Communication and Network Security exercises

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Contents

Preface

This material is prepared for use in *Communication and Network 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 communication-and-network-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

Introduction to networking

IP - Internet protocol suite

It is extremely important to have a working knowledge about IP to implement secure and robust infrastructures. Knowing about the alternatives while doing implementation will allow the selection of the best features.

ISO/OSI reference model

A very famous model used for describing networking is the ISO/OSI model of networking which describes layering of network protocols in stacks.

This model divides the problem of communicating into layers which can then solve the problem as smaller individual problems and the solution later combined to provide networking.

Having layering has proven also in real life to be helpful, for instance replacing older hardware technologies with new and more efficient technologies without changing the upper layers.

In the picture the OSI reference model is shown along side with the Internet Protocol suite model which can also be considered to have different layers.

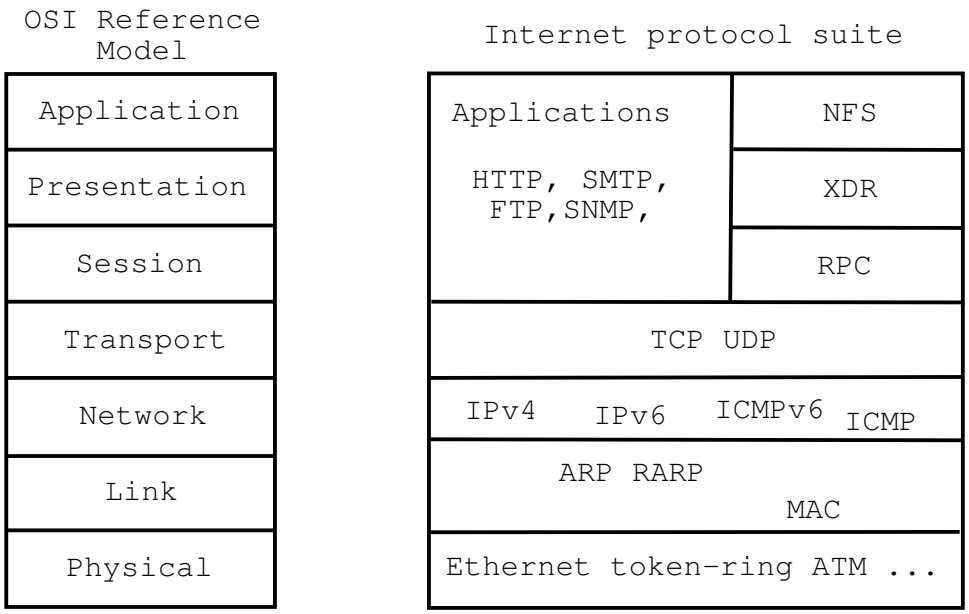


Figure 1: OSI og Internet Protocol suite

Exercise content

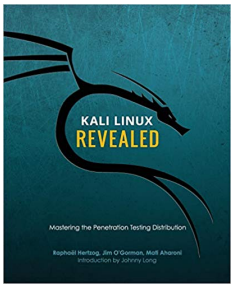
Most exercises follow the same procedure and has the following content:

- **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

Bonus: 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 - one is needed per team that want to try these tools. Tools which need Debian are Zeek and Suricata.

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.

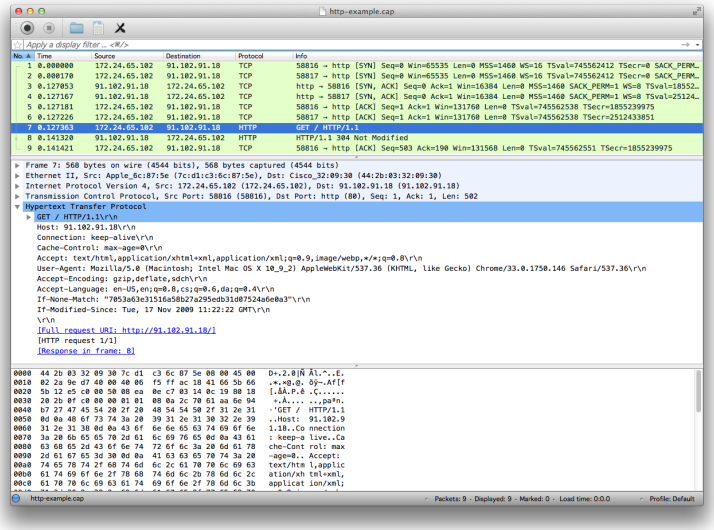
Hints:

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

Wireshark and Tcpdump 15 min



Objective:
Try the program Wireshark locally your workstation, or tcpdump

You can run Wireshark on your host too, if you want.

Purpose:
Installing Wireshark will allow you to analyse packets and protocols

Tcpdump is a feature included in many operating systems and devices to allow packet capture and saving network traffic into files.

Suggested method:
Run Wireshark or tcpdump from your Kali Linux

The PPA book page 41 describes Your First Packet Capture.

Hints:
PCAP is a packet capture library allowing you to read packets from the network. Tcpdump uses libpcap library to read packet from the network cards and save them. Wireshark is a graphical application to allow you to browse through traffic, packets and protocols.

Both tools are already on your Kali Linux, or do: `apt-get install tcpdump wireshark`

Solution:
When Wireshark is installed sniff some packets. We will be working with both live traffic and saved packets from files in this course.

If you want to capture packets as a non-root user on Debian, then use the command to add a Wireshark group:

```
sudo dpkg-reconfigure wireshark-common
```

and add your user to this:

```
sudo gpasswd -a $USER wireshark
```

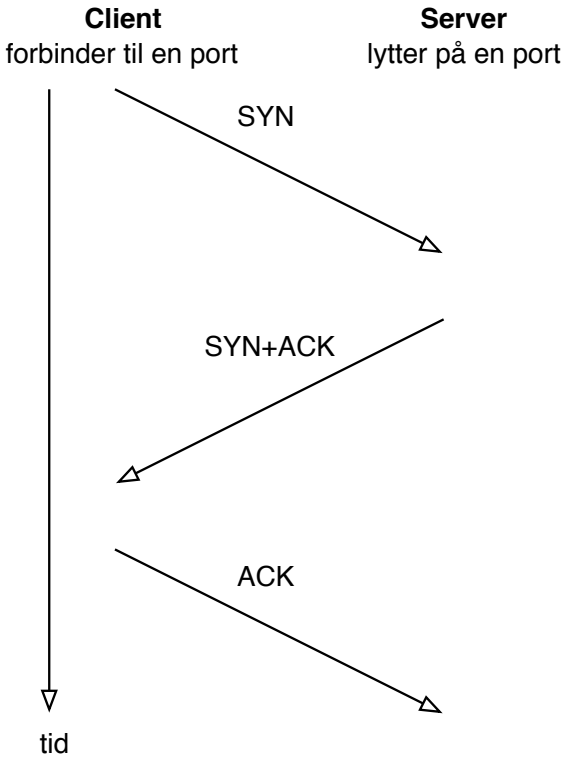
Dont forget to logout/login to pick up this new group.

