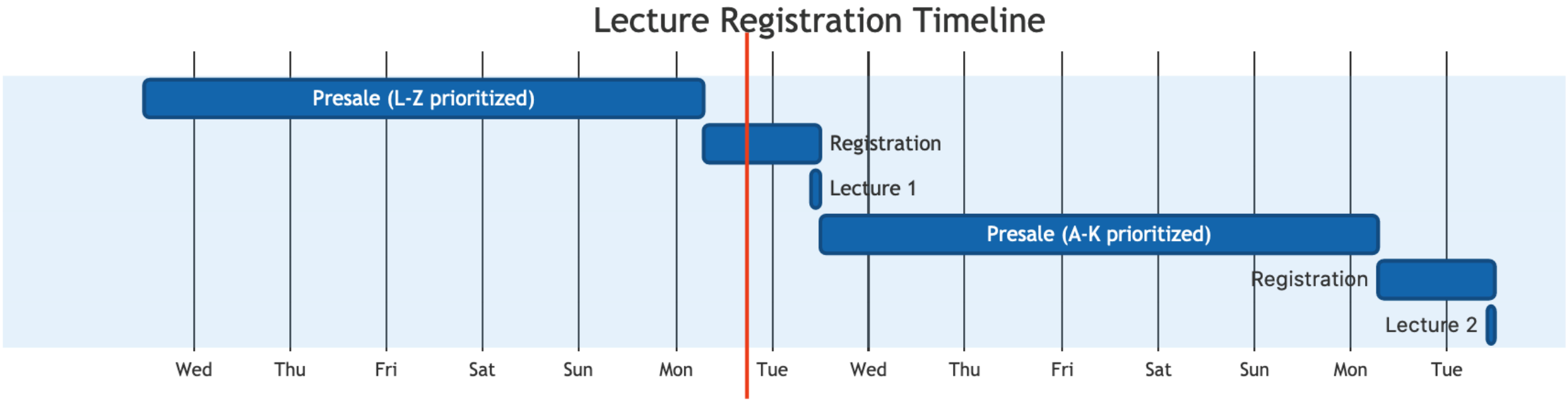


# Lecture Tickets

Alternating prioritization ensures that you can visit at least every other lecture.




More information on GitLab (see later)

# Network Security in the News

Hackers attacking US and European
energy firms could sabotage power grids

The Register®
Biting the hand that feeds IT

DATA CENTRE SOFTWARE **SECURITY** DEVOPS BUSINESS PERSONAL TECH SCIENCE EMERGENT TECH BOOTNOTES VENDOR VOICE

{* SECURITY *}

## There are DDoS attacks, then there's this 809 million packet-per-second tsunami Akamai says it just caught

Bank on the receiving end of massive 418Gbps traffic barrage

Thu 25 Jun 2020 // 10:03 UTC 50 GOT TIPS?

Symantec reports the hacking group appears to be in information-gathering mode, but warns this could pr
an attemp at sabotage. Photograph: Gareth Fuller/PA

A hacking campaign is targeting the energy sector in Europe and the US to potentially sabotage national power grids, a cybersecurity firm has warned.

The group, dubbed "Dragonfly" by researchers at Symantec, has been in opera since at least 2011 but went dark in 2014 after it was first exposed, secretly

ny Phone

nplice
vice

Victims
Device

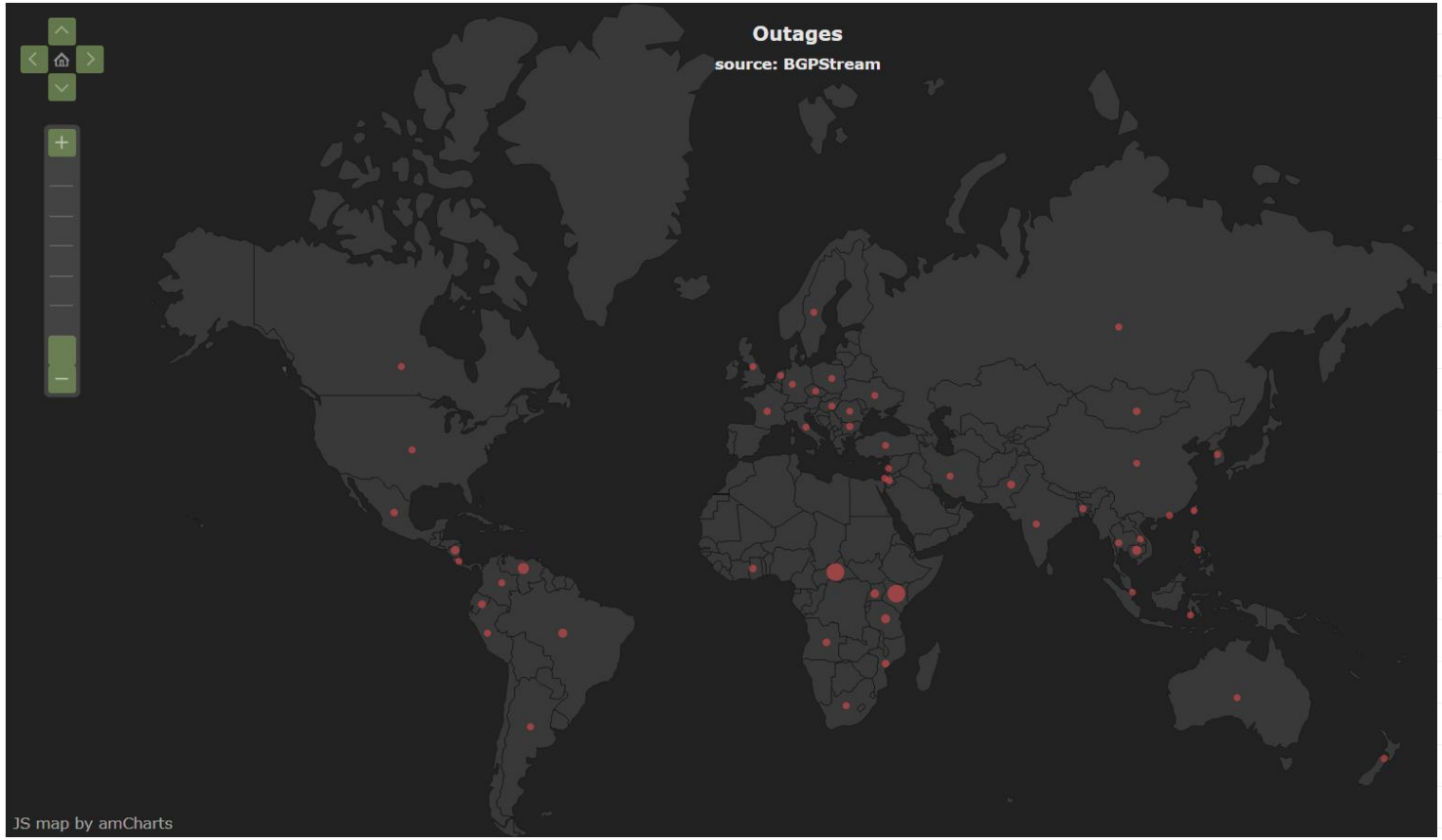
Cybersecurity researchers today revealed the existence of a new and previously undetected critical vulnerability in SIM cards that could allow remote attackers to compromise targeted mobile phones and spy on victims just by sending an SMS.

