Welcome to

0. Introduction

Communication and Network Security 2022

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Slides are available as PDF, kramse@Github

0-Introduction-comm-and-network-security.tex in the repo security-courses

Contact information

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- Network and security consultant Zencurity, teach at KEA and activist
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You are welcome to drop me an email

Goals for today

- Welcome, course goals and expectations
- Prepare Virtual Machines - hope you brought a laptop
- Create a good starting point for learning
- Concrete Expectations
- Prepare tools for the exercises

Photo by Thomas Galler on Unsplash

Plan for today

- Introduce lecturers and students
- Create a good starting point for learning
- Expectations for this course
- Literature list walkthrough
- Prepare tools for the exercises
- Kali and Debian Linux introduction

Exercises

- Kali Linux installation
- Debian Linux installation

Linux is a toolbox we will use and participants will use virtual machines

Time schedule

- 17:00 - 18:15
  Introduction and basics for the subject
- 30min break
  Eat with your family if you like, I will be around most of the break, available for questions
- 18:45 - 19:30
  Further teaching and exercises in the subject for the evening
- 15min break
  Stretch your legs, get some more water
- 19:45 -20:30 45min
  May contain exercises to be done on your own, with input from me

I will try to keep this plan for all evenings! So you hopefully can plan family life better

Course Materials

This material is in multiple parts:

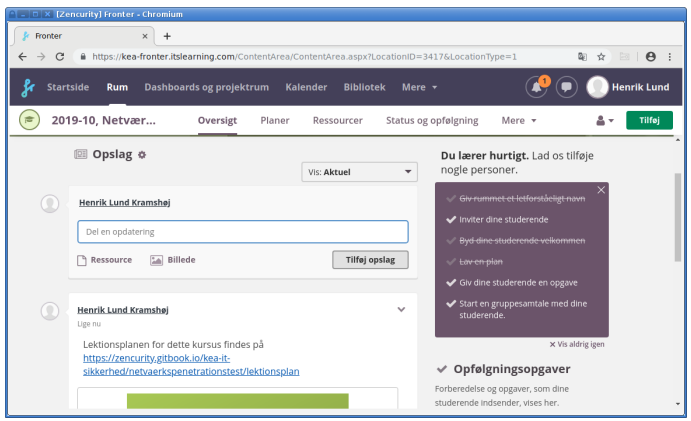
Slide shows - presentation - this file

Exercises - PDF which is updated along the way

Additional resources from the internet

Note: the presentation slides are not a substitute for reading the books, papers and doing exercises, many details are not shown

Fronter Platform



We will use fronter a lot, both for sharing educational materials and news during the course.

You will also be asked to turn in deliverables through fronter

https://kea-fronter.itslearning.com/

If you haven't received login yet, let us know

Overview Diploma in IT-security

Afgangsprojektet (15 ECTS)	
Der udvikles løbende nye valgfag til Diplom i it-sikkerhed. Disse vil løbende blive beskrevet i en allonge (bilag 2) til studieordningen.	
Sikkerhed i it-governance (it-sikkerhedsledelse) (5 ECTS)	Systemsikkerhed (10 ECTS)
Videregående sikkerhed i it-governance (Videregående sikkerhedsledelse) (5 ECTS)	
Softwaresikkerhed (10 ECTS)	
Netværks- og kommunikationssikkerhed (10 ECTS)	

Course: Communication and Network Security (10 ECTS)

Teaching dates: tuesdays and thursdays 17:00 - 20:30
13/4 2021, 15/4 2021, 20/4 2021, 22/4 2021, 27/4 2021, 29/4 2021, 4/5 2021, 6/5 2021, 11/5 2021, 18/5 2021, 20/5 2021, 25/5 2021, 27/5 2021, 1/6 2021

Exam: 15/6 2021

Photo by Pawel Janiak on Unsplash

Deliverables and Exam

- Exam
- Individual: Oral based on curriculum
- Graded (7 scale)
- Draw a question with no preparation. Question covers a topic
- Try to discuss the topic, and use practical examples
- Exam is 30 minutes in total, including pulling the question and grading
- Count on being able to present talk for about 10 minutes
- Prepare material (keywords, examples, exercises, wireshark captures) for different topics so that you can use it to help you at the exam

- Deliverables:
- 2 Mandatory assignments
- Both mandatory assignments are required in order to be entitled to the exam.