Discussion:
Wireshark is just an example other packet analyzers exist, some commercial and some open source like Wireshark

We can download a lot of packet traces from around the internet, we might use examples from
https://www.bro.org/community/traces.html

Exercise 5

Capturing TCP Session packets 10 min



Objective:
Sniff TCP packets and dissect them using Wireshark

Purpose:
See real network traffic, also know that a lot of information is available and not encrypted.

Note the three way handshake between hosts running TCP. You can either use a browser or command line tools like cURL while capturing

```
curl http://www.zencurity.com
```

Suggested method:
Open Wireshark and start a capture
Then in another window execute the ping program while sniffing

or perform a Telnet connection while capturing data

Hints:
When running on Linux the network cards are usually named eth0 for the first Ethernet and wlan0 for the first Wireless network card. In Windows the names of the network cards are long and if you cannot see which cards to use then try them one by one.

Solution:
When you have collected some TCP sessions you are done.

Discussion: Is it ethical to collect packets from an open wireless network?

Also note the TTL values in packets from different operating systems

Exercise 6

Whois databases 15 min

Objective:
Learn to lookup data in the global Whois databases

Purpose:
We often need to see where traffic is coming from, or who is responsible for the IP addresses sending attacks.

Suggested method:
Use a built-in command line, like: `host www.zencurity.dk` to look up an IP address and then `whois` with the IP address.

Hints:
Another option is to use web sites for doing Whois lookups https://apps.db.ripe.net/db-web-ui/#/query or their RIPEStat web site which can give even more information https://stat.ripe.net/

Solution:
When you can find our external address and look it up, you are done.

Discussion:
Whois databases are global and used for multiple purposes, the ones run by the Regional Internet Registries ARIN, RIPE, AfriNIC, LACNIC og APNIC have information about IP addresses and AS numbers allocated.

Exercise 7

Using ping and traceroute 10 min

Objective:
Be able to do initial debugging of network problems using commands ping and traceroute

Purpose:
Being able to verify connectivity is a basic skill.

Suggested method:
Use `ping` and `traceroute` to test your network connection - can be done one Windows and UNIX.

Hints:

```
$ ping 10.0.42.1
PING 10.0.42.1 (10.0.42.1) 56(84) bytes of data.
64 bytes from 10.0.42.1: icmp_seq=1 ttl=62 time=1.02 ms
64 bytes from 10.0.42.1: icmp_seq=2 ttl=62 time=0.998 ms
^C
--- 10.0.42.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 0.998/1.012/1.027/0.034 ms
```

Dont forget that UNIX ping continues by default, press ctrl-c to break.

Do the same with traceroute.

Solution:
Run both programs to local gateway and some internet address by your own choice.

Discussion:
Note the tool is called tracert on Windows, shortened for some reason.

ICMP is the Internet Control Message Protocol, usually used for errors like host unreachable. The ECHO request ICMP message is the only ICMP message that generates another.

The traceroute programs send packets with low Time To Live (TTL) and receives ICMP messages, unless there is a problem or a firewall/filter. Also used for mapping networks.

Bonus:

Whats the difference between:

- **traceroute** and **traceroute -I**
- NB: traceroute -I is found on UNIX - traceroute using ICMP pakker
- Windows tracert by default uses ICMP
- Unix by default uses UDP, but can use ICMP instead.
- Lots of traceroute-like programs exist for tracing with TCP or other protocols

Exercise 8

DNS and Name Lookups 10 min

Objective:
Be able to do DNS lookups from specific DNS server

Purpose:
Try doing DNS lookup using different programs

Suggested method:
Try the following programs:

- nslookup - UNIX and Windows, but not recommended
  `nslookup -q=txt -class=CHAOS version.bind. 0`
- dig - syntax @server domain query-type query-class
  `dig @8.8.8.8 www.example.com`
- host - syntaks host [-l] [-v] [-w] [-r] [-d] [-t querytype] [-a] host [server]
  `host www.example.com 8.8.8.8`

Hints:
Dig is the one used by most DNS admins, I often prefer the host command for the short output.

Solution:
Shown inline, above.

Discussion:
The nslookup program does not use the same method for lookup as the standard lookup libraries, results may differ from what applications see.

What is a zone transfer, can you get one using the host command?

Explain forward and reverse DNS lookup.

Exercise 9

Nping check ports 10 min

Objective:
Show the use of Nping tool for checking ports through a network

Purpose:
Nping can check if probes can reach through a network, reporting success of failure. Allows very specific packets to be sent.

Suggested method:
Run the command using a common port like Web HTTP:

```
root@KaliVM:~# nping --tcp -p 80 www.zencurity.com

Starting Nping 0.7.70 ( https://nmap.org/nping ) at 2018-09-07 19:06 CEST
SENT (0.0300s) TCP 10.137.0.24:3805 > 185.129.60.130:80 S ttl=64 id=18933 iplen=40  seq=2984847972 win=1480
RCVD (0.0353s) TCP 185.129.60.130:80 > 10.137.0.24:3805 SA ttl=56 id=49674 iplen=44  seq=3654597698 win=16384 <mss
SENT (1.0305s) TCP 10.137.0.24:3805 > 185.129.60.130:80 S ttl=64 id=18933 iplen=40  seq=2984847972 win=1480
RCVD (1.0391s) TCP 185.129.60.130:80 > 10.137.0.24:3805 SA ttl=56 id=50237 iplen=44  seq=2347926491 win=16384 <mss
SENT (2.0325s) TCP 10.137.0.24:3805 > 185.129.60.130:80 S ttl=64 id=18933 iplen=40  seq=2984847972 win=1480
RCVD (2.0724s) TCP 185.129.60.130:80 > 10.137.0.24:3805 SA ttl=56 id=9842 iplen=44  seq=2355974413 win=16384 <mss 1
SENT (3.0340s) TCP 10.137.0.24:3805 > 185.129.60.130:80 S ttl=64 id=18933 iplen=40  seq=2984847972 win=1480
RCVD (3.0387s) TCP 185.129.60.130:80 > 10.137.0.24:3805 SA ttl=56 id=1836 iplen=44  seq=3230085295 win=16384 <mss 1
SENT (4.0362s) TCP 10.137.0.24:3805 > 185.129.60.130:80 S ttl=64 id=18933 iplen=40  seq=2984847972 win=1480
RCVD (4.0549s) TCP 185.129.60.130:80 > 10.137.0.24:3805 SA ttl=56 id=62226 iplen=44  seq=3033492220 win=16384 <mss

Max rtt: 40.044ms | Min rtt: 4.677ms | Avg rtt: 15.398ms
Raw packets sent: 5 (200B) | Rcvd: 5 (220B) | Lost: 0 (0.00%)
Nping done: 1 IP address pinged in 4.07 seconds
```

Hints:
A lot of options are similar to Nmap

Solution:
When you have tried it towards an open port, a closed port and an IP/port that is filtered you are done.