Dubbed "**SimJacker**," the vulnerability resides in a particular piece of software, called the **S@T**

# Daily Internet Attack: BGP Prefix Hijacking

# Remote questions: https://course.netsec.inf.ethz.ch/questions

## Attack Monitor: bgpstream.com



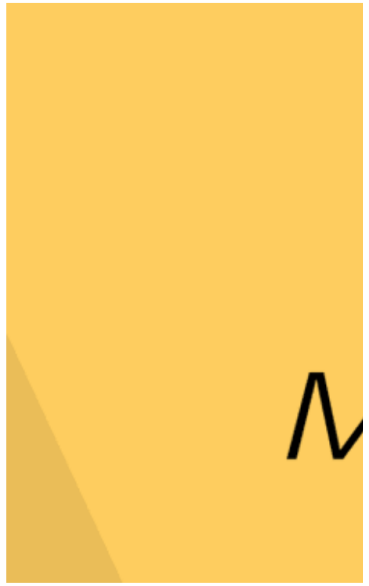

| Event type | Country | ASN | Start time (UTC) | End time (UTC) |
|---|---|---|---|---|
| Possible Hijack | | *Expected Origin AS:* COGENT-174, US (AS 174)<br>*Detected Origin AS:* EAGLENET, LB (AS 60372) | 2020-09-14 20:42:41 | |
| Possible Hijack | | *Expected Origin AS:* COGENT-174, US (AS 174)<br>*Detected Origin AS:* EAGLENET, LB (AS 60372) | 2020-09-14 20:42:41 | |
| Possible Hijack | | *Expected Origin AS:* IPMEN, GB (AS 209372)<br>*Detected Origin AS:* RU-FIXED-KRSK, RU (AS 57129) | 2020-09-14 19:47:29 | |
| Outage | | VALLEY-COMMUNICATIONS, US (AS 394972) | 2020-09-14 19:41:00 | 2020-09-14 19:44:00 |
| Possible Hijack | | *Expected Origin AS:* SIGNET-AS, NL (AS 28878)<br>*Detected Origin AS:* COLT Technology Services Group, SE (AS 15404) | 2020-09-14 19:34:52 | |
| Possible Hijack | | *Expected Origin AS:* SIGNET-AS, NL (AS 28878)<br>*Detected Origin AS:* COLT Technology Services Group, SE (AS 15404) | 2020-09-14 19:34:52 | |
| Outage | | INFOSTROY-AS INFOSTROY AS, RU (AS 208397) | 2020-09-14 16:48:00 | 2020-09-14 16:55:00 |
| Outage | | INFOSTROY-AS INFOSTROY AS, RU (AS 208397) | 2020-09-14 16:33:00 | 2020-09-14 16:36:00 |
| Possible Hijack | | *Expected Origin AS:* JOSE MARIA DELPINO(TELMIIX), PY (AS 269763)<br>*Detected Origin AS:* (AS 269764) | 2020-09-14 16:22:20 | |
| Possible Hijack | | *Expected Origin AS:* GROUPNET, IQ (AS 209699)<br>*Detected Origin AS:* ALSARD, IQ (AS 39216) | 2020-09-14 15:29:59 | |
| Possible Hijack | | *Expected Origin AS:* FORCEPOINT-CLOUD-AS, EU (AS 44444)<br>*Detected Origin AS:* ASN-ORANGE-ROMANIA, RO (AS 8953) | 2020-09-14 15:07:56 | |
| Possible Hijack | | *Expected Origin AS:* SMPHI-AS-AP SM Prime Holdings, Inc., PH (AS 58884)<br>*Detected Origin AS:* SMIC-AS-AP SM Investments Corporation, PH (AS 141016) | 2020-09-14 14:56:46 | |
| Outage | | Global Conect Ltda, BR (AS 262735) | 2020-09-14 13:56:00 | |
| Possible Hijack | | *Expected Origin AS:* ASSKYNET, LB (AS 48418)<br>*Detected Origin AS:* Beirut-Lebanon, LB (AS 9051) | 2020-09-14 13:50:41 | |
| Possible Hijack | | *Expected Origin AS:* ALTIMA-TELECOM, CA (AS 22423)<br>*Detected Origin AS:* SPRINTLINK, US (AS 1239) | 2020-09-14 12:11:04 | |
| Possible Hijack | | *Expected Origin AS:* ALEXHOST_SRL, MD (AS 207636)<br>*Detected Origin AS:* SPRINTLINK, US (AS 1239) | 2020-09-14 12:11:04 | |
| Outage | | INFOSTROY-AS INFOSTROY AS, RU (AS 208397) | 2020-09-14 12:04:00 | 2020-09-14 12:10:00 |
| Outage | | COOPERATIVAS DE CALAMUCHITA - CONSORCIO DE COOPERACION, AR (AS 263230) | 2020-09-14 11:55:00 | 2020-09-14 11:58:00 |
| Outage | | INFOSTROY-AS INFOSTROY AS, RU (AS 208397) | 2020-09-14 11:54:00 | 2020-09-14 11:58:00 |
| Outage | KI | N/A | 2020-09-14 09:42:00 | |
| Outage | | BENCHMARK-AS-IN Benchmark Infotech Services Pvt.Ltd., IN (AS 58966) | 2020-09-14 09:34:00 | 2020-09-14 09:37:00 |
| Outage | | KINGS-AS-ID Kings Network Indonesia, PT, ID (AS 45725) | 2020-09-14 06:51:00 | |
| Possible Hijack | | *Expected Origin AS:* ESINNET Shenzhen ESIN Technology Co., Ltd, CN (AS 59072)<br>*Detected Origin AS:* ULAN-NETWORK-LIMITED ULan Network Limited, HK (AS 134196) | 2020-09-14 01:40:00 | |
| Outage | | COFRACTAL-001, US (AS 26073) | 2020-09-14 01:24:00 | 2020-09-14 01:31:00 |

