The iLab Experience

a blended learning hands-on course concept

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facts

- iLab (=Internet) & iLab^2 (=selected network architectures and services)
- Bachelor and Master Level hands-on lab
- 1 semester / 10 ECTS (~300h)
- over 1000 participants so far
- over 80 registrations for next semester

only possible as working with the eLearning platform scales
in short

listen

encourage

constantly improve
the beginning

2003 Universität Tübingen: Internetpraktikum 2003
constant improvement
didactic concept
blended learning concept

Lecture
~1h

Individual Preparation
~4-6h

Practical Teamwork
~6-8h

Individual Oral Exam
~20min

Time

Happening at the TUM
Happening wherever you have Internet
Happening within the eLearning environment
Done with all participants, alone, in your team
eLearning support

Individual Preparation

Lecture

Practical Teamwork
eLearning prelab

not taken into account for grading
(directly learn from errors)

lecture recording
preparation texts
multiple-choice motivation
ranking + who did not finish?
eLearning lab

- all instructions online
- free text inputs inline
- cross correction
- course management
- credits for grading
- no additional reports
- fast feedback
important success factors
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.
frequent change

variation

in learning methods and modes
iLab

= online + live

instructions, self-correcting multiple-choice questions, free text inputs, course management, mail support, chat

lecture, hands-on, discussion
iLab

= group + individual + team

lecture  self-preparation  hands-on
teamwork

you are not alone

learning from and supporting the team mate
further encouragement
eLearning registration

- Registration
- Immediate access
- Tutorials web-based labsystem
- Tutorials environment / basic tools
feel at home
- **Demonstration lab** - This lab module makes you familiar with the web-based learning system and the didactical principles behind the course.
- **Cisco IOS Tutorials** - This tutorial give an introduction into the programming languages used in iLab2 (C, Java, Python). It also introduces the basics of Cisco IOS.
- **Environment Tutorial Lab Room** - This tutorial introduces the lab room environment.

### The basics

- **Static routing** - Continuing on Layer 3 we have a deeper look into IP-Routing.
- **Dynamic routing** - On our journey towards the "real Internet" we learn how automatic routing works inside the different domains of the net.
- **TCP/UDP** - After taking a look at IP fragmentation, we climb up one Layer to Layer 4: The end-to-end-communication of is of interest now.
- **DNS** - Most of the time we address machines using names instead of (IP-)numbers... but how does the Domain Name System work? After this lab you should know exactly what happens, when you type http://ilab.net.in.tum.de into your browsers url-field...
- **NAT/DHCP/IPv6** - Coming closer to our home setup we look inside Network Address Translation as technique to use one external address to allow multiple intern machines to access the Internet. NAT is especially important today since we are getting out of ipv4 addresses. Besides ist usefulness NAT causes some trouble as we will see. Another important mechanism is Dynamic Host Control Protocol allowing computers to be partly automatically configured. As the migration towards ipv6 is ongoing and since the new protocol provides interesting mechanisms we will have a look at it here.
- **Security I** - In this lab we get to know how Firewalls help to secure our network-nodes. As example we use a webserver using TLS.
- **Security II** - How can we establish secure connections over insecure networks?
- **Wireless LAN** - Often used but how is it really working? We address physical aspects as well as protocol aspects before we come to security. We will explore how fast we can crack a WEP. Key and more important why. We will look at WPA and Radius for a more secure wireless infrastructure.

### Environment Tutorial Lab Room

- **Environment Tutorial Lab Room** - This tutorial introduces the lab room environment.
- **Programming Language and Cisco IOS Tutorials** - This tutorial give an introduction into the programming languages used in iLab2 (C, Java, Python). It also introduces the basics of Cisco IOS.
- **Demonstration lab** - This lab module makes you familiar with the web-based learning system and the didactical principles behind the course.
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### Border Gateway Protocol

- **Border Gateway Protocol** - This lab is about the Border Gateway Protocol (BGP) that is used for routing between Autonomous Systems (AS). You will learn about the power of this protocol and the risks of configuration errors...
- **IPv6** - In this lab different features of IPv6 are examined: Autoconfiguration, DHCPv6, NAT64, Fragmentation, and Dual Stack implementation. Additionally a DNS Server running with IPv6 and IPv4 addresses and automatic Zone transfer is configured.
- **SCTP** - You will get to know the features of SCTP realizing a video streaming example.
- **Advanced NAT** - You will explore advanced NAT traversal techniques in this exercise.
- **WWW Security** - In this lab, you are going to investigate some of the most important security challenges on the WWW. You will hack a Web server using a number of attack techniques, working your way through SQL Injection, Cross-Site Scripting and Remote Code Execution until you gain shell access to the server and can manipulate the file system.
- **Multicast SIP** - In the first part of this PreLab you will learn about IP Multicast and the protocols used by it, IGMP and PIM. The second part is about SIP, the Session Initialization Protocol, and how it is used, both in voice over IP and other applications.
- **Measurement** - This lab is about passive traffic measurements and the export of measurement data from a monitoring probe to a remote traffic analyzer using the IPIFX protocol.
- **Advanced Wireless LAN** - Defend my wireless territory - Do you have problems with overcrowded frequency bands for WLAN? The ilab2 can help you!
- **Smart Space Orchestration** - Physical spaces that are enriched with networked sensors and actuators are called smart spaces. In this exercise you will build your own smart device, write a protocol for communicating with it, write a driver that connects your device with the ds2os middleware, and create user application services that orchestrate your space using your device.
iLab exercises grow from continuous exchange. Exchange within the group of learners and between the students and the professors. The iLab encourages to exchange wherever possible. It is an important element of the success of the concept.
context related chat

mop> do not forget to look at the routing table of PC4 here!

good point :)

jan> Did anyone get this running?
silvie> sure. Though we had to reset up. Probably we had a bug. Maybe you have a similar problem.
automatic diffs in correction
create your own exercise

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**Introductory Lecture**
- didactic concept | authoring tutorial | topic selection | assignment review teams
- ~1h

**Team Prepares Exercise**
- slides for talk | prelab | lab | slides | tutor support
- ~10-12h

**Intermediate Presentation**
- presentation | feedback | quality alignment
- ~2h

**Review & Update**
- review team feedback | revision
- ~10-12h

**Final Presentation**
- how is it now | what did you change/learn | your take home?
- ~2h
summary
in short

- listen
- variation: online + live
- team work + individual + group
- feedback
- encouraging environment
- encourage
- constantly improve
lots of happy faces
The iLab Experience

• [http://ilab.net.in.tum.de/](http://ilab.net.in.tum.de/)
  Bachelor/ Master course

• [http://ilab2.net.in.tum.de/](http://ilab2.net.in.tum.de/)
  Master/ Bachelor course

• [http://labsystem.sf.net/](http://labsystem.sf.net/)
  eLearning environment ([open source](http://labsystem.sf.net/))

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