Course Description

From: STUDIEORDNING Diplomuddannelse i it-sikkerhed August 2018

Indhold:
Modulet går ud på at forstå og håndtere netværkssikkerhedstrusler samt implementere og konfigurere udstyr til samme.

Modulet omhandler forskellig sikkerhedsudstyr (IDS) til monitorering. Derudover vurdering af sikkerheden i et netværk, udarbejdelse af plan til at lukke eventuelle sårbarheder i netværket samt gennemgang af forskellige VPN teknologier.

My translation:
The module is centered around network threats and implementing and configuring equipment in this area.

Module includes different security equipment like IDS for monitoring. The evaluation of security in a network, developing plans for closing security vulnerabilities in the network and a review of various VPN technologies.

Final word is the Studieordning which can be downloaded from

https://kompetence.kea.dk/uddannelser/it-digitalt/diplom-i-it-sikkerhed

Studieordning_for_Diplomuddannelsen_i_IT-sikkerhed_Aug_2018.pdf

Goals and plans

> "A goal without a plan is just a wish."
> Antoine de Saint-Exupéry

My overall goal for this course:

- Include everything required by studieordningen
- Introduce networking and related security issues
- Introduce resources, programs, people, authors, documents, sites that further your exploration into network security
- Kickstart your journey into the subjects
  Getting the best books with pointers
- Present a lot of useful sources, data types, tools
- Be practical – you can do something useful

Expectations alignment

In groups of 2 students, brainstorm for 10 minutes on what topics you would like to have in this course

Use 5 minutes more on Agreeing on 5 topics and prioritize these 5 topics

I look forward to hearing your wishes, and hopefully we can accomodate some

PS We will from time to time have exercises, groups dont need to be the same each time.

Exercises

Exercise theme: Virtual Machines allows us play with tech

Hardware

Since we are going to be doing exercises, each team will need virtual machines.

The following are recommended systems:

- One VM based on Debian, running software servers and web applications
- Setup instructions and help https://github.com/kramse/kramse-labs

Linux is a toolbox we will use and participants will use virtual machines

Prerequisites

This course includes exercises and getting the most of the course requires the participants to carry out these practical exercises

We will use Kali Linux for the exercises but previous Linux and Unix knowledge is not needed

It is recommended to use virtual machines for the exercises

Network security and most internet related security work has the following requirements:

- Network experience
- TCP/IP principles - often in more detail than a common user
- Programming is an advantage, for automating things
- Some Linux and Unix knowledge is in my opinion a **necessary skill** for infosec work
  – too many new tools to ignore, and lots found at sites like Github and Open Source written for Linux

Course Network

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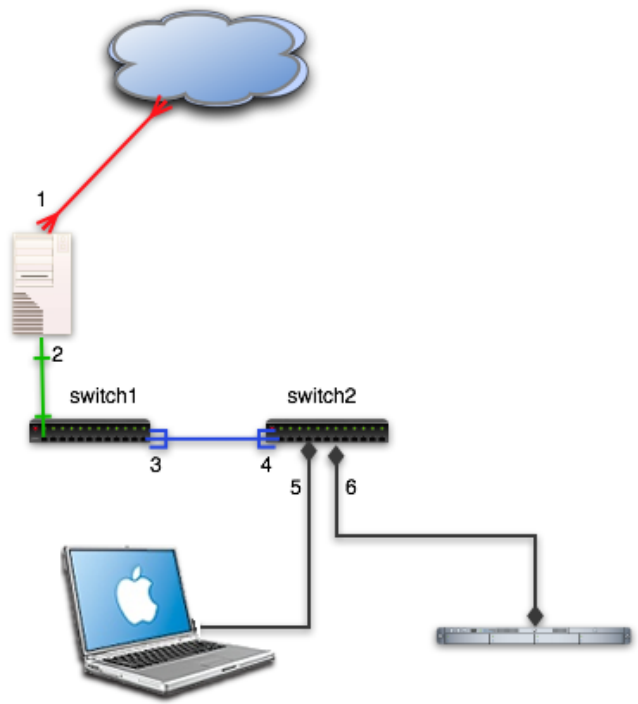
I have a course network with me when needed, which has the following systems:

- OpenBSD router
- Switches Juniper EX2200-C and small TP-Link
- UniFi AP wireless access-point



This will be at my home, and due to remote teaching - we will investigate your networks and scan across the internet to *my servers*!