# Remote questions: https://course.netsec.inf.ethz.ch/questions

# Network Components are Also Vulnerable

**Hackers Infect Ov**
**Crypto Mining Ma**

August 02, 2018 Mohit Kuma



Security researchers have discover
thousands of unpatched MikroTik
connected to them.

In all, the malware campaigns have
hardware provider Mikrotik across

**Thousands of Mikro**
**On Network Traffic**

September 03, 2018 Swati Khandelw

Last month we reported about
MikroTik routers using a previ

Now Chinese security researc
vulnerable MikroTik routers, m
maliciously, allowing attackers

**Some**
**Passw**

Septembe

What could

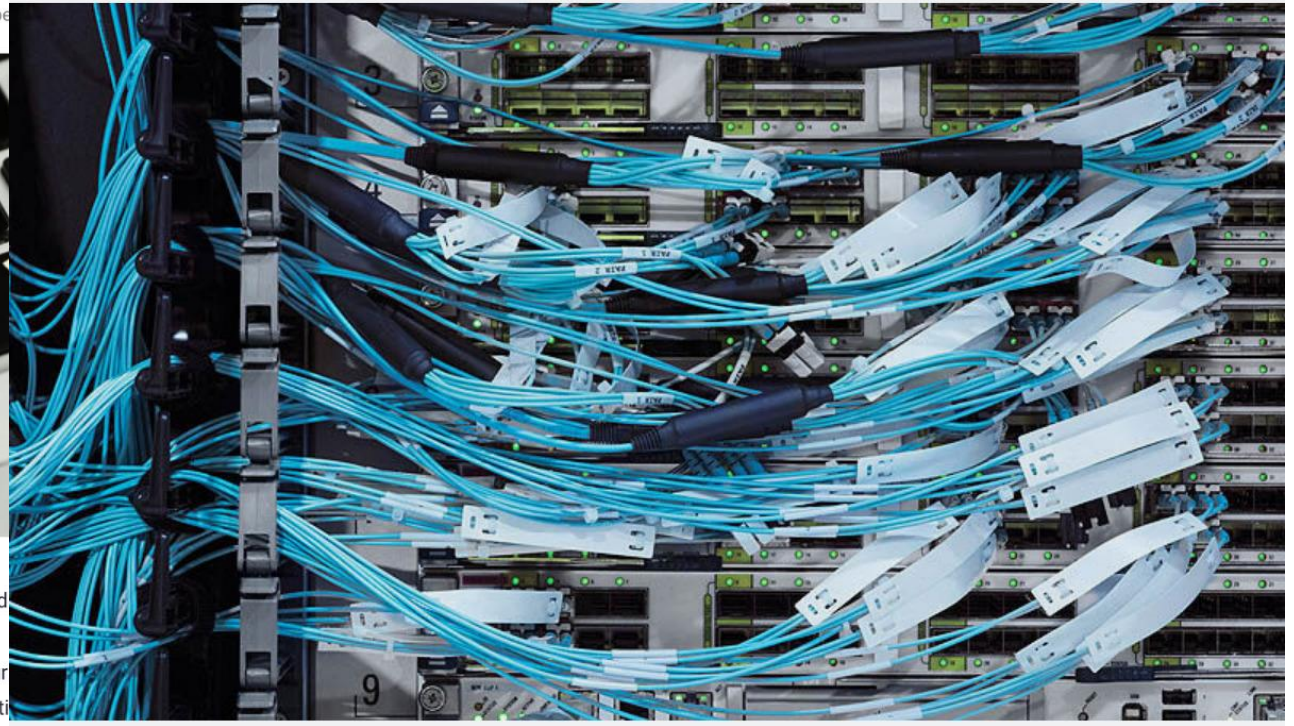
Cybersecur
vulnerabiliti
—that involve insecure storage of credentials, potentially affecting every user and system on that

*TELECOMS TAKE NOTE —*

## Attackers are trying to exploit a high-severity zeroday in Cisco gear

Exploits can exhaust memory in hardware used by telecoms and cloud providers.

