Computer Systems Security exercises

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Contents

Preface

This material is prepared for use in *Computer Systems Security workshop* and was prepared by Henrik Lund Kramshoej, http://www.zencurity.com . It describes the networking setup and applications for trainings and workshops where hands-on exercises are needed.

Further a presentation is used which is available as PDF from kramse@Github
Look for system-security-exercisesin the repo security-courses.

These exercises are expected to be performed in a training setting with network connected systems. The exercises use a number of tools which can be copied and reused after training. A lot is described about setting up your workstation in the repo

https://github.com/kramse/kramse-labs

Prerequisites

This material expect that participants have a working knowledge of TCP/IP from a user perspective. Basic concepts such as web site addresses and email should be known as well as IP-addresses and common protocols like DHCP.

Have fun and learn

Exercise content

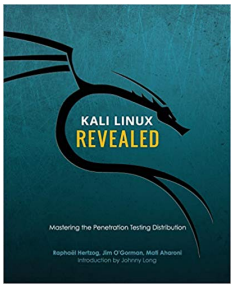
Most exercises follow the same procedure and has the following content:

- **Objective:** What is the exercise about, the objective
- **Purpose:** What is to be the expected outcome and goal of doing this exercise
- **Suggested method:** suggest a way to get started
- **Hints:** one or more hints and tips or even description how to do the actual exercises
- **Solution:** one possible solution is specified
- **Discussion:** Further things to note about the exercises, things to remember and discuss

Please note that the method and contents are similar to real life scenarios and does not detail every step of doing the exercises. Entering commands directly from a book only teaches typing, while the exercises are designed to help you become able to learn and actually research solutions.

Exercise 1

Download Kali Linux Revealed (KLR) Book 10 min



Kali Linux Revealed Mastering the Penetration Testing Distribution

Objective:
We need a Kali Linux for running tools during the course. This is open source, and the developers have released a whole book about running Kali Linux.

This is named Kali Linux Revealed (KLR)

Purpose:
We need to install Kali Linux in a few moments, so better have the instructions ready.

Suggested method:
Create folders for educational materials. Go to https://www.kali.org/download-kali-linux-revealed-book/ Read and follow the instructions for downloading the book.

Solution:
When you have a directory structure for download for this course, and the book KLR in PDF you are done.

Discussion:
Linux is free and everywhere. The tools we will run in this course are made for Unix, so they run great on Linux.

Kali Linux is a free pentesting platform, and probably worth more than $10.000

The book KLR is free, but you can buy/donate, and I recommend it.

Exercise 2

Check your Kali VM, run Kali Linux 30 min

Objective:
Make sure your virtual machine is in working order.

We need a Kali Linux for running tools during the course.

Purpose:
If your VM is not installed and updated we will run into trouble later.

Suggested method:
Go to https://github.com/kramse/kramse-labs/

Read the instructions for the setup of a Kali VM.

Hints:
If you allocate enough memory and disk you wont have problems.

Solution:
When you have a updated virtualisation software and Kali Linux, then we are good.

Discussion:
Linux is free and everywhere. The tools we will run in this course are made for Unix, so they run great on Linux.

Kali Linux includes many hacker tools and should be known by anyone working in infosec.

Exercise 3

Check your Debian VM 10 min

Objective:
Make sure your virtual Debian 9 machine is in working order.

We need a Debian 9 Linux for running a few extra tools during the course.

This is a bonus exercise - only one Debian is needed per team.

Purpose:
If your VM is not installed and updated we will run into trouble later.

Suggested method:
Go to https://github.com/kramse/kramse-labs/

Read the instructions for the setup of a Kali VM.

Hints:

Solution:
When you have a updated virtualisation software and Kali Linux, then we are good.

Discussion:
Linux is free and everywhere. The tools we will run in this course are made for Unix, so they run great on Linux.

Exercise 4

Investigate /etc 10 min

Objective:
We will investigate the /etc directory on Linux

We need a Debian 9 Linux and a Kali Linux, to compare

Purpose:
Start seeing example configuration files, including:

- User database `/etc/passwd` and `/etc/group`
- The password database `/etc/shadow`

Suggested method:
Boot your Linux VMs, log in

Investigate permissions for the user database files `passwd` and `shadow`

Hints:
Linux has many tools for viewing files, the most efficient would be less.

```
hlk@debian:~$ cd /etc
hlk@debian:/etc$ ls -l shadow passwd
-rw-r--r-- 1 root root   2203 Mar 26 17:27 passwd
-rw-r----- 1 root shadow 1250 Mar 26 17:27 shadow
hlk@debian:/etc$ ls
... all files and directories shown, investigate more if you like
```

Showing a single file: `less /etc/passwd` and press q to quit

Showing multiple files: `less /etc/*` then :n for next and q for quit

```
Trying reading the shadow file as your regular user:
user@debian-9-lab:/etc$ cat /etc/shadow
cat: /etc/shadow: Permission denied
```

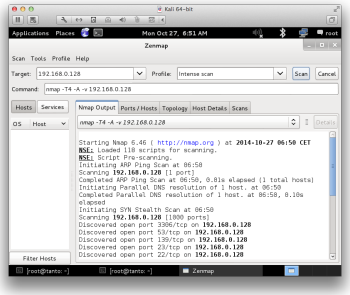
Why is that? Try switching to root, using su or sudo, and redo the command.