Wifi Hardware

Since we are going to be doing exercises, sniffing data it
will be an advantage to have a wireless USB network card.

- The following are two recommended models:
- TP-link TL-WN722N hardware version 2.0 cheap but only support 2.4GHz
- Alfa AWUS036ACH 2.4GHz + 5GHz Dual-Band and high performing
- Both work great in Kali Linux for our purposes.
  Unfortunately the vendors change models often enough that the above are hard to find. I recommend using your favourite search engine and research which cards work with Kali Linux and airodump-ng.

I have some available for teams if you dont buy them.

Primary literature

Primary literature are these three books:

- *Applied Network Security Monitoring Collection, Detection, and Analysis*, 2014 Chris Sanders ISBN: 9780124172081 - shortened ANSM
- *Practical Packet Analysis - Using Wireshark to Solve Real-World Network Problems*, 3rd edition 2017, Chris Sanders ISBN: 9781593278021 - shortened PPA
- *Linux Basics for Hackers Getting Started with Networking, Scripting, and Security in Kali*. OccupyTheWeb, December 2018, 248 pp. ISBN-13: 978-1-59327-855-7 - shortened LBfH

Price check around January 2019 - all three can be bought in hardcopy for 1.000-1.100DKK

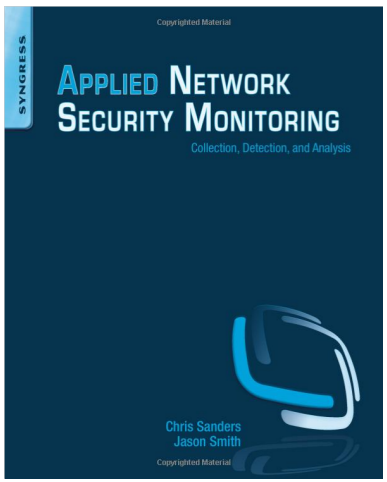
Problem: You probably dont have the books yet ...

Course overview

We will now go through a little from the Table of Contents in the books.

and the *Lektionsplan*
https://zencurity.gitbook.io/kea-it-sikkerhed/net-og-komm-sikkerhed/lektionsplan

Book: Applied Network Security Monitoring (ANSM)

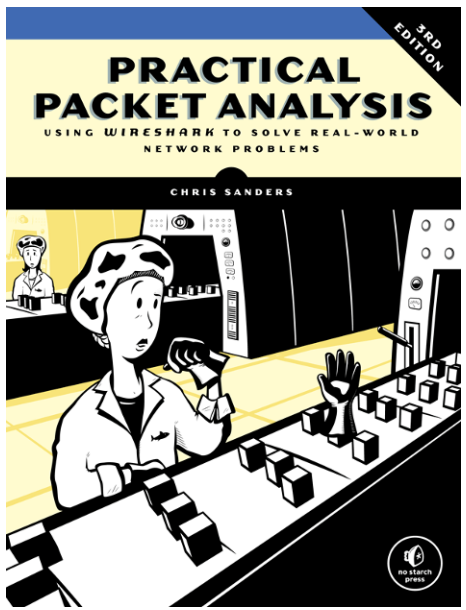


Applied Network Security Monitoring: Collection, Detection, and Analysis 1st Edition

Chris Sanders, Jason Smith eBook ISBN: 9780124172166 Paperback ISBN: 9780124172081 496 pp. Imprint: Syngress, December 2013

https://www.elsevier.com/books/applied-network-security-monitoring/unknown/978-0-12-417208-1

Book: Practical Packet Analysis (PPA)



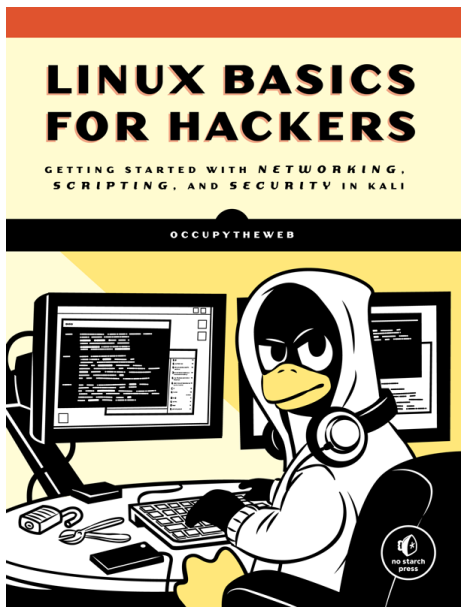
Practical Packet Analysis, Using Wireshark to Solve Real-World Network Problems by Chris Sanders, 3rd Edition April 2017, 368 pp. ISBN-13: 978-1-59327-802-1