Discussion:
A colleague of ours had problems sending specific IPsec packets through a provider. Using a tool like Nping it is possible to show what happens, or where things are blocked.

Things like changing the TTL may provoke ICMP messages, like this:

```
root@KaliVM:~# nping --tcp -p 80 --ttl 3 www.zencurity.com

Starting Nping 0.7.70 ( https://nmap.org/nping ) at 2018-09-07 19:08 CEST
SENT (0.0303s) TCP 10.137.0.24:37244 > 185.129.60.130:80 S ttl=3 id=60780 iplen=40  seq=1997801125 win=1480
RCVD (0.0331s) ICMP [10.50.43.225 > 10.137.0.24 TTL=0 during transit (type=11/code=0) ] IP [ttl=62 id=28456 iplen=7
SENT (1.0314s) TCP 10.137.0.24:37244 > 185.129.60.130:80 S ttl=3 id=60780 iplen=40  seq=1997801125 win=1480
RCVD (1.0337s) ICMP [10.50.43.225 > 10.137.0.24 TTL=0 during transit (type=11/code=0) ] IP [ttl=62 id=28550 iplen=7
SENT (2.0330s) TCP 10.137.0.24:37244 > 185.129.60.130:80 S ttl=3 id=60780 iplen=40  seq=1997801125 win=1480
RCVD (2.0364s) ICMP [10.50.43.225 > 10.137.0.24 TTL=0 during transit (type=11/code=0) ] IP [ttl=62 id=28589 iplen=7
SENT (3.0346s) TCP 10.137.0.24:37244 > 185.129.60.130:80 S ttl=3 id=60780 iplen=40  seq=1997801125 win=1480
RCVD (3.0733s) ICMP [10.50.43.225 > 10.137.0.24 TTL=0 during transit (type=11/code=0) ] IP [ttl=62 id=29403 iplen=7
SENT (4.0366s) TCP 10.137.0.24:37244 > 185.129.60.130:80 S ttl=3 id=60780 iplen=40  seq=1997801125 win=1480
RCVD (4.0558s) ICMP [10.50.43.225 > 10.137.0.24 TTL=0 during transit (type=11/code=0) ] IP [ttl=62 id=30235 iplen=7

Max rtt: 38.574ms | Min rtt: 2.248ms | Avg rtt: 13.143ms
Raw packets sent: 5 (200B) | Rcvd: 5 (360B) | Lost: 0 (0.00%)
Nping done: 1 IP address pinged in 4.07 seconds
```


Exercise 10

Try pcap-diff 15 min

Objective:
Try both getting an utility tool from Github and running an actual useful tool for comparing packet captures.

Purpose:
Being able to get tools and scripts from Github makes you more effective.

The tool we need today is https://github.com/isginf/pcap-diff **Suggested method:**
Git clone the repository, follow instructions for running a packet diff.

Try saving a few packets in a packet capture, then using tcpdump read and write a subset - so you end up with two packet captures:

```
sudo tcpdump -w icmp-dump.cap
// run ping in another window, which probably creates ARP packets
// Check using tcpdump
sudo tcpdump -r icmp-dump.cap arp
reading from file icmp-dump.cap, link-type EN10MB (Ethernet)
10:06:18.077055 ARP, Request who-has 10.137.0.22 tell 10.137.0.6, length 28
10:06:18.077064 ARP, Reply 10.137.0.22 is-at 00:16:3e:5e:6c:00 (oui Unknown), length 28
10:06:24.776987 ARP, Request who-has 10.137.0.6 tell 10.137.0.22, length 28
10:06:24.777107 ARP, Reply 10.137.0.6 is-at fe:ff:ff:ff:ff:ff (oui Unknown), length 28
// Write the dump - but without the ARP packets:
sudo tcpdump -r icmp-dump.cap -w icmp-dump-no-arp.cap not arp
```

With these pcaps you should be able to do:

```
sudo pip install scapy
git clone https://github.com/isginf/pcap-diff.git
cd pcap-diff/

$ python pcap_diff.py -i ../icmp-dump.cap -i ../icmp-dump-no-arp.cap -o diff.cap
Reading file ../icmp-dump.cap:
Found 23 packets

Reading file ../icmp-dump-no-arp.cap:
Found 19 packets

Diffing packets:

Found 2 different packets

Writing diff.cap
// Try reading the output packet diff:

$ sudo tcpdump -r diff.cap
```



```
reading from file diff.cap, link-type EN10MB (Ethernet)
10:06:24.777107 ARP, Reply 10.137.0.6 is-at fe:ff:ff:ff:ff:ff (oui Unknown), length 28
10:06:24.776987 ARP, Request who-has 10.137.0.6 tell 10.137.0.22, length 28
```

Note: I ran these on a Debian, so I needed the sudo, if you run this on Kali there is no need to use sudo.

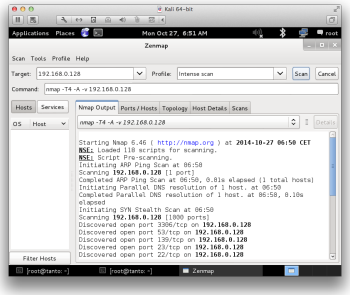
Hints:
Git is one of the most popular software development tools, and Github is a very popular site for sharing open source tools.

Solution:
When you or your team mate has a running pcap-diff then you are done

Discussion:
I often find that 90% of my tasks can be done using existing open source tools.

Exercise 11

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 12

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 13

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.