Solution:
When you have seen the most basic files you are done.

Discussion:
Linux is free and everywhere. The tools we will run in this course are made for Unix, so they run great on Linux.

Exercise 5

Discover active systems ping sweep 10 min



Objective:
Use nmap to discover active systems

Purpose:
Know how to use nmap to scan networks for active systems.

Suggested method:
Try different scans,

- Ping sweep to find active systems
- Port sweeps to find active systems with specific ports

Hints:
Try nmap in sweep mode - and you may run this from Zenmap

Solution:
Use the command below as examples:

- Ping sweep `nmap -sP 10.0.45.*`
- Port sweeps `nmap -p 80 10.0.45.*`

Discussion:
Quick scans quickly reveal interesting hosts, ports and services

Also now make sure you understand difference between single host scan 10.0.45.123/32, a whole subnet /24 250 hosts 10.0.45.0/24 and other more advanced targeteting like 10.0.45.0/25 and 10.0.45.1-10

Exercise 6

Execute nmap TCP and UDP port scan 20 min

Objective:
Use nmap to discover important open ports on active systems

Purpose:
Finding open ports will allow you to find vulnerabilities on these ports.

Suggested method:
Use `nmap -p 1-1024 server` to scan the first 1024 TCP ports and use Nmap without ports. What is scanned then?

Try to use `nmap -sU` to scan using UDP ports, not really possible if a firewall is in place.

If a firewall blocks ICMP you might need to add `-Pn` to make nmap scan even if there are no Ping responses

Hints:
Sample command: `nmap -Pn -sU -p1-1024 server` UDP port scanning 1024 ports without doing a Ping first

Solution:
Discover some active systems and most interesting ports, which are 1-1024 and the built-in list of popular ports.

Discussion:
There is a lot of documentation about the nmap portscanner, even a book by the author of nmap. Make sure to visit http://www.nmap.org

TCP and UDP is very different when scanning. TCP is connection/flow oriented and requires a handshake which is very easy to identify. UDP does not have a handshake and most applications will not respond to probes from nmap. If there is no firewall the operating system will respond to UDP probes on closed ports - and the ones that do not respond must be open.

When doing UDP scan on the internet you will almost never get a response, so you cannot tell open (not responding services) from blocked ports (firewall drop packets). Instead try using specific service programs for the services, sample program could be `nsping` which sends DNS packets, and will often get a response from a DNS server running on UDP port 53.

Exercise 7

Perform nmap OS detection 10 min

Objective:
Use nmap OS detection and see if you can guess the brand of devices on the network

Purpose:
Getting the operating system of a system will allow you to focus your next attacks.

Suggested method:
Look at the list of active systems, or do a ping sweep.

Then add the OS detection using the option `-O`

Better to use -A all the time, includes even more scripts and advanced stuff See the next exercise.

Hints:
The nmap can send a lot of packets that will get different responses, depending on the operating system. TCP/IP is implemented using various constants chosen by the implementors, they have chosen different standard packet TTL etc.

Solution:
Use a command like `nmap -O -p1-100 10.0.45.45` or `nmap -A -p1-100 10.0.45.45`

Discussion:
nmap OS detection is not a full proof way of knowing the actual operating system, but in most cases in can detect the family and in some cases it can identify the exact patch level of the system.

Exercise 8

Run Armitage - Hail Mary

Objective:
Try hacking using a graphical program, see how quick and easy it can be.

Purpose:
Show that when a vulnerability exist attacks can be quick and easy.

Suggested method:

Running Armitage as a gui on top of Metasploit is the easiest way to do this.

1. Boot up Kali Linux
2. Boot up Metasploitable - from ISO
   There may be a couple of systems already running this.
3. Run Armitage Hail-Mary against Metasploitable
4. Note which succeeded, describe those attacks that succeeded in relation to MITRE ATT&CK framework

Hints:
Running Metasploit against Metasploitable - which is a vulnerable system - should result in multiple vulnerabilities exploited.

Each of these may have different characteristics.

We are aiming at:

- Vulnerable application - root access
- Vulnerable application - non-root access, would need privilege escalation
- Bad password allowing *Brute Force* access, msfadmin/msfadmin - see also *Valid Accounts*

Solution:
When you have exploited and mapped at least one vulnerability you are done, but should spend more time.

Discussion:
Do we need these frameworks? What are the benefits? - can we become product blind - so we only see what these framework cover.

Exercise 9

SELinux Introduction

Objective:
Create a secret file, that you can read, but root cant.