https://nostarch.com/packetanalysis3

Supporting literature books

- *Linux Basics for Hackers Getting Started with Networking, Scripting, and Security in Kali*
  OccupyTheWeb, December 2018, 248 pp. ISBN-13: 978-1-59327-855-7 - shortened LBfH
- *The Debian Administrator's Handbook*, Raphaël Hertzog and Roland Mas
  https://debian-handbook.info/ - shortened DEB
- *Kali Linux Revealed Mastering the Penetration Testing Distribution*
  Raphaël Hertzog, Jim O'Gorman - shortened KLR

Book: Linux Basics for Hackers (LBhf)



Linux Basics for Hackers Getting Started with Networking, Scripting, and Security in Kali by OccupyTheWeb December 2018, 248 pp. ISBN-13: 9781593278557

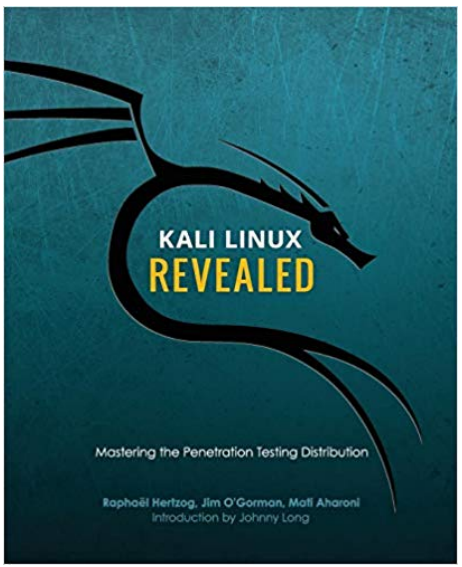
https://nostarch.com/linuxbasicsforhackers Not curriculum but explains how to use Linux

Book: The Debian Administrator's Handbook (DEB)

The Debian Administrator's Handbook, Raphaël Hertzog and Roland Mas
https://debian-handbook.info/ - shortened DEB

Not curriculum but explains how to use Debian Linux

Book: Kali Linux Revealed (KLR)



Kali Linux Revealed Mastering the Penetration Testing Distribution

https://www.kali.org/download-kali-linux-revealed-book/
Not curriculum but explains how to install Kali Linux

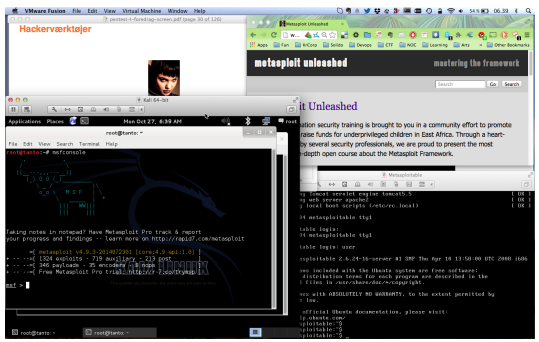
Exercise

Now lets do the exercise

Download Kali Linux Revealed (KLR) Book 10 min

which is number 1 in the exercise PDF.

Hackerlab Setup



- Hardware: modern laptop CPU with virtualisation
  Dont forget to enable hardware virtualisation in the BIOS
- Software Host OS: Windows, Mac, Linux
- Virtualisation software: VMware, Virtual box, HyperV pick your poison
- **Hackersoftware: Kali Virtual Machine https://www.kali.org/**
- Soft targets: Metasploitable, Windows 2000, Windows XP, ...

Having a Debian VM will also be recommended, one pr team

Mixed exercises

Then we will do a mixed bag of exercises to introduce technologies, find your current knowledge level with regards to:

- Linux
- Linux command line
- Git, Python and Ansible
- Elasticsearch – how to run a *service*
- Running Java on Linux – environment variables?!
- Ansible provisioning – installing and configuring software for production

Note: today we will consider all these optional, we wont be able to do them all

Later we will return to them!