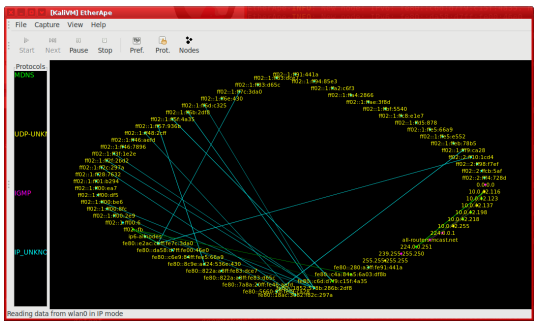
Hints:
The nmap can send a lot of packets that will get different responses, depending on the operating system. TCP/IP is implemented using various constants chosen by the implementors, they have chosen different standard packet TTL etc.

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 14

EtherApe 10 min



> EtherApe is a graphical network monitor for Unix modeled after etherman. Featuring link layer, IP and TCP modes, it displays network activity graphically. Hosts and links change in size with traffic. Color coded protocols display. Node statistics can be exported.

Objective:
Use a tool to see more about network traffic, whats going on in a network.

Purpose:
Get to know the concept of a node by seeing nodes communicate in a graphical environment.

Suggested method:
Use the tool from Kali

The main page for the tool is: https://etherape.sourceforge.io/

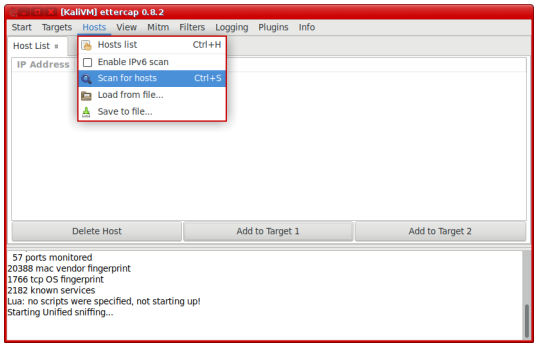
Hints:
Your built-in network card may not be the best for sniffing. Borrow one from Henrik.

Solution:
When you have the tool running and showing data, you are done.

Discussion:

Exercise 15

ARP spoofing and ettercap 20



Objective:
Use a tool to see more about network traffic, whats going on in a network.

Purpose:
Start the tool, do a scan and start sniffing between your laptop and the router.

Suggested method:

1. Start the tool using `ettercap --gtk` to get the graphical version.
2. Select menu Info, Help - and read about unified and bridged sniffing.
3. Start Unified sniffing from Sniff, Unified sniffing - select your network card.
4. Select Hosts - Scan

You should be able to see some hosts. Then the next step would be to initiate attacks - which are menu-driven and easy to perform.

Hints:
We might be messing to much with the traffic, so attacks wont succeed. Some coordination is needed.

Solution:
When you can scan for hosts and realize how easy that was, you are done.

Discussion:
How many admins know about ARP spoofing, ARP poisoning?

Exercise 16

Perform nmap service scan 10 min

Objective:
Use more advanced features in Nmap to discover services.

Purpose:
Getting more intimate with the system will allow more precise discovery of the vulnerabilities and also allow you to select the next tools to run.

Suggested method:
Use `nmap -A` option for enabling service detection and scripts

Hints:
Look into the manual page of nmap or the web site book about nmap scanning

Solution:
Run nmap and get results.

Discussion:
Some services will show software versions allowing an attacker easy lookup at web sites to known vulnerabilities and often exploits that will have a high probability of success.

Make sure you know the difference between a vulnerability which is discovered, but not really there, a false positive, and a vulnerability not found due to limitations in the testing tool/method, a false negative.

A sample false positive might be reporting that a Windows server has a vulnerability that you know only to exist in Unix systems.

Exercise 17

Nmap full scan - strategy 15 min

Objective:
Write down your Nmap strategy, and if needed create your own Nmap profile in Zenmap.

Purpose:
Doing a port scan often requires you to run multiple Nmap scans.

Suggested method:
Use Zenmap to do:

1. A few quick scans, to get web servers and start web scanners/crawlers
2. Full scan of all TCP ports, -p 1-65535
3. Full or limited UDP scan, `nmap -sU --top-ports 100`
4. Specialized scans, like specific source ports

Hints:
Using a specific source ports using -g/–source-port <portnum>: Use given port number with ports like FTP 20, DNS 53 can sometimes get around router filters and other stateless Access Control Lists

Solution:
Run nmap and get results.

Discussion:
Recommendation it is highly recommended to always use:

```
-iL <inputfilename>: Input from list of hosts/networks
-oA outputbasename: output in all formats, see later
```

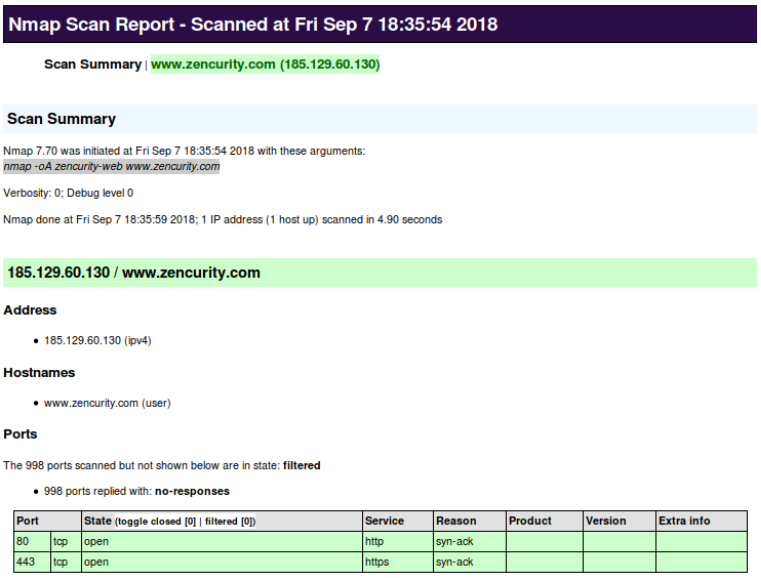
Some examples of real life Nmaps I have run recently:

```
dns-scan: nmap -sU -p 53 --script=dns-recursion -iL targets -oA dns-recursive
bgpscan: nmap -A -p 179 -oA bgpscan -iL targets
dns-recursive: nmap -sU -p 53 --script=dns-recursion -iL targets -oA dns-recursive
php-scan: nmap -sV --script=http-php-version -p80,443 -oA php-scan -iL targets
scan-vtep-tcp: nmap -A -p 1-65535 -oA scan-vtep-tcp 185.129.60.77 185.129.60.78
```

```
snmp-10.x.y.0.gnmap: nmap -sV -A -p 161 -sU --script=snmp-info -oA snmp-10xy 10.x.y.0/19
snmpscan: nmap -sU -p 161 -oA snmpscan --script=snmp-interfaces -iL targets
sshscan: nmap -A -p 22 -oA sshscan -iL targets
vncscan: nmap -A -p 5900-5905 -oA vncscan -iL targets
```