DAN GOODIN - 8/31/2020, 9:59 PM



# Example: Ethereum Wallet Heist

THE VERGE TECH SCIENCE CULTURE CARS REVIEWS LONGFORM VIDEO MORE

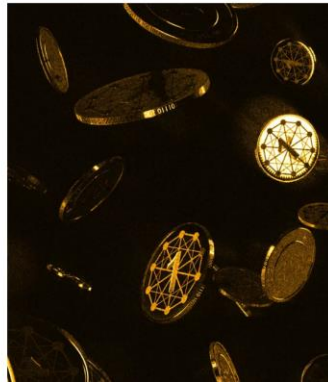
TECH CYBERSECURITY ENTERPRISE

## Hackers emptied Ethereum wallets by breaking the basic infrastructure of the internet

21

By Russell Brandom | @russellbrandom | Apr 24, 2018, 1:40pm EDT

SHARE



Hijack of Am
service used
hours unnot

Between 11am until 1
internet, routing you t
unknown actor.

## $150K Stolen From MyEtherWallet Users in DNS Server Hijacking



363 7

David Floyd
Apr 24, 2018 at 16:35 UTC | Updated Apr 24, 2018 at 16:37 UTC

NEWS




Users of MyEtherWallet, a web app for storing and sending ether and ethereum-based tokens, experienced an attack Tuesday that saw users of the service lose around $152,000 worth of ether.

commercial cloud provider who
count major websites such as
Twitter.com as customers.

# About This Course

- The course will cover topics spanning four broad themes:
  - Network **defense mechanisms** such as secure routing protocols, TLS, anonymous communication systems, network intrusion detection systems, and public-key infrastructures;
  - Network **attacks** such as denial of service (DoS) and distributed denial-of-service (DDoS) attacks;
  - Attack **analysis and inference** topics such as network forensics and attack economics;
  - Secure **next-generation network architectures**.
- We will assume knowledge of the “Computer Networks” course taught in the spring semester (https://ndal.ethz.ch/courses/networks.html)
  - “Networking Refresher” in exercise session this week
  - More pointers during the course
  - No specific questions in exam, but may be required to answer other questions

# Draft Syllabus

| | |
|---|---|
| AP | Course introduction, crypto refresher |
| AP | PKI systems |
| KP | TLS |
| KP | TLS |
| ML | VPNs, IPsec, Wireguard |
| ML | Anonymous-communication systems |
| ML | BGP security, BGPsec, best practices |
| ML | (D)DoS attacks and current defense mechanisms |
| SF | DNS security and privacy |
| SF | Firewalls, IDS, evasion and limitations |
| SF | Cybersecurity in practice / legal aspects |
| AP | Probabilistic traffic-monitoring techniques |
| AP | Next-generation Internet (SCION) |
| AP | Next-generation PKIs + DRKey |

# Learning Objectives

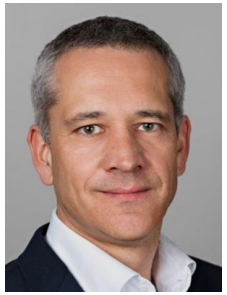
- You are familiar with fundamental **network-security concepts**.
- You can **assess current threats** that Internet services and networked devices face and can evaluate appropriate countermeasures.
- You can **identify and assess known vulnerabilities** in a software system that is connected to the Internet (through analysis and penetration testing tools).
- You have an in-depth understanding of a range of important **security technologies**.
- And: You develop some **intuition** and reasonable **paranoia** in your work with ICT.

# Remote questions: https://course.netsec.inf.ethz.ch/questions

## Lecturers

**Prof. Dr. Adrian Perrig,** Twitter @adrianperrig

- Since 2013, Professor of Computer Science, ETH Zürich
- 2002-2012: Professor at Carnegie Mellon University
- Core focus: network and systems security, secure communication architectures



**Dr. Stefan Frei,** Twitter @stefan_frei

- Senior Security Principal, Accenture Cyber Defense
- PhD ETH Zurich
- Formerly VP Research NSS Labs, Austin/TX, USA, Research Director Secunia
- Penetration Tester/Researcher ISS X-Force (now part of IBM)

**Dr. Markus Legner,**

- Postdoctoral Researcher, Network Security Group
- PhD ETH Zurich (in theoretical physics)
- Working on further improving data-plane security and quality of service for SCION

**Prof. Dr. Kenny Paterson,** Twitter @kennyog

- Since 2019, Professor of Computer Science, ETH Zürich
- Until 2019: Professor at University of London
- Core focus: applied cryptography, many contributions to TLS

# Lecture and Exercise Sessions

**Lecture**: **Tue 10:00-12:00, CHN C 14**

- Key security concepts, theory, technologies, case studies
- Schedule and topics at https://www.netsec.ethz.ch/courses/netsec-2020/

