CS-E4160 - Laboratory Works in Networking and Security, 10.01.2024-12.04.2024

Course Arrangements

Course Personnel

Responsible Teacher
- Antti Ylä-Jääski

Course Coordinator
- Esa Vikberg

Teaching Assistants
- Zainab Ahmad
- Akram Aziz
- Radu Pogonariu

Course information, contact information

All course materials in MyCourses

- For general discussion about assignments
  - Zulip
- Personal matters to course personnel mailing list
  - cs-e4160@aalto.fi

Please do not contact course staff directly!

Course Contents and Motivation

Course material will provide you with the base information

You learn the rest yourself by:

- Reading the manuals/manpages (Seriously, read them)
- Google, recommended readings, Google
- Doing the assignments step by step (and Google ☺)

The course has no lectures.

-> The amount of support you get depends on active reaching out to TAs.

Prerequisites

Recommended prerequisites:
- **A course on computer networks or similar useful skills**
- **Basics of Unix-based systems administration**
  - **We will be using Ubuntu in the course**
- **Command line**
  - **We have a brief primer on Linux/Unix basics to help you get started**
- **During the course you should be able to do things in Unix-based machines**

Prerequisites

- **Course is 5 to 10 credits, meaning 27 hours per assignment.**
  - **We expect you to put in effort before handing out the answers for the assignments.**
    - **That's not to discourage from asking for help, but tell us what you've tried so far, and how that went.**
  - **If you feel overqualified for the course, you can complete the assignments faster, or take a different course.**

Assignments

Path A
- **Network tools**
- **Email server**
- **IPv6**
- **Encrypted filesystems**
- **Firewall**
- **Extra: SDN**

Path B
- **Network tools**
- **Web server**
- **DNS**
- **Network filesystems**
- **VPN**
- **Extra: Containers**

Course Environment

You will install your own Virtual Machines (VMs)

- **VirtualBox* as the Hypervisor**
- **Vagrant to speed up the setup**
- **Multiple virtual Ubuntu servers (2-4 used in assignments)**
- **Virtual networks**
- **Installation instructions in MyCourses**
- **You will have to bring your own laptop** to the sessions**

*Can't be downloaded over Aalto network. Use e.g. eduroam
**If you have ARM based Mac, let course staff know

Passing the course

You can get 5 or 10 ECTS from this course

- Path A or Path B: 5 ECTS, intro(n/w tools) + 4 mandatory assignments (+ 1 extra)
- Path A+B: 10 ECTS, intro (n/w tools) + 8 mandatory assignments (+ 1 extra)
- You must demonstrate each assignment to an assistant to be graded
- Points for each task shown in the assignment (scaled to [0,100])
    - -> minimum 30% to pass an assignment
- First assignments is shared between paths

Extra (optional) assignments
- Can be used to replace missed mandatory assignment
- Can be used to increase your total score

Detailed grading information is available in MyCourses

Schedule

Week	Event	Path A	Path B
2	This Lecture		
3-4	Round 1 demos	Networking tools	Networking tools
5-6	Round 2 demos	Email server	Web server
7,9	Round 3 demos	IPv6	DNS
10-11	Round 4 demos	Encrypted Filesystems	Network Filesystems
12-14	Round 5 demos	Firewall	VPN
15	Extra Round demos	SDN	Containers

First demo week of an assignment, there is a reception where you can ask for help.

Reception sessions

During reception week you can ask questions about your assignments

- Either in a reception session or Zulip
- Assistants will answer your questions the best they can
- But they will **not do** the assignments for you

Reception sessions

- Not mandatory!
- No reservation, first-come-first-serve
- Reception Week Wednesdays (16:00 - 18:00)
    - Unless otherwise announced

Demo sessions

Reserve your personal slot in MyCourses
- 30 minutes per assignment, **hard limit**
- You can reserve 30min + 30min, if doing both paths

Demonstrate your solution for the assignment face-to-face
- Assistants will ask questions, you answer to your best knowledge
- Your responsibility is to prepare your answers to questions so that you can demonstrate the whole assignment in reserved times

Demos are MANDATORY SESSIONS
- Possibility for remote attendance over Zoom. Links on MyCourses.
- Some can be attended on campus. Details on MyCourses

FAQs

Can I work with a pair?

- Yes, but you will have to demo with your own virtual machines without your pair!

Can I reuse the work of some other student?

- Zero tolerance; plagiarism will lead to failing of the whole course
- The course personnel asks you additional questions to see you understand what you were doing and why

Can I use my own work from previous years? Do I have to demo those?

- Contact the course personnel!

Assignments

Overview

Two paths, with shared 1st assignment

- **Path A more security oriented**

- **Path B more networking oriented**

- **You can *NOT* pick and choose from A & B to create a custom path**

- **Once you choose which paths you are going to do, fill out the questionnaire on MyCourses**

- **Helps us allocate sufficient resources for demos**

A1B1 – Setting up and Networking Tools

VirtualBox and Vagrant

- **Setup VMs, configure network interfaces**

Basic Unix-tools for networking

- **ip, arp, dig, ping, traceroute, mtr, nmap**

Client-server communication and admin tools

- **ssh, netcat, telnet**

Path A

A2: Email server

- Setup an email server and client
- Configure postfix
- Learn to filter spam with procmail and spamassassin
- Learn to filter non-spam with procmail
- DNS and Email

A3: IPv6

- Build a small network with IPv6
- Routing in IPv6
- IPv6 over IPv4
- Security issues in Ipv4/Ipv6 mixed networks

A4: Encrypted filesystems

- Simulation of encryption of an external memory (such as an USB memory stick)
- Two different schemes:
- Encrypted loopback device with dm_crypt
- Encryption layer for an existing filesystem with gocryptfs
- Truecrypt (or a clone) also used to create a hidden volume inside another encrypted volume.

A5: Firewall

- Firewall basics
- Packet filtering with netfilter/nftables
- Squid as web proxy to control traffic
- Implement a DMZ

Path B

B2: Web server

- Configuring Apache
- A basic Node.js application
- Encryption using SSL / HTTPS
- Using nginx as a reverse proxy
- Test DVWA

B3: DNS

- Create caching-only name server
- Create a DNS domain
- Configure subdomains
- Secure the server with DNSSEC
- DNS Sinkhole using Pi-hole

B4: Network filesystems

- Setup and compare network filesystems
- NFS
- Samba
- sshfs
- WebDAV
- NAS

B5: VPN

- Introduction to VPN concepts
- Set up an OpenVPN server
- Create bridged and routed VPN

Extras

Extra A: SDN

Openflow basics

- Build custom topologies with mininet

- Control switches using POX

Extra B : Containers

Docker and Kubernetes basics
- Deploy services with Docker
- Scale services with Kubernetes

Questions?