Exercise 18

Reporting HTML 15 min



Nmap Scan Report - Scanned at Fri Sep 7 18:35:54 2018

Scan Summary | www.zencurity.com (185.129.60.130)

Scan Summary

Nmap 7.70 was initiated at Fri Sep 7 18:35:54 2018 with these arguments:
nmap -oA zencurity-web www.zencurity.com

Verbosity: 0; Debug level 0

Nmap done at Fri Sep 7 18:35:59 2018; 1 IP address (1 host up) scanned in 4.90 seconds

185.129.60.130 / www.zencurity.com

Address

- 185.129.60.130 (ipv4)

Hostnames

- www.zencurity.com (user)

Ports

The 998 ports scanned but not shown below are in state: **filtered**

- 998 ports replied with: **no-responses**

Port		State (toggle closed [0] | filtered [0])	Service	Reason	Product	Version	Extra info
80	tcp	open	http	syn-ack			
443	tcp	open	https	syn-ack			

Objective:
Show the use of XML output and convert to HTML

Purpose:
Reporting data is very important. Using the oA option Nmap can export data in three formats easily, each have their use. They are normal, XML, and grepable formats at once.

Suggested method:
First run Nmap, with output, then process it

```
sudo nmap -oA zencurity-web www.zencurity.com
xsltproc zencurity-web.xml > zencurity-web.html
```

Hints:
Nmap includes the stylesheet in XML and makes it very easy to create HTML.

If the tool `xsltproc` is not installed, then install it: `apt-get install xsltproc`

Solution:
Run XML through xsltproc, command line XSLT processor, or another tool

Discussion:

Options you can use to change defaults:

```
--stylesheet <path/URL>: XSL stylesheet to transform XML output to HTML
--webxml: Reference stylesheet from Nmap.Org for more portable XML
```

Also check out the Ndiff tool

```
hlk@cornerstone03:~$ ndiff zencurity-web.xml zencurity-web-2.xml
-Nmap 7.70 scan initiated Fri Sep 07 18:35:54 2018 as: nmap -oA zencurity-web www.zencurity.com
+Nmap 7.70 scan initiated Fri Sep 07 18:46:01 2018 as: nmap -oA zencurity-web-2 www.zencurity.com

 www.zencurity.com (185.129.60.130):
 PORT    STATE SERVICE VERSION
+443/tcp open  https
```

(I ran a scan, removed a port from the first XML file and re-scanned)

Exercise 19

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 20

sslstrip 15 min

Objective:
sslstrip https://moxie.org/software/sslstrip/

Purpose:
Read about the tool, and lets try to run it - on a single VM.

> This tool provides a demonstration of the HTTPS stripping attacks that I presented at Black Hat DC 2009. It will transparently hijack HTTP traffic on a network, watch for HTTPS links and redirects, then map those links into either look-alike HTTP links or homograph-similar HTTPS links. It also supports modes for supplying a favicon which looks like a lock icon, selective logging, and session denial. For more information on the attack, see the video from the presentation below.

Suggested method:
Make sure tool is installed, Then run it and intercept your own traffic from the same system.

You may run this on the wireless and try intercepting others.

Hints:
IF you are using wireless - most likely, then make sure to run on the same channel/AP/frequency. Either switch everything to 2.4GHz and have only one AP or just do the mitm on a single host - run browser and mitmproxy on the same VM.

Solution:
When you have intercepted some traffic you are done, we will spend at least 30-45 minutes doing various mitm related stuff.

Discussion:

Exercise 21

mitmproxy 30 min

Objective:
mitmproxy https://mitmproxy.org/

mitmproxy is a free and open source interactive HTTPS proxy

Purpose:
Try running a mitm attack on your phone or another laptop.

Suggested method:
Make sure tool is installed

Then use the command line interface to verify it is working, then switch to the Web interface for playing with the tool.

Hints:
IF you are using wireless - most likely, then make sure to run on the same channel/AP/frequency. Either switch everything to 2.4GHz and have only one AP or just do the mitm on a single host - run browser and mitmproxy on the same VM.

Solution:
When you have intercepted some traffic you are done, we will spend at least 30-45 minutes doing various mitm related stuff.

Discussion:

Exercise 22

sslsplit 10 min

Objective:
Read about sslsplit https://www.roe.ch/SSLsplit - transparent SSL/TLS interception system

Purpose:
This tool has a lot of features described on the home page.

> Overview
> SSLsplit is a tool for man-in-the-middle attacks against SSL/TLS encrypted network connections. It is intended to be useful for network forensics, application security analysis and penetration testing.
>
> SSLsplit is designed to transparently terminate connections that are redirected to it using a network address translation engine. SSLsplit then terminates SSL/TLS and initiates a new SSL/TLS connection to the original destination address, while logging all data transmitted. Besides NAT based operation, SSLsplit also supports static destinations and using the server name indicated by SNI as upstream destination. SSLsplit is purely a transparent proxy and cannot act as a HTTP or SOCKS proxy configured in a browser.

Suggested method:
If we were to use this tool, we would redirect traffic using ”firewalls”/routers

- SSLsplit currently supports the following operating systems and NAT engines:
- FreeBSD: pf rdr and divert-to, ipfw fwd, ipfilter rdr
- OpenBSD: pf rdr-to and divert-to
- Linux: netfilter REDIRECT and TPROXY
- Mac OS X: ipfw fwd and pf rdr

We wont run this tool, but beware such tools exist

Hints:
Specifically read the section *SSLsplit implements a number of defences against mechanisms* - and think about the consequences to a regular user.

Solution:
When you feel you have a idea about what this tool can do then you are done.

Discussion:
Should tools like this even exist?

Exercise 23

Wardriving Up to 60min

Objective:
Try putting a network card in monitor mode and sniff wireless networks.

Purpose:
See that wireless networks dont encrypt MACs addresses and other characteristics - what can be found just by turning on the radio.

Suggested method:
Insert USB wireless card, make sure your VM has USB 2.0 Hub and allow VM to control the card.

Start monitor mode - maybe card is not wlan0!:
```
airmon-ng start wlan0
```

Start airodump-ng:
```
airodump-ng wlan0mon
```

See the data

Hints:
Selecting a specific channel can be done using –channel and writing captured packets can be done using -w

Solution:
When you have an overview of nearby networks you are done.