Check out the SELinux system
https://www.debian.org/doc/manuals/debian-handbook/sect.selinux.en.html

Purpose:

Suggested method:
Try enabling and disabling the policies

Hints:

Solution:
When you have a small text file which you can read, but root cannot, you are done.

Yes, the root user can disable the SELinux protection :-D

Discussion:

Exercise 10

Example AUPs

Objective:
See real world high level policies

Purpose:
When writing your first policy it may be hard to know what to include. Starting from an example is often easier.

Suggested method:
Find your AUP for the ISPs we use, you use, your company uses

Hints:
Policies for different environments are often very different in scope and goals.

Solution:
When you have seen at least two different policies you are done.

Discussion:
How do you both write AND create awareness about a policy?

Exercise 11

Database Security

Objective:

Purpose:

Suggested method:

Hints:

Solution:

Discussion:
Databases - discussion about Relational Database Management System RDBMS Model and NoSQL

Exercise 12

SYN flooding 101

Objective:

Purpose:

Suggested method:

Hints:

Solution:

Discussion:

Exercise 13

Medical Security Oolicies

Objective:

Purpose:

Suggested method:
Find example medical security policies

Fitbit

Hints:

Solution:

Discussion:

Exercise 14

Perform privilege escalation using files

Objective:
Perform a simple privilege escalation attack

Purpose:

Suggested method:

1. Make a non-privileged user
2. make a system directory writable
3. create root cronjob without path
4. Insert a malicious script as one of the commands from the root cron job

Hints:
A cron job runs scheduled commands. They usually perform cleanup functions, removing old files, doing a backup or similar

Solution:

Discussion:
This was chosen as I found a similar vulnerability in a professional product, in 2019

Exercise 15

Anti-virus and ”endpoint security”

Objective:
Discuss when to use Anti-virus and ”endpoint security”

Purpose:

Suggested method:

Hints:

Solution:

Discussion:

Exercise 16

SSL/TLS scanners 15 min

Objective:
Try the Online Qualys SSLLabs scanner https://www.ssllabs.com/ Try the command line tool sslscan checking servers - can check both HTTPS and non-HTTPS protocols!

Purpose:
Learn how to efficiently check TLS settings on remote services.

Suggested method:
Run the tool against a couple of sites of your choice.

```
root@kali:~# sslscan --ssl2 web.kramse.dk
Version: 1.10.5-static
OpenSSL 1.0.2e-dev xx XXX xxxx

Testing SSL server web.kramse.dk on port 443
...
  SSL Certificate:
Signature Algorithm: sha256WithRSAEncryption
RSA Key Strength:    2048

Subject:  *.kramse.dk
Altnames: DNS:*.kramse.dk, DNS:kramse.dk
Issuer:   AlphaSSL CA - SHA256 - G2
```

Also run it without `--ssl2` and against SMTPTLS if possible.

Hints:
Originally sslscan is from http://www.titania.co.uk but use the version on Kali, install with apt if not installed.

Solution:
When you can run and understand what the tool does, you are done.

Discussion:
SSLscan can check your own sites, while Qualys SSLLabs only can test from hostname

Exercise 17

Nmap Ikescan IPsec

Objective:
Try Nmap and Ikescan

Purpose:

Suggested method:

Hints:

Solution:

Discussion:

Exercise 18

SSH scanners

Objective:

Try ssh scanners, similar to sslscan and Nmap sshscan

Purpose:

Suggested method:

Hints:

Solution:

Discussion:

Exercise 19

Password Cracking

Objective:

Crack your own passwords **Purpose:**

Suggested method:

Hints:

Solution:

Discussion:

Exercise 20

Email Security 2019

Objective:

Purpose:

DNSSEC, SPF, DMARC - DNS based updates to your email domain security

Suggested method:

Hints:

Solution:

Discussion:

Exercise 21

VM escapes

Objective:

Purpose:
Research VM escapes

Suggested method:

Hints:

Solution:

Discussion:

Exercise 22

Centralized syslog

Objective:

Centralized syslogging and example system

Purpose:

Suggested method:

Hints:

Solution:

Discussion:

Exercise 23

File System Forensics

Objective:

Open a file system dump **Purpose:**

Suggested method:

Hints:

Solution:

Discussion:

Exercise 24

Clean or rebuild a server

Objective:

Purpose:

Suggested method:

Hints:

Solution:

Discussion:

Exercise 25

Cloud environments influence on incident response

Objective:

Purpose:

Suggested method:

Hints:

Solution:

Discussion:

Exercise 26

System Security in Practice

Objective:

Purpose:

Suggested method:

- Work on our model network, each team has a router and an attacker - prevent most of the attacks on the Metasploitable server by firewall configuration
- Investigate Debian as a server - default settings for Web, we will install a system which requires database and web server configured
- Configure SSH keys

Hints:

Solution:

Discussion:

Exercise 27

Evaluate our network PCI

Objective:
Evaluate our network, quick gap analysis for becoming PCI compliant

Purpose:

Suggested method:

Hints:

Solution:

Discussion:

