Joint Info Event of the iLab1, iLab2, and iLabX (iLab Info Event)

IN0012, IN2106, IN2257, IN4060, IN4097, IN4240, IN8016, IN8018 – SS & WS

iLab Teams

Chair of Network Architectures and Services
School of Computation, Information, and Technology
Technical University of Munich

1.ilab.net.cit.tum.de

Florian Wiedner

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Manuel Simon

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Daniel Petri

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Kilian Holzinger

Johannes Späth

Tim Betzer

How did you hear about the ilabs?

- Course information in TUMonline
- Chair website (`net.cit.tum.de`)
- Friends

iLab History

EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

part II – for master

part I – for bachelor

Internet-praktikum

iLab

iLabX

iLab2

2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

- Bachelor and Master students
- Informatics, Engineering Systems, Data Engineering and Analytics
- 10 ECTS $\approx$ 300 h workload distributed over course duration
- Language: English

iLab1 Build your own Internet! (since 2004)
iLab2 You set the Focus! (since 2010)
iLabX The virtual Internet Laboratory (since 2018)

The lab courses run very successfully with more than 2000 participants at different German Universities. All iLab courses were originally designed by Marc-Oliver Pahl.

The iLabs

iLab1—*Build your own Internet!* teaches you how to **core protocols and tools that hold the Internet together** work.

iLab2—*You set the Focus!* teaches you **selected protocols and mechanisms** of Computer **Networks** and **Distributed Systems**.

iLabX—*The virtual Internet Laboratory* **combines gems from both courses**. In its remote version at TUM you will have essentials of both courses, iLab1 and iLab2. The first part will be a self-paced online course.. The second part will be online at TUM.

What is special about the iLabs?

What is special about the iLabs?

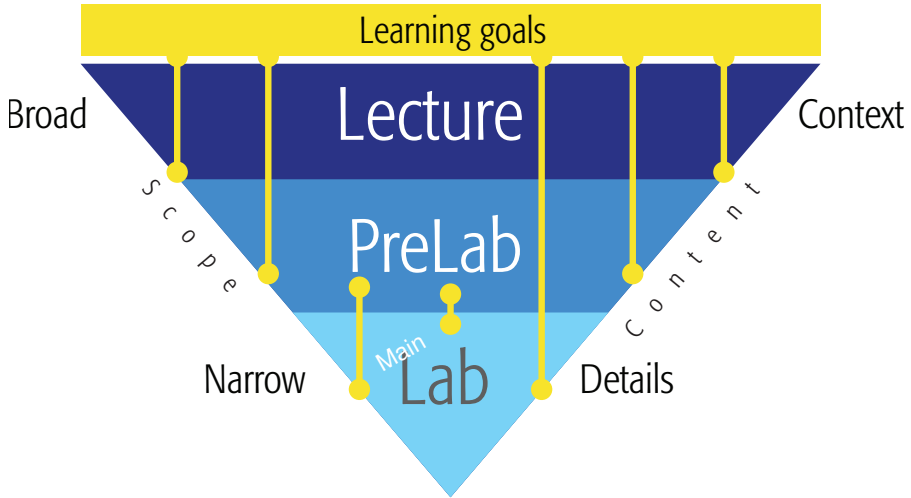
Many things are!

Didactics ✓

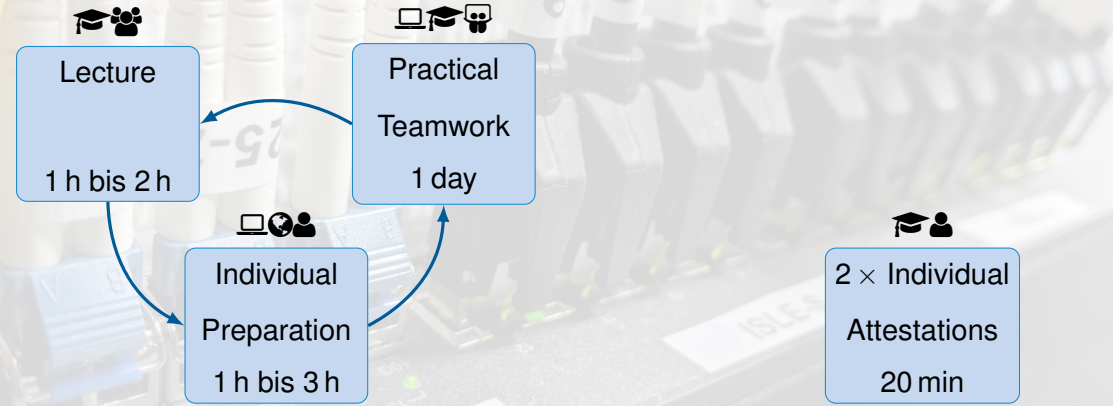
People ✓

Topics ✓

Focus & Constructive Alignment

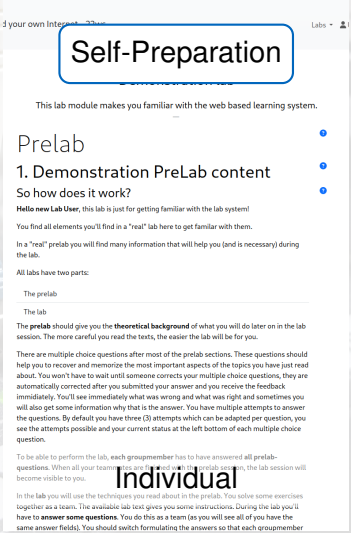


Blended Learning Concept



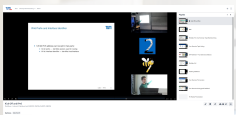
iLab =


Lecture
Group


Self-Preparation
Labs
This lab module makes you familiar with the web based learning system.
Prelab
1. Demonstration PreLab content
So how does it work?
Hello new Lab User, this lab is just for getting familiar with the lab system!
You find all elements you'll find in a "real" lab here to get familar with them.
In a "real" prelab you will find many information that will help you (and is necessary) during the lab.
All labs have two parts:
The prelab
The lab
The prelab should give you the theoretical background of what you will do later on in the lab session. The more careful you read the texts, the easier the lab will be for you.
There are multiple choice questions after most of the prelab sections. These questions should help you to recover and memorize the most important aspects of the topics you have just read about. You won't have to wait until someone corrects your multiple choice questions, they are automatically corrected after you submitted your answer and you receive the feedback immidiately. You'll see immediately what was wrong and what was right and sometimes you will also get some information why that is the answer. You have multiple attempts to answer the questions. By default you have three (3) attempts which can be adapted per question, you see the attempts possible and your current status at the left bottom of each multiple choice question.
To be able to perform the lab, each groupmember has to have answered all prelab-questions. When all your teammates are finished with the prelab session, the lab session will become visible to you.
In the lab you will use the techniques you read about in the prelab. You solve some exercises together as a team. The available lab text gives you some instructions. During the lab you'll have to answer some questions. You do this as a team (as you will see all of you have the same answer fields). You should switch formulating the answers so that each groupmember
Individual


Hands-On
Team

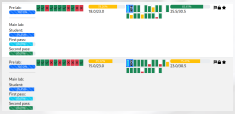
eLearning: preLab



Lecture Recording

Preparation Texts

Multiple Choice Motivation



Statistics: Ranking & who did not finish

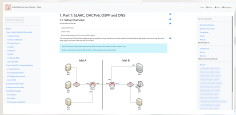
The preLab is not considered for calculating your grade.
Use the feedback to directly learn from your mistakes.

Lecture

- Context for next lab
- Real-world motivation and application
- Lean theoretical background
- Learn required topics

Attendance is mandatory

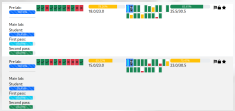
eLearning: MainLab



All instructions are online

Free text inputs

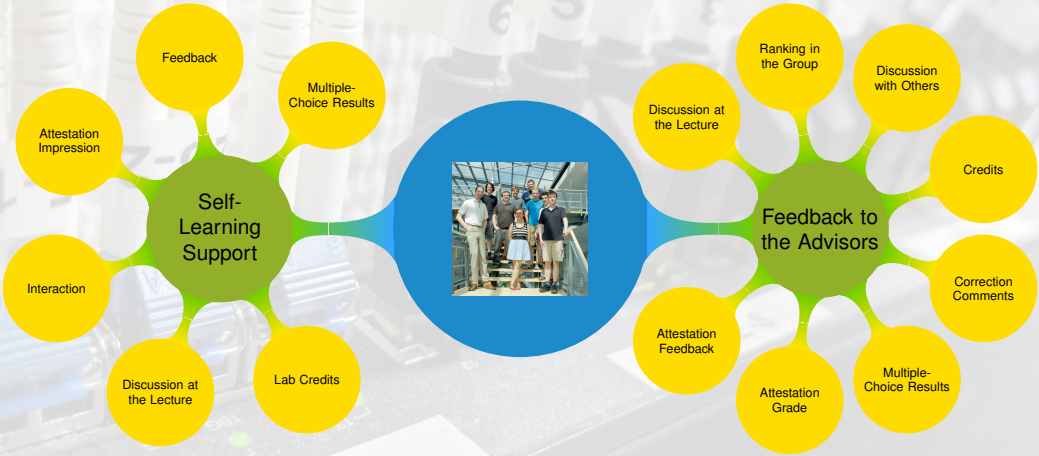
Tutors: Cross correction



Course management

The grading of the labs contributes 60 % to your grade.
Use the feedback from the tutors to improve for future labs.