Discussion:

Lots of information is available on the internet. One recommended site is: http://www.aircrack-ng

Exercise 24

Aircrack-ng 30 min

Objective:
See the program aircrack-ng being used for cracking WEP and WPA-PSK keys.

Purpose:
Some methods previously used to protect wireless networks should not be used anymore.

Suggested method:
Get access to a WEP encrypted dump of wireless network traffic and break encryption.
Get access to a WPA handshake and try cracking it.

Hints:
Kali includes the aircrack-ng program and some test data in
`/pentest/wireless/aircrack-ng/test`

Solution:
When you have cracked a network from either testdata or real nearby - our lab network.

Discussion:
There is a lot of information available about aircrack-ng at the web site:
http://www.aircrack-ng.org/

Another tool available is pyrit and cpyrit which can break WPA-PSK using CUDA enabled graphic cards - instead of 100s of keys/second this may allow 10000s keys/second.

Hashcat also is able to crack WPA https://hashcat.net/hashcat/

Exercise 25

SNMP walk 15min

Objective:
Run SNMP walk on a switch, `snmpwalk` see information from device.

Lots of basic information helps defenders - AND attackers.

Purpose:
SNMP is a default management protocol used in almost any network.

Suggested method:
Run snmpwalk using community string public. Command is: `snmpwalk -v 2c -c public system`

Hints:
Community strings private and public used to be default for network devices. Today professionel devices have no SNMP configured by default, but lots of networks install the community "public" anyway.

Solution:
When you have done snmpwalk for at least one device.

Discussion:
Which part of the information is most relevant to defenders, and attackers.

Also remember on internal LAN segments, use Nmap:

```
snmp-10.x.y.0.gnmap: nmap -sV -A -p 161 -sU --script=snmp-info -oA snmp-10xy 10.x.y.0/19
snmpscan: nmap -sU -p 161 -oA snmpscan --script=snmp-interfaces -iL targets
```


Exercise 26

Try Hydra brute force 30min

Objective:
Try a brute force program named hydra/Xhydra.

You decide which service to attack, SSH or SNMP are good examples.

Purpose:
Learn that some protocols allow brute forcing.

Suggested method:
Make a short list of usernames and a short list of passwords and use hydra to brute force your way into a system. Use the editor `kate`, using `kate users.txt` and `kate pass.txt` followed by a command similar to this:

```
$ hydra -V -t 1 -L users.txt -P pass.txt 10.0.45.2 ssh
```

If you want to attack SNMP try with a small list of community names: public, private, kramse, etc.

Hints:
When learning tools create a nice environment and check that things are working before trying to hack. So with brute forcing an account, create and test it!

Solution:
When you have found working credentials for at least one service, like SNMP and done SNMPwalk

Discussion:
The hydra program can brute force a lot of different protocols and also allow a lot of tuning.

The hydra program does an online brute force attack, in some cases you can get access to data like password databases, or hash values that can be cracked in off-line brute force attacks.

Exercise 27

Zeek on the web

Objective:
Try Zeek Network Security Monitor - without installing it.

Purpose:
Show a couple of examples of Zeek scripting, the built-in language found in Zeek Network Security Monitor

Suggested method:
Go to http://try.bro.org/ and try a few of the examples.

Hints:
The exercise *The Summary Statistics Framework* can be run with a specifc PCAP.

```
192.168.1.201 did 402 total and 2 unique DNS requests in the last 6 hours.
```

Solution:
You should read the example *Raising a Notice*. Getting output for certain events may be interesting to you.

Discussion:
Zeek Network Security Monitor is an old/mature tool, but can still be hard to get started using. I would suggest that you always start out using the packages available in your Ubuntu/Debian package repositories.

They work, and will give a first impression of Zeek. If you later want specific features not configured into the binary packet, then install from source.

Also Zeek uses a broctl program to start/stop the tool, and a few config files which we should look at. From a Debian system they can be found in `/etc/bro` :

```
root@NMS-VM:/etc/bro# ls -la
drwxr-xr-x   3 root root  4096 Oct  8 08:36 .
drwxr-xr-x 138 root root 12288 Oct  8 08:36 ..
-rw-r--r--   1 root root  2606 Oct 30  2015 broctl.cfg
-rw-r--r--   1 root root   225 Oct 30  2015 networks.cfg
-rw-r--r--   1 root root   644 Oct 30  2015 node.cfg
drwxr-xr-x   2 root root  4096 Oct  8 08:35 site
```

Exercise 28

Zeek DNS capturing domain names

Objective:
We will now start using Zeek on our systems.

Purpose:
Try Zeek with example traffic, and see what happens.

Suggested method packet capture file:
Note: a dollar sign is the Linux prompt, showing the command after

```
$ cd
$ wget http://downloads.digitalcorpora.org/corpora/network-packet-dumps/2008-nitroba/nitroba.pcap
$ mkdir $HOME/bro;cd $HOME/bro; bro -r ../nitroba.pcap
... bro reads the packets
~/bro$ ls
conn.log  dns.log  dpd.log  files.log  http.log  packet_filter.log
sip.log  ssl.log  weird.log  x509.log
$ less *
```

Use :n to jump to the next file in less, go through all of them.

Suggested method Live traffic:
Make sure Zeek is configured as a standalone probe and configured for the right interface. Linux used to use eth0 as the first ethernet interface, but now can use others, like ens192 or enx00249b1b2991.

```
root@NMS-VM:/etc/bro# cat node.cfg
# Example BroControl node configuration.
#
# This example has a standalone node ready to go except for possibly changing
# the sniffing interface.

# This is a complete standalone configuration.  Most likely you will
# only need to change the interface.
[bro]
type=standalone
host=localhost
interface=eth0
...
```

Hints:

There are multiple commands for showing the interfaces and IP addresses on Linux. The old way is using `ifconfig -a` newer systems would use `ip a`

Note: if your system has a dedicated interface for capturing, you need to turn it on, make it available. This can be done manually using `ifconfig eth0 up` **Solution:** When you either run Zeek using a packet capture or using live traffic

Running with a capture can be done using a command line such as: `bro -r traffic.pcap`