Command prompts in Unix

Shells :

- sh - Bourne Shell
- bash - Bourne Again Shell, often the default in Linux
- ksh - Korn shell, original by David Korn, but often the public domain version used
- csh - C shell, syntax similar to C language
- Multiple others available, zsh is very popular

Windows have `command.com`, `cmd.exe` but PowerShell is more similar to the Unix shells

Used for scripting, automation and programs

Command prompts

```
[hlk@fischer hlk]$ id
uid=6000(hlk) gid=20(staff) groups=20(staff),
0(wheel), 80(admin), 160(cvs)
[hlk@fischer hlk]$ sudo -s
[root@fischer hlk]#
[root@fischer hlk]# id
uid=0(root) gid=0(wheel) groups=0(wheel), 1(daemon),
20(staff), 80(admin)
[root@fischer hlk]#
```

Note the difference between running as root and normal user. Usually books and instructions will use a prompt of hash mark # when the root user is assumed and dollar sign $ when a normal user prompt.

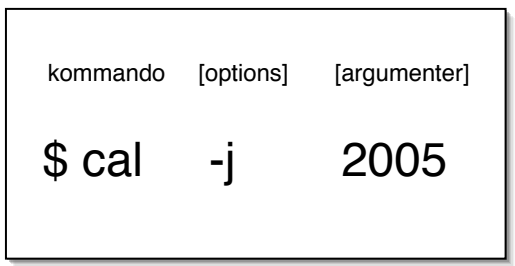
Command syntax

```
echo [-n] [string ...]
```

Commands are written like this:

- Always begin with the command to execute, like `echo` above
- Options typically short form with single dash `-n`
- or long options `--version`
- Some commands allow grouing options, `tar -c -v -f` becomes `tar -cvf`
  NOTE: some options require parameters, so `tar -c -f filename.tar` not equal to `tar -fc filename.tar`
- Optional options are in brackets `[ ]`
- Output can be saved using redirection, into new file/overwrite `echo hello > file.txt` or append `echo hello >> file.txt`
- Read from files `wc -l file.txt` or pipe output into input `cat file.txt | wc -l`
  `wc` is word count, and option l is count lines

Unix Manual system



It is a book about a Spanish guy called Manual. You should read it. – Dilbert

Manual system in Unix is always there!

Key word search `man -k` see also `apropos`

Different sections, can be chosen

See `man crontab` the command vs the file format in section 5 `man 5 crontab`

A manual page

```
NAME
     cal - displays a calendar
SYNOPSIS
     cal [-jy] [[month]  year]
DESCRIPTION
   cal displays a simple calendar.  If arguments are not specified, the cur-
   rent month is displayed.  The options are as follows:
   -j      Display julian dates (days one-based, numbered from January 1).
   -y      Display a calendar for the current year.

The Gregorian Reformation is assumed to have occurred in 1752 on the 3rd
of September.  By this time, most countries had recognized the reforma-
tion (although a few did not recognize it until the early 1900's.)  Ten
days following that date were eliminated by the reformation, so the cal-
endar for that month is a bit unusual.
```

The year 1752

```
  user@Projects:$ cal 1752
...
         April                May                 June
  Su Mo Tu We Th Fr Sa  Su Mo Tu We Th Fr Sa  Su Mo Tu We Th Fr Sa
              1  2  3  4                  1  2      1  2  3  4  5  6
   5  6  7  8  9 10 11   3  4  5  6  7  8  9   7  8  9 10 11 12 13
  12 13 14 15 16 17 18  10 11 12 13 14 15 16  14 15 16 17 18 19 20
  19 20 21 22 23 24 25  17 18 19 20 21 22 23  21 22 23 24 25 26 27
  26 27 28 29 30        24 25 26 27 28 29 30  28 29 30
                        31
          July                August              September
  Su Mo Tu We Th Fr Sa  Su Mo Tu We Th Fr Sa  Su Mo Tu We Th Fr Sa
              1  2  3  4                     1        1  2 14 15 16
   5  6  7  8  9 10 11   2  3  4  5  6  7  8  17 18 19 20 21 22 23
  12 13 14 15 16 17 18   9 10 11 12 13 14 15  24 25 26 27 28 29 30
  19 20 21 22 23 24 25  16 17 18 19 20 21 22
  26 27 28 29 30 31     23 24 25 26 27 28 29
                        30 31
...
```