Interactivity



Feedback is important to encourage the learners to continue learning. It is a main mean for motivation. Feedback is important for the teachers as well as it helps them to adapt to the needs of the current student group. The student feedback is continuously used to improve the exercises.

Learn from each other . . .


one isle
It could be yours for one day a week…

What is special about the iLabs?

Many things are!

Didactics ✓

People ✓

Topics ✓

iLab People

Great team

Very good Hiwis

And you

What is special about the iLabs?

Many things are!

Didactics	People	Topics
✔	✔	✔

The iLabs

iLab1—*Build your own Internet!* teaches you how to **core protocols and tools that hold the Internet together** work.

Internet Lab (iLab1)

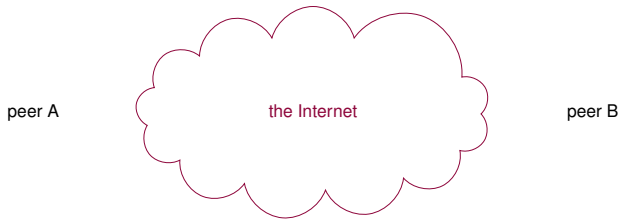
Build your own Internet!

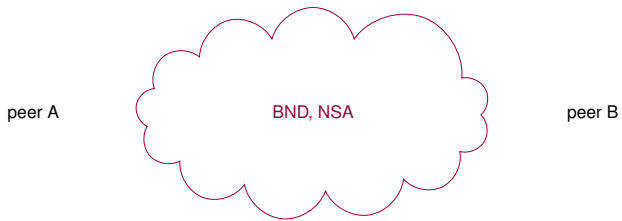
Florian Wiedner, Eric Hauser

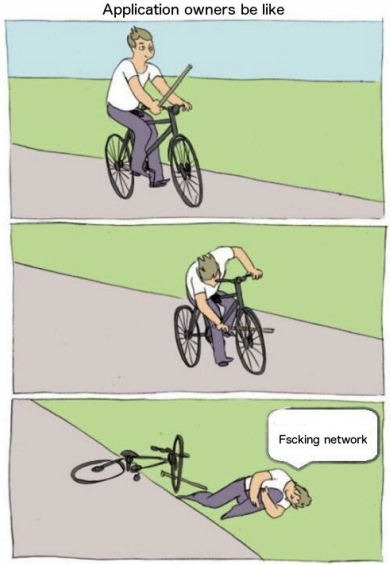
ilab1@net.in.tum.de

Chair of Network Architectures and Services
School of Computation, Information, and Technology
Technical University of Munich

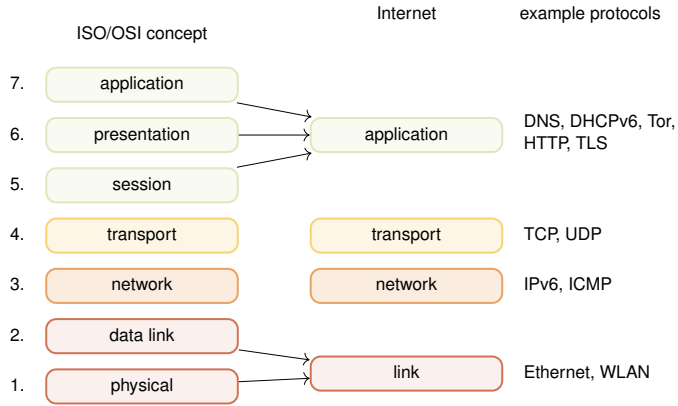
Pre-course Meeting – WiSe 2025


peer A
the Internet
peer B

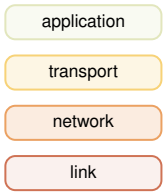

peer A
BND, NSA
peer B


Application owners be like
Fscking network

Course content overview



Basics

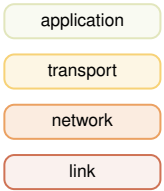


IPv4, IPv6, NDP

Ethernet, switching, MAC, ARP

- interface setup with `ip`
- tcpdump and wireshark
- ARP spoofing

Static routing



SLAAC, routing table, ICMP

- Cisco routers
- packet forwarding

Dynamic routing

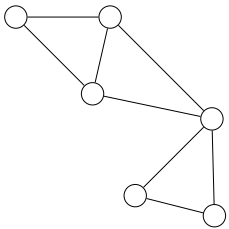
application

transport

network

link

RIPng, OSPF, BGP



- autonomous systems
- OSPF areas

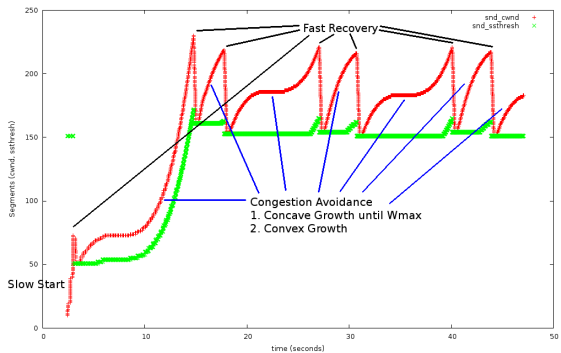
application

transport — TCP, UDP

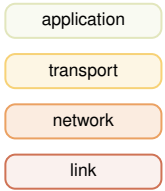
network — fragmentation

link

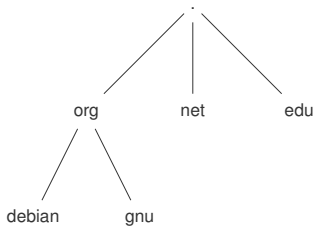
- connection
- CUBIC behaviour
- nmap



DNS

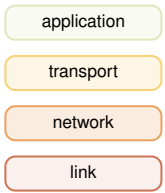


DNS



- root servers, TLDs, . . .
- authoritative servers and resolvers
- caching

DHCPv6, DHCP, NAT



DHCPv6, DHCP

NAT

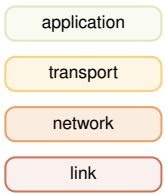
- IPv6 prefix delegation
- NAT and FTP

TLS and packet filtering

application	TLS
transport	
network	packet filter
link	

- secure web server
- nmap
- packet filter (“firewall”)
  - nftables
  - policies
  - IPv6 considerations

QUIC

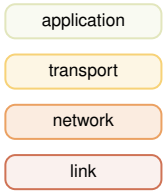


QUIC, TLS

UDP

- new standard
- alternative to HTTP over TCP

WLAN



IEEE 802.11, 802.1X

- `iw`
- medium access control experiments
- build an AP
- breaking wireless encryption
- secure wireless configuration
- EAP and radius

Requirements

None, just interest in networking!

- you will learn all required Linux knowledge
- networking course is **recommended**

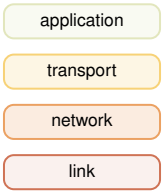
Lecture: Wednesdays, 1700-2000, MI 00.13.009A

First lecture: 2025-10-15 – kickoff (team assignment) and The Basics

Attendance mandatory!

- Stevens: TCP/IP illustrated, vol. 1, 1994 (1-4, 6-9, 11, 17-21, 26)
  - Tanenbaum: Computer Networks
  - Kurose, Ross: Computer Networking
- Katz, Lindell: Introduction to modern cryptography, 2nd edition, 2015 (1-3, 4.1-4.2, 5.1-5.3, 10, 11.1-11.2, 12.1-12.3)
- Tanenbaum: Modern operating systems, 4th edition, 2015 (1, 2-2.1, 3-3.3, 3.7, 5-5.1, 5.3, 8.3, 9-9.3, 10-10.2, 10.5)
- basics in theoretical computer science, complexity theory, algorithms

Questions?



ilab1@net.in.tum.de

The iLabs

iLab2—*You set the Focus!* teaches you **selected protocols and mechanisms** of Computer **Networks** and **Distributed Systems**.

iLab2 - You set the Focus!

WiSe 2025

Manuel Simon, Stefan Lachnit, Daniel Petri

ilab2@net.in.tum.de

Chair of Network Architectures and Services
School of Computation, Information, and Technology
Technical University of Munich