**Exercise session and guest talks**: **Thu 16:00-18:00, HG F 1**

- "Attack show cases", discussion of assignments, guest talks

**Teaching assistants**

- Piet De Vaere, Head TA
- Giacomo Giuliari, Exercise TA
- Simon Scherrer, Project TA

**Student assistants**

- Tommaso Ciussani
- Marc-Philippe Bartholomä
- Ben Fiedler, DtF project






# Exercise Sessions

- Will take place on Thursday 16:15–18:00 in HG F 1
- Sessions will consist of:
  - 1 hour discussion of last exercise sheet
  - 1 hour of one of the following:
    - Guest lecture
    - Project discussion
    - Question hour
- First exercise session is this Thursday (17.09.2020)
  - By exception this exercise session will contain a “Networking Refresher” lecture

# Guest Lectures

**We will again have exiting guest lectures this year**

- Nico Schottelius, **Ungleich**, “Security Aspects of IPv6”
- Maxim Salomon, **Google**, “Security vulnerabilities of modern Wireless LAN Systems”
- Rayhaan Jaufeerally, **AS210036**, “An exploration of real-world network security”
- Candid Wüest, **Acronis**, “Malware Analysis and Prevention”
- Patrick Schmid, **RedGuard**, “Top X Ways to get Domain Admin”
- David Mc Laughlin, **ETH Zürich**, “Email spam prevention at ETH”

# Course Webpage

The course's webpage is at:

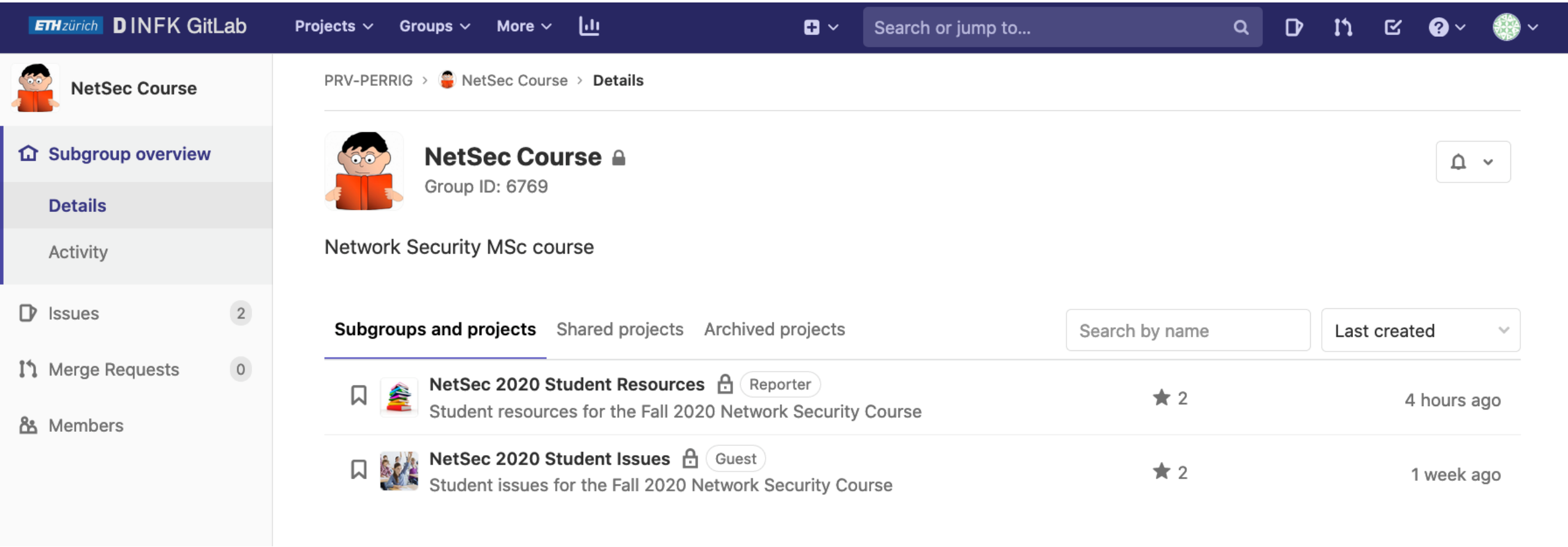
**https://netsec.ethz.ch/courses/netsec-2020/**

Course materials (slides, exercises, …) will be distributed through a GitLab repository linked to on this page. Course registration is required for access.

Lecture recordings will be distributed through the ETH video portal.