Using broctl to start it would be like this:

```
// install bro first
kunoichi:~ root# broctl
Hint: Run the broctl "deploy" command to get started.

Welcome to BroControl 1.5
Type "help" for help.

[BroControl] > install
creating policy directories ...
installing site policies ...
generating standalone-layout.bro ...
generating local-networks.bro ...
generating broctl-config.bro ...
generating broctl-config.sh ...
...


// back to Broctl and start it
[BroControl] > start
starting bro
// and then
kunoichi:bro root# cd /var/spool/bro/bro
kunoichi:bro root# tail -f dns.log
```

You should be able to spot entries like this:

```
#fields ts      uid     id.orig_h       id.orig_p       id.resp_h       id.resp_p       proto   trans_i
     query   qclass  qclass_name     qtype   qtype_name      rcode   rcode_name      AA      TC      RD
1538982372.416180 CD12Dc1SpQm42QW4G3 10.xxx.0.145 57476 10.x.y.141 53 udp 20383 0.045021 www.dr.dk
1 C_INTERNET 1 A 0 NOERROR F F T T 0 www.dr.dk-v1.edgekey.net,e16198.b.akamaiedge.net,2.17.212.93
60.000000,20409.000000,20.000000 F
```

Note: this show ALL the fields captured and dissected by Zeek, there is a nice utility program bro-cut which can select specific fields:

```
root@NMS-VM:/var/spool/bro/bro# cat dns.log | bro-cut -d ts query answers | grep dr.dk
2018-10-08T09:06:12+0200 www.dr.dk www.dr.dk-v1.edgekey.net,e16198.b.akamaiedge.net,2.17.212.93
```

Discussion:
Why is DNS interesting?

Exercise 29

Zeek TLS capturing certificates

Objective:
Run more traffic through Zeek, see the various files.

Purpose:
See that even though HTTPS and TLS traffic is encrypted it often show names and other values from the certificates and servers.

Suggested method:
Run Zeek capturing live traffic, start https towards some sites. A lot of common sites today has shifted to HTTPS/TLS.

Hints:
use broctl start and watch the output directory

```
root@NMS-VM:/var/spool/bro/bro# ls *.log
communication.log  dhcp.log files.log known_services.log packet_filter.log  stats.log
stdout.log x509.log conn.log dns.log known_hosts.log loaded_scripts.log  ssl.log
stderr.log weird.log
```

We already looked at `dns.log`, now check `ssl.log` and `x509.log`

```
root@NMS-VM:/var/spool/bro/bro# grep dr.dk ssl.log
1538983060.546122 CtKYZ625cq3m3jUz9k 10.xxx.0.145 49932 2.17.212.93 443 TLSv12 TLS_ECDHE_RSA_WITH_AES_2
secp256r1 www.dr.dk F -h2 T FzmZCt3o9EYcmNaxIi,FKXcmxQHT3znDDMSj (empty) CN=*.dr.dk,O=DR,L=Copenhagen S
CN=GlobalSign Organization Validation CA - SHA256 - G2,O=GlobalSign nv-sa,C=BE --ok
1538983060.674217 CLjZo51fzuTcvPT0lg 200xxxxb:89b0:5cbf 49933 2a02:26f0:2400:2a1::3f46 443 TLSv12
TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384 secp256r1 asset.dr.dk F -h2 TFEpW9a1IFe6NTUZNpb,FwV50B4CHIwF1CPlu
(empty) CN=*.dr.dk,O=DR,L=Copenhagen S,ST=Copenhagen,C=DK CN=GlobalSign Organization Validation CA - SH
sa,C=BE --ok
```

Solution:
When you have multiple log files with data from Zeek, and have looked into some of them. You are welcome to ask questions and look into more files.

Discussion:
How can you hide that you are going to HTTPS sites?

Hint: VPN

Exercise 30

Suricata Basic Operation

Objective:
Start using Suricata IDS engine with some traffic.

Purpose:
Show how to get started, meet some obstacles - missing files etc.

Discuss how to solve problems, why do we miss them, how to fix

Suggested method packet capture file:
Note: a dollar sign is the Linux prompt, showing the command after

```
$ cd
$ wget http://downloads.digitalcorpora.org/corpora/network-packet-dumps/2008-nitroba/nitroba.pcap
$ mkdir $HOME/suricata;cd $HOME/suricata;  suricata -r ../nitroba.pcap -c /etc/suricata/suricata.yaml -
l .
... Suricata reads the packets
~/suricata$ ls
eve.json  fast.log  stats.log
$ less *
```

Suggested method live capture:
Make sure the config file `/etc/suricata/suricata.yaml` has the right interface eth0 - or maybe ens192?. Check using `ifconfig -a`

Try starting the service

```
hlk@debian:~$ sudo service suricata start
hlk@debian:~$ cd /var/log/suricata/
hlk@debian:/var/log/suricata$ ls
eve.json  fast.log  stats.log  suricata.log
hlk@debian:/var/log/suricata$

hlk@debian:/var/log/suricata$ tail -3 suricata.log
8/10/2018 -- 17:15:58 - <Warning> - [ERRCODE: SC_ERR_AFP_CREATE(190)] - Can not open iface 'eth0'
8/10/2018 -- 17:15:58 - <Warning> - [ERRCODE: SC_ERR_AFP_CREATE(190)] - Can not open iface 'eth0'
8/10/2018 -- 17:16:19 - <Warning> - [ERRCODE: SC_ERR_AFP_CREATE(190)] - Can not open iface 'eth0'
```

Yeah my network card is called `ens33`, and I should replace eth0 with ens33 in the config file.

```
perl -pi -e "s/eth0/ens33/g" /etc/suricata/suricata.yaml
```



```
hlk@debian:/var/log/suricata$ sudo service suricata stop
hlk@debian:/var/log/suricata$ sudo service suricata start
hlk@debian:/var/log/suricata$ tail -3 suricata.log
8/10/2018 -- 17:23:20 - <Warning> - [ERRCODE: SC_ERR_NO_RULES(42)] - No rule files match the pattern /e
worm.rules
8/10/2018 -- 17:23:20 - <Warning> - [ERRCODE: SC_ERR_NO_RULES(42)] - No rule files match the pattern /e
8/10/2018 -- 17:23:20 - <Notice> - all 2 packet processing threads, 4 management threads initialized, e
```

Hints:
https://redmine.openinfosecfoundation.org/projects/suricata/wiki/Quick_Start_Guide and
https://redmine.openinfosecfoundation.org/projects/suricata/wiki/Basic_Setup

Solution:
When you can start and stop suricata, and it only complains about missing rules, you are done with this exercise.

Discussion:
What was the main problems in this exercise?

Exercise 31

Basic Suricata rule configuration

Objective:
See the Suricata configuration files, and get some rules.