Setting the Focus
Scope of the content

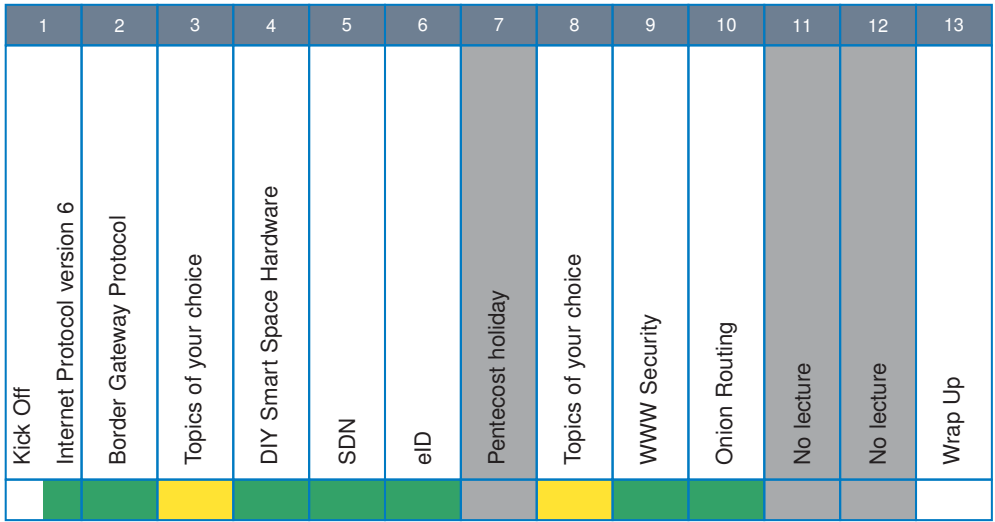
Full Labs

- Chosen by us
- Selected protocols and mechanisms of
  - computer networks,
  - distributed systems,
  - and their services

Minilabs

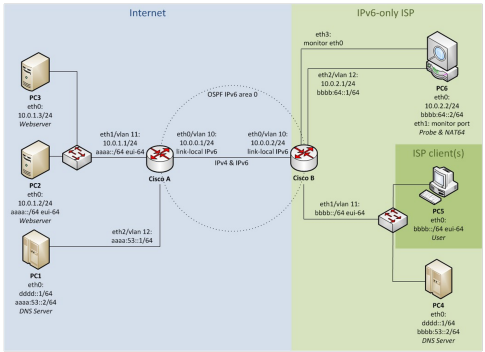
- Chosen by you
- Created by iLab 2 alumni

On-site Classes



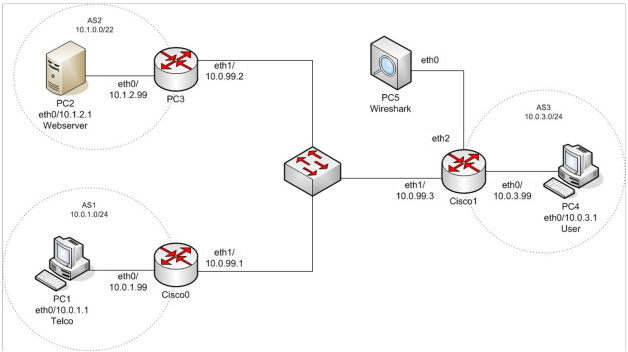
Internet Protocol version 6

1	2	3	4	5	6	7	8	9	10	11	12	13
IPv6	BGP	Minilabs	IoT	SDN	eID		Minilabs	WWW	OR			
	Minilab Voting				Quiz 1							Quiz 2



Border Gateway Protocol

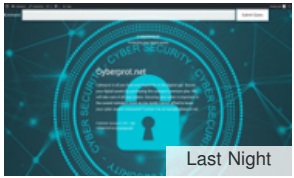
1	2	3	4	5	6	7	8	9	10	11	12	13
IPv6	BGP	Minilabs	IoT	SDN	eID		Minilabs	WWW	OR			
	Minilab Voting				Quiz 1							Quiz 2



Minilabs

1	2	3	4	5	6	7	8	9	10	11	12	13
IPv6	BGP	Minilabs	IoT	SDN	eID		Minilabs	WWW	OR			
	Minilab Voting				Quiz 1							Quiz 2

Screw you, Baby Yoda



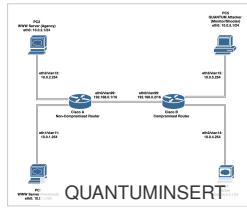
Last Night


Romeo and Juliet

Is this still a break-in? – RFID

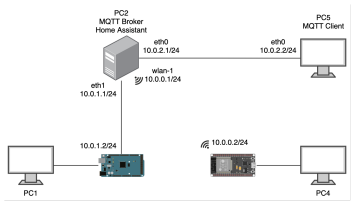
Student-created Minilabs during past iLab 2 runs