# Remote questions: https://course.netsec.inf.ethz.ch/questions

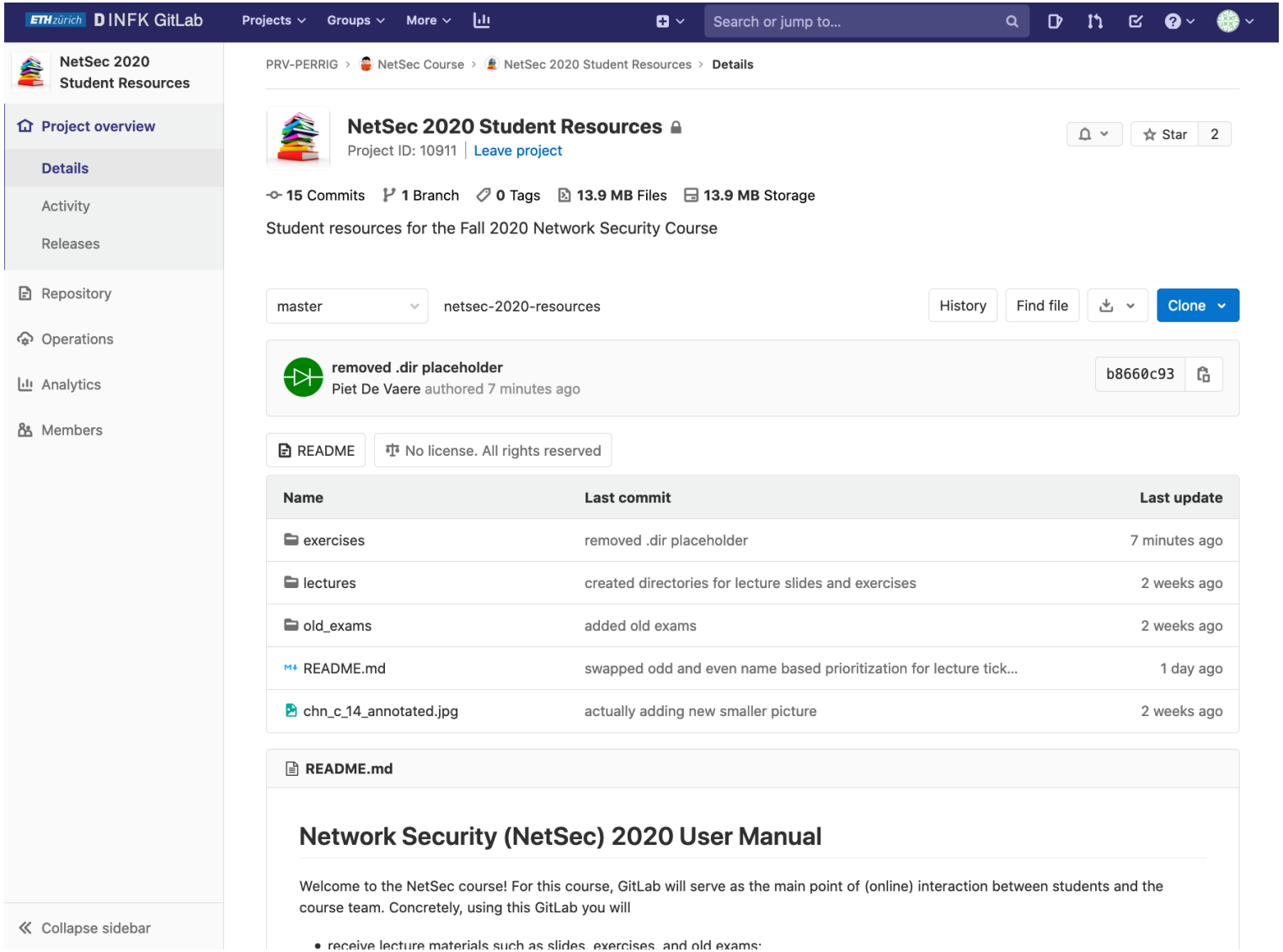
## GitLab




We use the D-INFK GitLab instance: **https://gitlab.inf.ethz.ch**

# Remote questions: https://course.netsec.inf.ethz.ch/questions

## GitLab Resources




Slides

Exercises

Old Exams

Project Descriptions

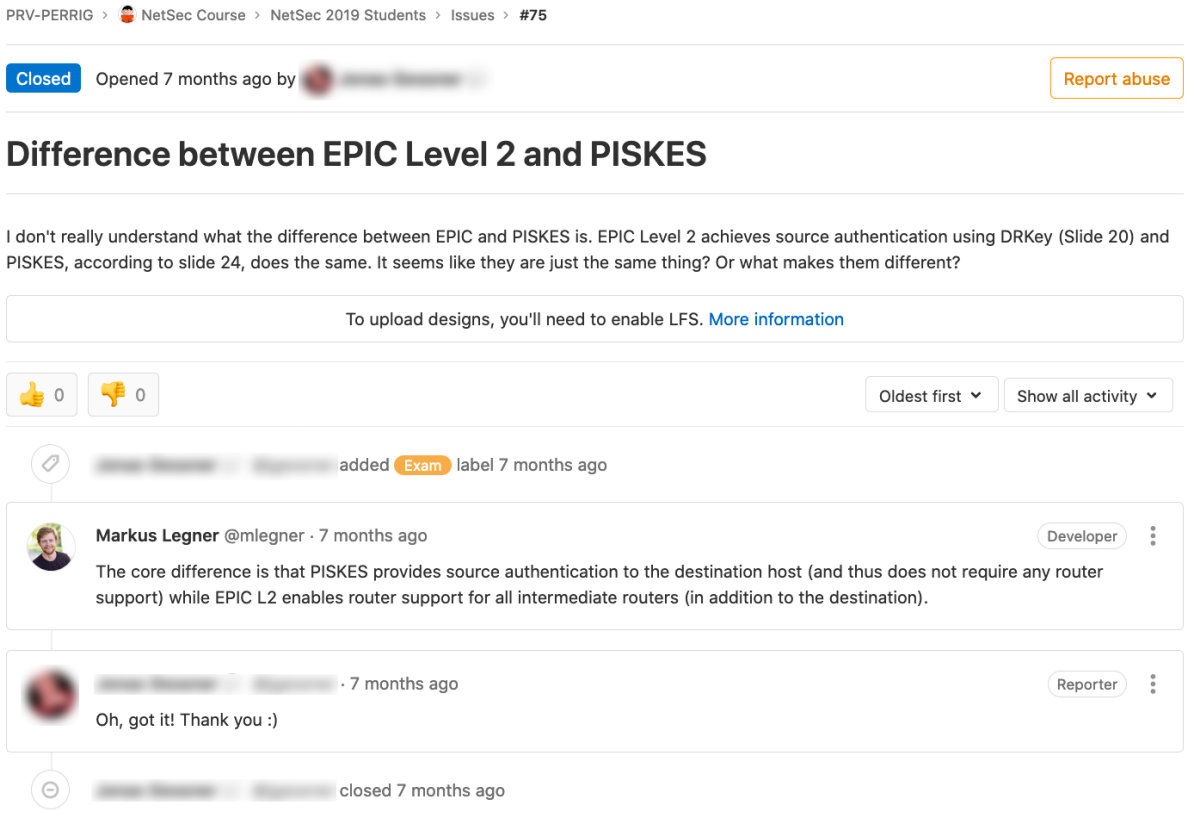
...