Linux configuration in /etc

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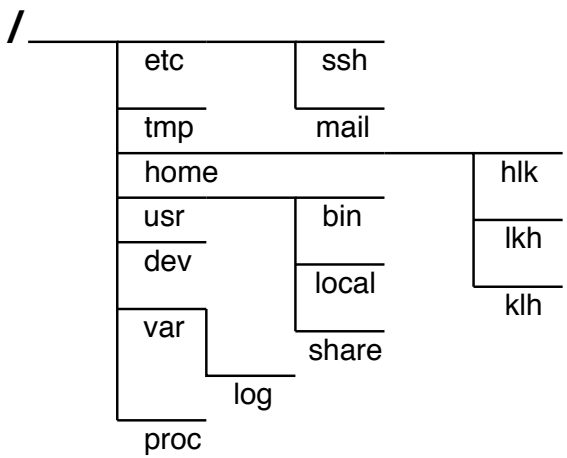
- Command line is a requirement in the *studieordningen* ☺
- Linux and Unix uses a single virtual file system
  https://en.wikipedia.org/wiki/Unix_filesystem
- No drive letters like the ones in MS-DOS and Microsoft Windows
- Everything starts at the root of the file system tree / - NOTE: *forward slash*
- One special directory is `/etc/` and sub directories which usually contain a lot of configuration files



Installing software in Debian – apt

```
DESCRIPTION
apt provides a high-level commandline interface for the package management system. It is intended as an end user interface
and enables some options better suited for interactive usage by default compared to more specialized APT tools like apt-
get(8)
and apt-cache(8).

update (apt-get(8))
  update is used to download package information from all configured sources. Other commands operate on this data to e.g.
  perform package upgrades or search in and display details about all packages available for installation.

upgrade (apt-get(8))
  upgrade is used to install available upgrades of all packages currently installed on the system from the sources configured
  via sources.list(5). New packages will be installed if required to satisfy dependencies, but existing packages will never
  be removed. If an upgrade for a package requires the removal of an installed package the upgrade for this package isn't performed.

full-upgrade (apt-get(8))
  full-upgrade performs the function of upgrade but will remove currently installed packages if this is needed to upgrade the
  system as a whole.
```

- Install a program using apt, for example `apt install nmap`

Ansible

From my course materials:
Ansible is great for automating stuff, so by running the playbooks we can get a whole lot of programs installed, files modified - avoiding the Vi editor.

- Easy to read, even if you don't know much about YAML
- https://www.ansible.com/ and https://en.wikipedia.org/wiki/Ansible_(software)
- Great documentation
  https://docs.ansible.com/ansible/latest/collections/ansible/builtin/apt_module.html

Ansible Dependencies

- Ansible based on Python, only need Python installed
  https://www.python.org/
- Often you use Secure Shell for connecting to servers
  https://www.openssh.com/
- Easy to configure SSH keys, for secure connections

Ansible playbooks

Example playbook content, installing software using APT:

```
apt:
    name: "{{ packages }}"
    vars:
      packages:
        - nmap
        - curl
        - iperf
        ...
```

Running it:

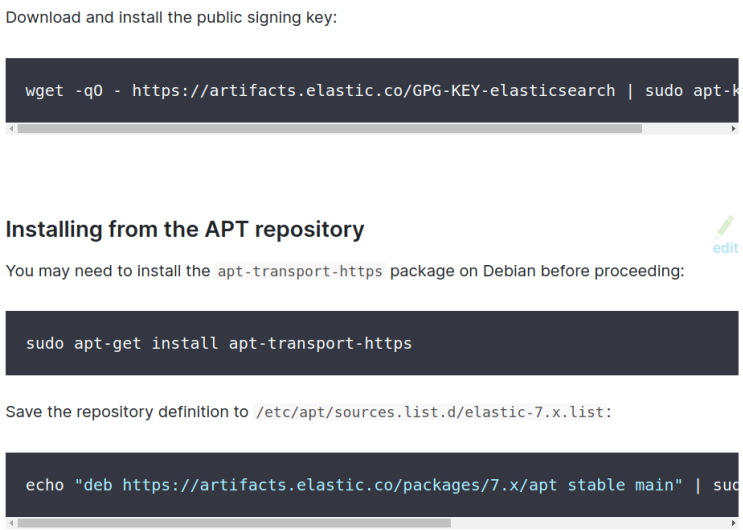
```
cd kramse-labs/suricatazeek
ansible-playbook -v 1-dependencies.yml 2-suricatazeek.yml 3-elasticstack.yml
```