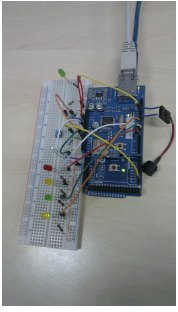

Save the ISS

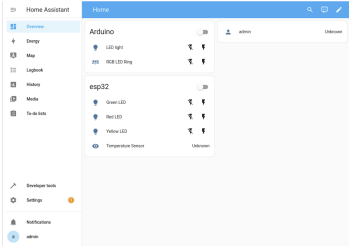

QUANTUMINSERT

IoT and Smart Home

1	2	3	4	5	6	7	8	9	10	11	12	13
IPv6	BGP	Minilabs	IoT	SDN	eID		Minilabs	WWW	OR			
	Minilab Voting				Quiz 1							Quiz 2

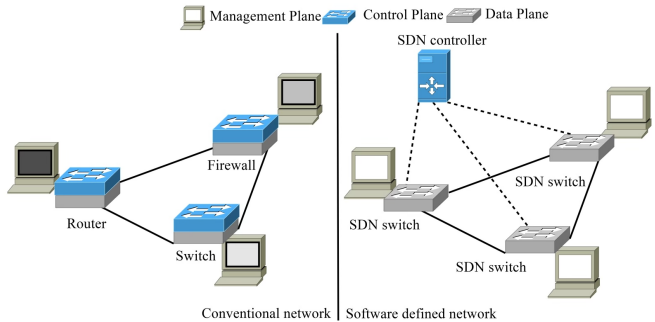






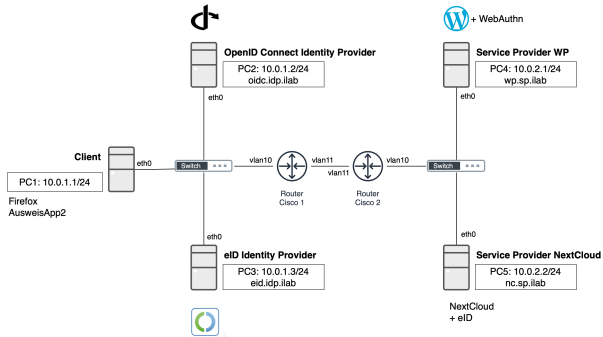
Software-defined Networking

1	2	3	4	5	6	7	8	9	10	11	12	13
IPv6	BGP	Minilabs	IoT	SDN	eID		Minilabs	WWW	OR			
	Minilab Voting				Quiz 1							Quiz 2



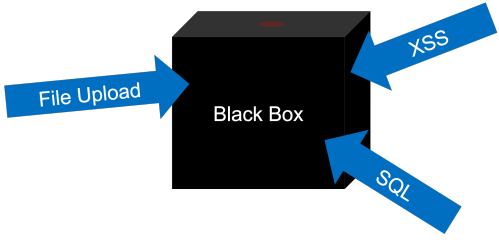
Web Authentication Methods

1	2	3	4	5	6	7	8	9	10	11	12	13
IPv6	BGP	Minilabs	IoT	SDN	eID		Minilabs	WWW	OR			
	Minilab Voting				Quiz 1							Quiz 2



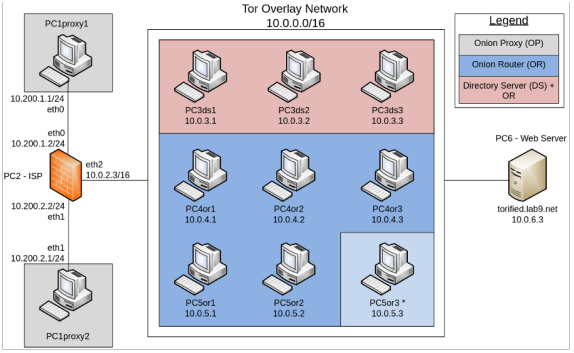
WWW Security

1	2	3	4	5	6	7	8	9	10	11	12	13
IPv6	BGP	Minilabs	IoT	SDN	eID		Minilabs	WWW	OR			
	Minilab Voting				Quiz 1							Quiz 2



Onion Routing

1	2	3	4	5	6	7	8	9	10	11	12	13
IPv6	BGP	Minilabs	IoT	SDN	eID		Minilabs	WWW	OR			
	Minilab Voting				Quiz 1							Quiz 2



Requirements

iLab 2 covers advanced topics

- Previous knowledge from an introductory networking course recommended
  - e.g., GRNVS
- iLab1 is **not** a required prerequisite

- Lectures on Tuesdays starting at 16:00
- First session: 2025-10-14 (kickoff, team assignment, lab room tour, and first lecture)
- Mandatory attendance

The iLabs

iLabX—*The virtual Internet Laboratory* **combines gems from both courses**. In its remote version at TUM you will have essentials of both courses, iLab1 and iLab2. The first part will be a self-paced online course.. The second part will be online at TUM.