# Remote questions: https://course.netsec.inf.ethz.ch/questions

## GitLab Issues

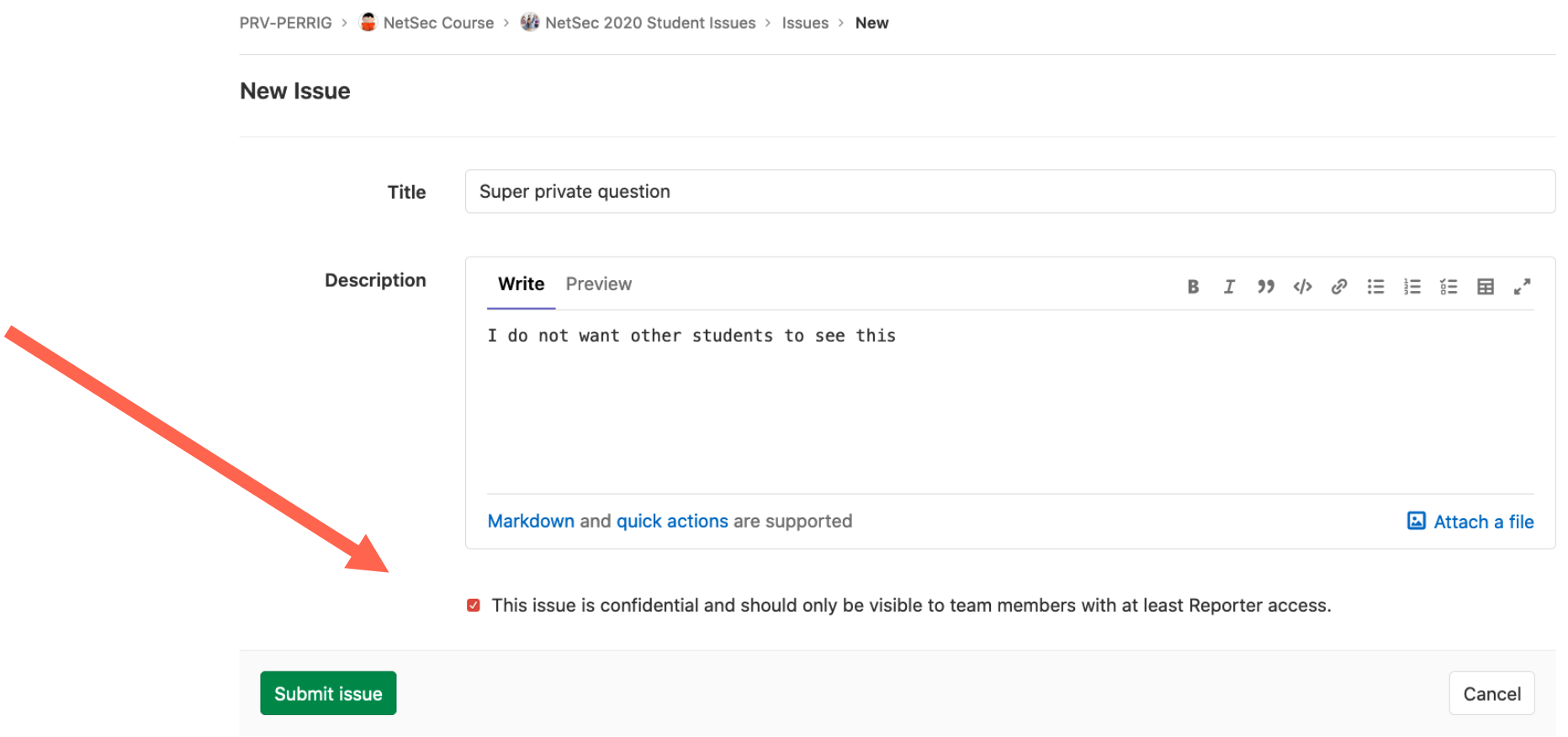
We will use the GitLab issue tracker extensively in this course:

- Lecture registration
- Questions about lecture, exercises, projects
- Administrative questions
- Handing in exercises
- ...