"YAML (a recursive acronym for "YAML Ain't Markup Language") is a human-readable data-serialization language." https://en.wikipedia.org/wiki/YAML

Python and YAML – Git

- We need to store configurations
- Run playbooks
- Problem: Remember what we did, when, how
- Solution: use git for the playbooks
- Not the only version control system, but my preferred one

Alternative



Download and install the public signing key:

```
wget -qO - https://artifacts.elastic.co/GPG-KEY-elasticsearch | sudo apt-k
```

Installing from the APT repository

edit

You may need to install the `apt-transport-https` package on Debian before proceeding:

```
sudo apt-get install apt-transport-https
```

Save the repository definition to `/etc/apt/sources.list.d/elastic-7.x.list`:

```
echo "deb https://artifacts.elastic.co/packages/7.x/apt stable main" | suc
```

My playbooks allow installation of a whole Elastic stack in less then 10 minutes,

compare to:

Getting started with the Elastic Stack

https://www.elastic.co/guide/en/elastic-stack-get-started/current/get-started-elastic-stack.html

Git getting started

Hints:
Browse the Git tutorials on https://git-scm.com/docs/gittutorial
and https://guides.github.com/activities/hello-world/

- What is git
- Terminology

Note: you don't need an account on Github to download/clone repositories, but having an acccount allows you to save repositories yourself and is recommended.

Demo: Ansible, Python, Git!

Running Git will allow you to clone repositories from others easily. This is a great way to get new software packages, and share your own.

Git is the name of the tool, and Github is a popular site for hosting git repositories.

- Go to https://github.com/kramse/kramse-labs
- Lets explore while we talk

Demo: output from running a git clone

```
user@Projects:tt$  git clone https://github.com/kramse/kramse-labs.git
Cloning into 'kramse-labs'...
remote: Enumerating objects: 283, done.
remote: Total 283 (delta 0), reused 0 (delta 0), pack-reused 283
Receiving objects: 100% (283/283), 215.04 KiB | 898.00 KiB/s, done.
Resolving deltas: 100% (145/145), done.

user@Projects:tt$  cd kramse-labs/

user@Projects:kramse-labs$  ls
LICENSE  README.md  core-net-lab  lab-network  suricatazeek  work-station
user@Projects:kramse-labs$ git pull
Already up to date.
```

for reference at home later

Exercise CHAOS: Don't Panic – have fun learning

> "It is said that despite its many glaring (and occasionally fatal) inaccuracies, the Hitchhiker's Guide to the Galaxy itself has outsold the Encyclopedia Galactica because it is slightly cheaper, and because it has the words 'DON'T PANIC' in large, friendly letters on the cover."

Hitchhiker's Guide to the Galaxy, Douglas Adams

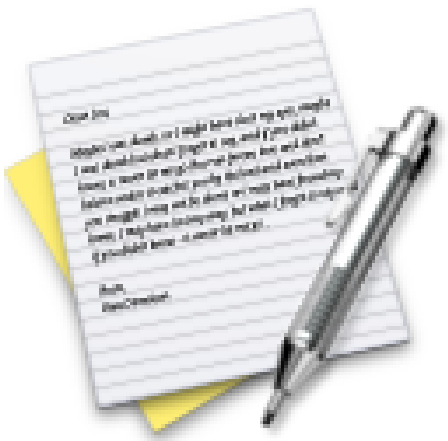
Your lab setup

- Go to GitHub, Find user Kramse, click through kramse-labs
- Look into the instructions for the Virtual Machine – Debian only
- Get the lab instructions, from

  https://github.com/kramse/kramse-labs/tree/master/suricatazeek

Yes, reusing instruction for the Suricata Zeek workshop - tested and working!

Exercise

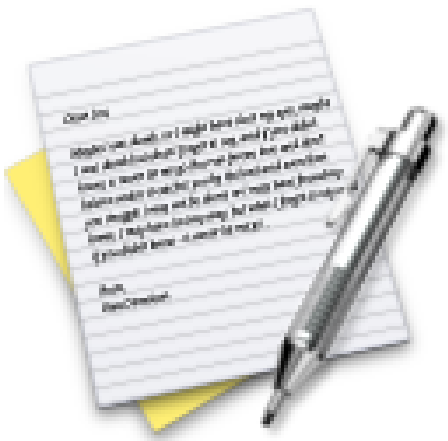


Now lets do the exercise

Download Kali Linux Revealed (KLR) Book 10 min

which is number 1 in the exercise PDF.