iLabX—*The virtual Internet Laboratory*

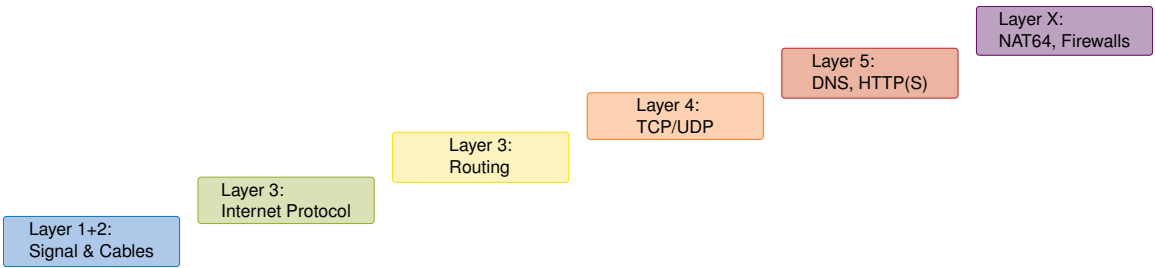
- **Combines gems from both courses:** essentials of iLab1 and iLab2
- Fully remote
- Two parts: self-paced online course *individual* and lab part *in teams of two*
- Open to many study programs, not restricted to Informatics department

iLabX
Self-Paced Part

- 6 Weeks: Self-paced part (tentative dates: mid January to end February)
- At your own schedule:

Layer	1+2	Basics, Physics
Layer	3	IPv6, IPv4
Layer	3	Routing
Layer	4	TCP, UDP
Layer	5	DNS, HTTP(S)
Layer	6	Firewall, NAT64

iLabX
Content of the Self-Paced Online Course



Detailed Keywords for the Six Parts of the Course

Part 1 Signals and Cables

Signals, shared medium, physical medium, noise, addressing, topologies, unicast, broadcast, headers, payload, trailer, twisted pair, optical fiber, wireless, non-return to zero (NRZ), Manchester encoding, self-clocking.

Part 2 Internet Protocol

Internet Protocol (IP), IPv6, IPv4, subnetting, fragmentation, Stateless Address Auto Configuration (SLAAC), Neighbour Discovery Protocol (NDP), Internet Control Message Protocol (ICMP), static routing, forwarding, multicast.

Part 3 Routing

Dynamic routing, longest prefix matching, Autonomous System (AS), Open Shortest Path First (OSPF), Routing Information Protocol (RIP), Dijkstra, Bellmann-Ford, paths, loops.

Part 4 Transmission Control Protocol and User Datagram Protocol

Transmission Control Protocol (TCP), User Datagram Protocol (UDP), reliable communication, stateful communication, 3-way handshake, acknowledgements (ACK), piggyback, retransmission, congestion control, flow control.

Part 5 Domain Name System and Web Servers

Domain Name System (DNS), resolver, nameserver, zones, sub-domains, iterative vs. recursive name resolution, A and AAAA records, Hyper Text Transfer Protocol (HTTP), Transport Layer Security (TLS), HTTPS, virtual hosts.

Part 6 DNS64/NAT64 and Firewalls

Network Address Translation (NAT), DNS64, NAT64, state, address rewriting, IP 5-tuple, chains, filter, blacklisting, whitelisting, rules, firewall, tables.

iLabX
Block Part

- 4 Weeks: Block part (tentative dates: early March to end of March)
- This part contains attestations, lectures, and labs
- Contents
  - IPv6
  - Dynamic Routing
  - BGP
  - Transport Layer
  - TLS and Filtering
  - WWW Security
- **Full time commitment required during block part!**

iLabX
What You'll Learn

- A full understanding of how the Internet works in its current version IPv6 and IPv4
- Basic knowledge about the Layered Architecture of the Internet
- Applied understanding of common Internet Protocols
- Applied understanding of common Internet Applications including DNS, NAT, and Firewalls
- Applied understanding of Internet security challenges and mitigation mechanisms

iLabX
Summary

- 10 ECTS lab course
- Online block course from January to end of March 2025
- No physical presence at TUM required
- Teams of 2
- Limited to 48 participants

100% Remote

https://www.net.in.tum.de/teaching/ws2526/ilab_information.html#ilabx

The edX course is a good preparation for all iLabs!