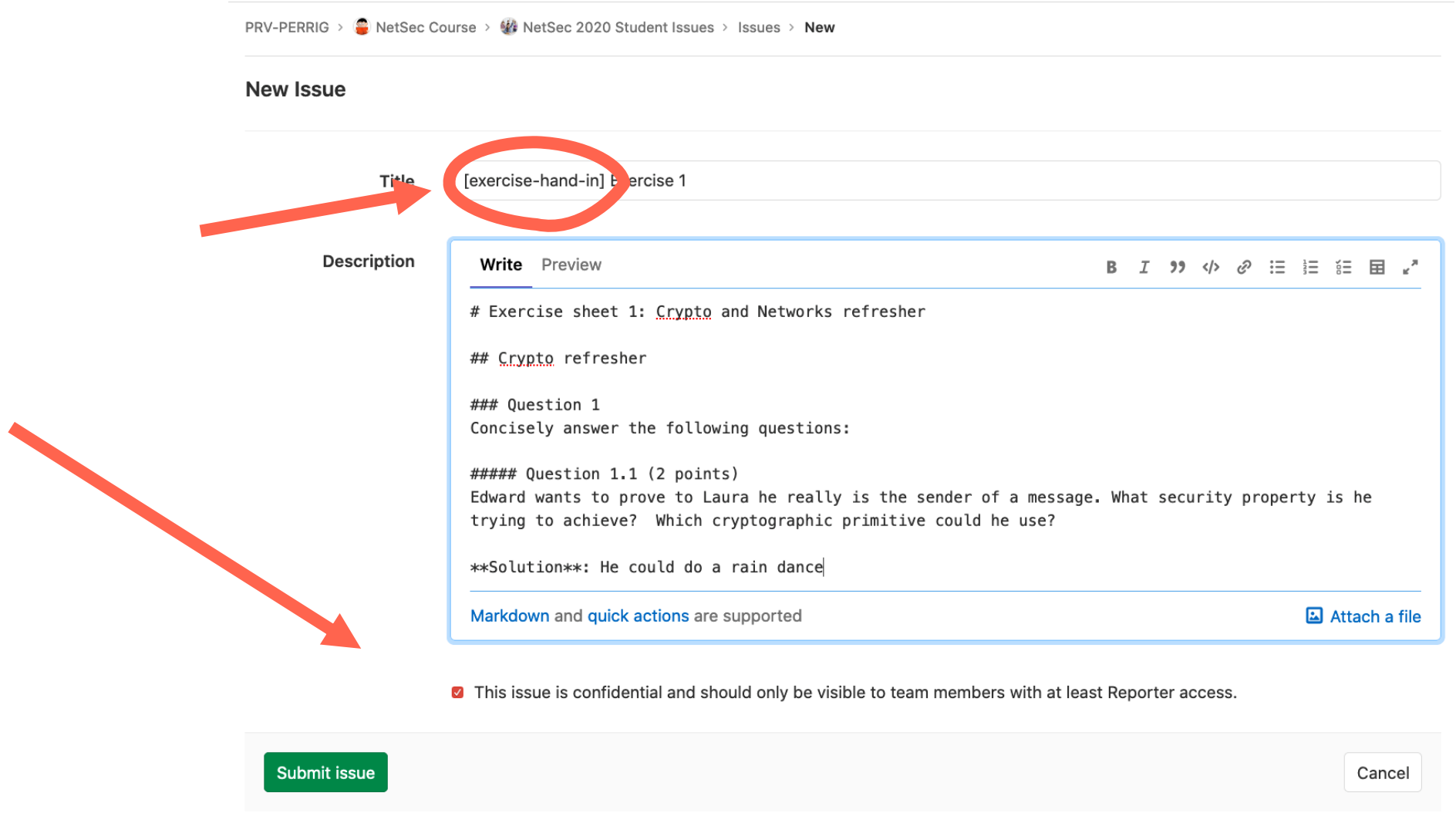
# Remote questions: https://course.netsec.inf.ethz.ch/questions

## Private questions through GitLab



# Remote questions: https://course.netsec.inf.ethz.ch/questions

# Handing in Exercises through GitLab



# Email

**Please use GitLab issues whenever possible**

**and do not send us email.**

Using issues allows for discussion, better tracking of questions, and more transparency!

# Hacking Lab

- Students can autonomously solve challenges on hacking lab.
- Solving the challenges is NOT mandatory and does NOT influence the final grade. Solving the challenges will provide some practical experience and may help with the exam.
- Hacking Lab will be explained more in detail in an exercise session.

# Projects

- There will be two projects
- The projects are mandatory and individual
- 20 % of the final grade will be determined by the projects
- Each project has an equal weight

- ACME Project:
  - Implement an Automatic Certificate Management Environment (ACME) client

- Defend-the-Flag Project:
  - Diagnose and patch a vulnerable server

- More information will follow in the exercise session.

# Exam in January/February

- **Time:** Written exam, 120 minutes
- **Language:** Q: English, A: German or English (your choice)
- **Exam materials:** No extra materials are permitted
- **Exam coverage:**
  - Lectures, guest talks, exercises, projects
- **What and how we assess:**
  - We cover most (if not all) course topics
  - Understanding of security concepts, techniques and attacks as well as the ability to suggest appropriate defense measures
- **The exam will probably take place on computers**

# Grading

- **Exam:** 80 % of grade
- **Projects**: 20 % of grade
  - The two projects are weighted equally.
  - Not handing in a projects results in a 1 *for that project.*
  - ➔ Not handing in the projects results in a maximum score of 5.00 for the course.

# Action Items for Network Security Students

- **Lecture registration** (“Einschreibung”)
  - Subscribe to “Network Security HS 2020” on http://www.mystudies.ethz.ch/

# Legal use of NetSec material

- Some knowledge, technologies, code usable for attacks, it is illegal to use them for criminal activities
- It is also illegal to make available such technologies and code without proper measures
- Only myStudies-registered students have access to the course materials