Exercise

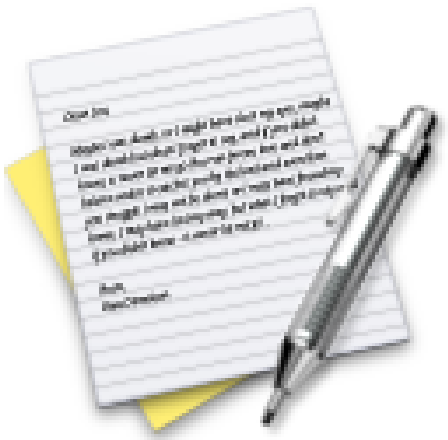


Now lets do the exercise

Check your Kali VM, run Kali Linux 30 min

which is number 2 in the exercise PDF.

Exercise



Now lets do the exercise

Bonus: Download Debian Administrator's Handbook (DEB) Book 10 min

which is number 3 in the exercise PDF.

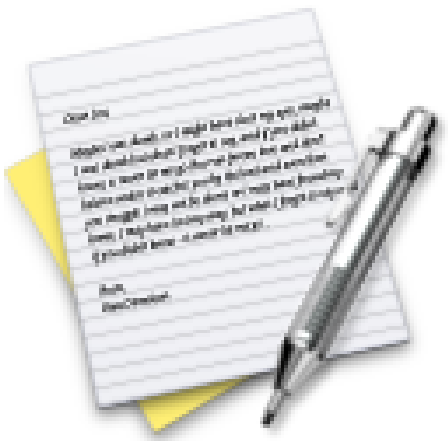
Exercise

Now lets do the exercise

Bonus: Check your Debian VM 10 min

which is number **4** in the exercise PDF.

Exercise

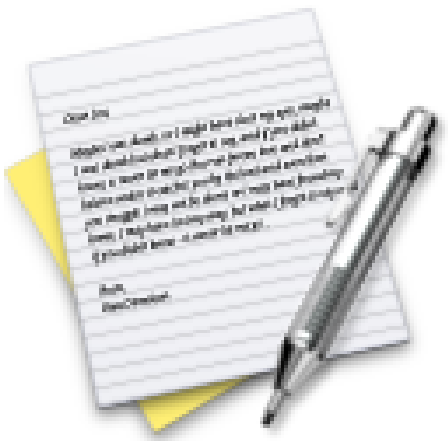


Now lets do the exercise

Investigate /etc 10 min

which is number **5** in the exercise PDF.

Exercise



Now lets do the exercise

Enable firewall - 15min

which is number **6** in the exercise PDF.

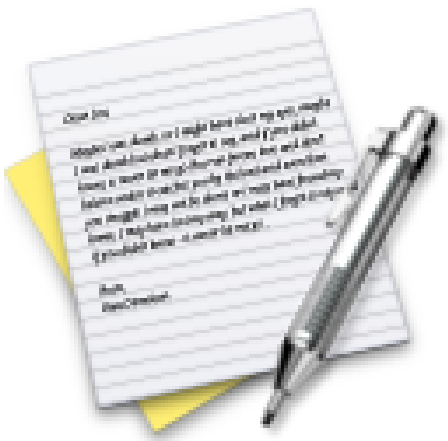
Exercise

Now lets do the exercise

Bonus: Git tutorials - 15min

which is number **7** in the exercise PDF.

Exercise



Now lets do the exercise

Bonus: Use Ansible to install Elastic Stack

which is number **8** in the exercise PDF.

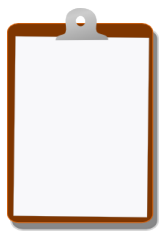
Exercise

Now lets do the exercise

Bonus: Configure Elasticsearch Security

which is number 9 in the exercise PDF.

For Next Time



Think about the subjects from this time, write down questions

Check the plan for chapters to read in the books

Visit web sites and download papers if needed

Retry the exercises to get more confident using the tools

Buy the books! Create your VMs