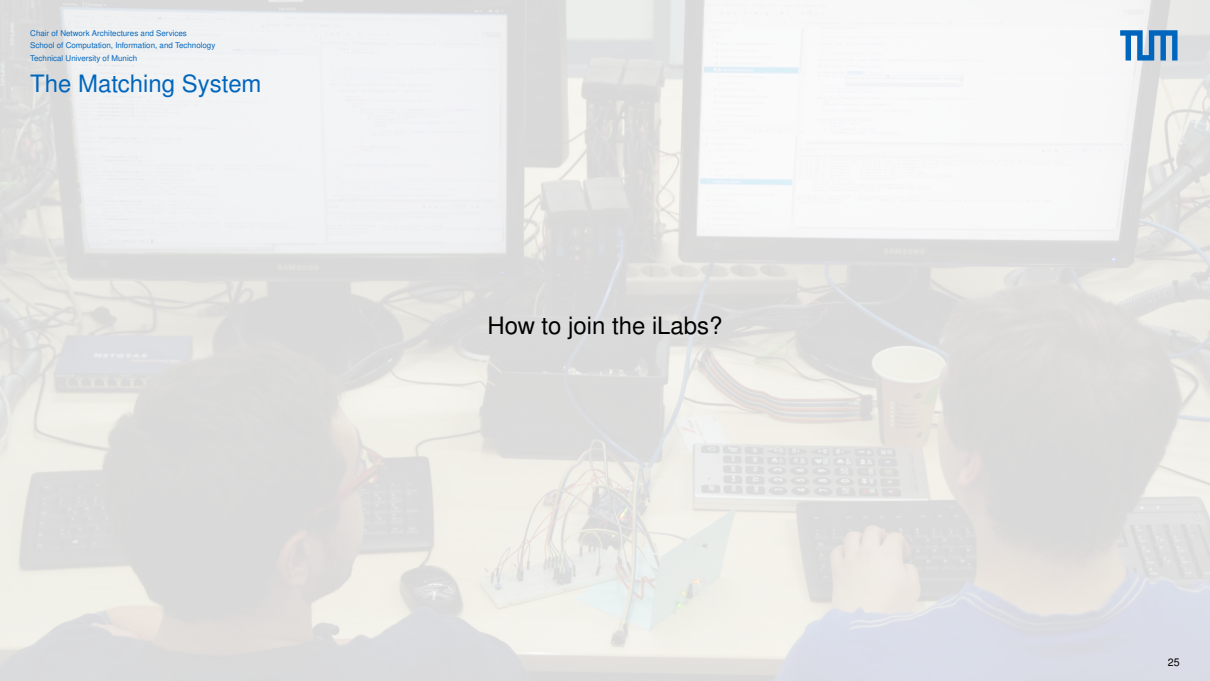
Disclaimer: Not updated anymore, might be slightly outdated.

https://www.edx.org/learn/computer-networking/technische-universitat-munchen-ilabx-the-internet-masterclass

The iLabs

iLabX—*The virtual Internet Laboratory* **combines gems from both courses**. In its remote version at TUM you will have essentials of both courses, iLab1 and iLab2. The first part will be a self-paced online course.. The second part will be online at TUM.

The Matching System



How to join the iLabs?

How to join the iLabs?

1. Enter your preferences in the IN TUM Matching System: `matching.in.tum.de`
2. We enter our student preferences
3. Matching Systems computes student-optimal matching See `docmatching.in.tum.de`

The result of the matching is binding.
You cannot step down from the course afterwards.

How to be preferred?

1. Wait until the end of today's session [1]
2. Read the provided instructions
3. Provide your matriculation number [2]

[1] A few more minutes
[2] German: "Matrikelnummer"

Why?

Your preferences:

1. ~~Course A~~
2. Your favorite iLab (s)
3. Course C

Your highest preference
→ Our preference does not influence this

The Matching System can't match you to *Course A*

Our preference now pulls you towards your favorite iLab (s)
→ Our preference increases your chance to join your favorite iLab (s)

Why?

Your preferences:

1. ~~Course A~~
2. Your favorite iLab (s)
3. Course C

Your highest preference
→ Our preference does not influence this

The Matching System can't match you to *Course A*

Our preference now pulls you towards your favorite iLab (s)
→ Our preference increases your chance to join your favorite iLab (s)

Why?

Your preferences:

1. ~~Course A~~
2. Your favorite iLab (s)
3. Course C

Your highest preference
→ Our preference does not influence this

The Matching System can't match you to *Course A*

Our preference now pulls you towards your favorite iLab (s)
→ Our preference increases your chance to join your favorite iLab (s)

Questions?

Next mandatory event? → First lecture!

Wednesdays, 5pm
First meeting: October 15

Tuesdays, 4pm
First meeting: October 14

2× **per week**
First meeting: Near end of lecture period

We are looking forward to seeing you in one of the courses!

Questions?

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