The best IDS is nothing without good rules.

Purpose:
The rules make Suricata useful, and we will learn how to get a ruleset installed, and to keep it updated.

Suggested method:
Check the file `/etc/suricata/suricata-oinkmaster.conf`

It contains this:

```
hlk@debian:/etc/suricata$ cat suricata-oinkmaster.conf
# This is a Debian specific config file for oinkmaster crafted for suricata,
# you should read oinkmaster documentation to modify this file.
# This config is loaded by default from the suricata-oinkmaster-updater binary
# which is called daily from a cronjob by default

skipfile local.rules
skipfile deleted.rules
skipfile snort.conf
use_external_bins = 0

url = https://rules.emergingthreats.net/open/suricata-3.0/emerging.rules.tar.gz
```

Then try running the oinkmaster program in "dry run" with -c

```
root@debian:~# oinkmaster -i -c -C /etc/suricata/suricata-oinkmaster.conf -o /etc/suricata/rules/
Loading /etc/suricata/suricata-oinkmaster.conf
Downloading file from https://rules.emergingthreats.net/open/suricata-3.0/emerging.rules.tar.gz... done
Archive successfully downloaded, unpacking... done.
Setting up rules structures... done.
Processing downloaded rules... disablesid 0, enablesid 0, modifysid 0, localsid 0, total rules 26212
```

If the output looks OK, then re-run without -c and let it update files.

```
root@debian:~# oinkmaster -i -C /etc/suricata/suricata-oinkmaster.conf -o /etc/suricata/rules/
...
```

```
[+] Added files (consider updating your snort.conf to include them if needed):
    -> botcc.portgrouped.rules
    -> botcc.rules
    -> BSD-License.txt
    -> ciarmy.rules
...
    -> emerging-chat.rules
    -> emerging-current_events.rules
    -> emerging-deleted.rules
    -> emerging-dns.rules
    -> emerging-dos.rules
    -> emerging-exploit.rules
    -> emerging-ftp.rules
Do you approve these changes? [Yn]
```

Hints:
You need to restart Suricata for the rules to be found. In the example below I remove the long log with errors, and restart:

```
root@debian:~# service suricata stop
root@debian:~# rm /var/log/suricata/suricata.log
root@debian:~# service suricata start
root@debian:~# cat /var/log/suricata/suricata.log
8/10/2018 -- 17:45:19 - <Notice> - This is Suricata version 3.2.1 RELEASE
```

Solution:
When you have the ruleset downloaded and Suricata is happy when starting you are done with this exercise.

In a real deployment it is advised to automate the update of rules, and also some rules are probably not needed in you environments, YMMV. We will not go through all the rules provided.

Discussion:
Emerging Threats is a well-known ruleset provider, with commercial support.

Whenever there is a new internet wide security incident there are people providing IDS rules in Snort or Suricata format. Since Suricata can read snort rules, this is a good way to add up-to-date rules to your installation.

Note: we haven't mentioned it, but the config files for both Zeek and Suricata allows one to specify your home network.

Checkout the files: Zeek configuration in `/etc/bro/networks.cfg` and Suricata main config `/etc/suricata/suricata.yaml`

```
vars:
  # more specifc is better for alert accuracy and performance
  address-groups:
    HOME_NET: "[192.168.0.0/16,10.0.0.0/8,172.16.0.0/12]"
    #HOME_NET: "[192.168.0.0/16]"
```


Exercise 32

Configure Mirror Port

Objective:
Mirror ports are a way to copy traffic to Suricata and other devices - for analyzing it. We will go through the steps on a Juniper switch to show how. Most switches which are configurable have this possibility.

Purpose:
We want to capture traffic for multiple systems, so we select an appropriate port and copy the traffic. In our setup, we select the uplink port to the internet/router.

It is also possible to buy passive taps, like a fiber splitter, which then takes part of the signal, and is only observable if you look for signal strength on the physical layer.

Suggested method:
We will configure a mirror port on a Juniper EX2200-C running Junos.

```
root@ex2200-c# show ethernet-switching-options | display set
set ethernet-switching-options analyzer mirror01 input ingress interface ge-0/1/1.0
set ethernet-switching-options analyzer mirror01 input egress interface ge-0/1/1.0
set ethernet-switching-options analyzer mirror01 output interface ge-0/1/0.0
set ethernet-switching-options storm-control interface all
```

Hints:
When checking your own devices this is often called SPAN ports, Mirror ports or similar.

```
https://en.wikipedia.org/wiki/Port_mirroring
```

Cisco has called this Switched Port Analyzer (SPAN) or Remote Switched Port Analyzer (RSPAN), so many will refer to them as SPAN-ports.

Solution:
When we can see the traffic from the network, we have the port configured - and can run any tool we like. Note: specialized capture cards can often be configured to spread the load of incoming packets onto separate CPU cores for performance. Capturing 100G and more can also be done using switches like the example found on the Zeek web site using an Arista switch 7150.

Discussion:
When is it ethical to capture traffic?

Exercise 33

Save Suricata JSON Output in Database

Objective:
Configure a system to read the output files from Suricata EVE logging and save into database system.

This will enable us to use browser based methods and dashboards to analyse more efficiently.

Purpose:
Flat files show that we can collect data, but processing big files when trying to solve problems or handling security incidents is slow. Using databases and document stores like Elasticsearch can help a lot.

Suggested method:
Open the Suricata config file suricata.yml and make sure eve-log is turned on. https://suricata.readthedocs.io/en/suricata-4.0.5/output/eve/eve-json-output.html

```
# Extensible Event Format (nicknamed EVE) event log in JSON format
- eve-log:
    enabled: yes
```

It might be enabled by default. So you can run the (complex) playbook to install database and supporting tools:

```
ansible-playbook -v elasticstack.yml
```

Run the playbook, that installs:

- Logstash for reading the EVE JSON log
- Elasticsearch the database / document store
- Kibana for showing data
- Nginx, because we really should put this in front of Kibana

Hints:
Logstash and Elastic stack are a great way to get started with dashboarding.

However, running a big installation is harder than it looks. Make sure to have multiple servers and good monitoring.

Solution:
When we have a few running installations we are done. Kibana should be available on port 5601 on localhost (127.0.0.1) only though!

Using Firefox visit Kibana on http://127.0.0.1:5601 first time you need to select `logstash-*` as a default index. Note: Kibana is an advanced and powerful tool in itself.

Don't be discouraged if something goes wrong, there are a lot of moving pieces.

A very common problem is the permissions to read files, from logstash log:

```
[2018-10-05T18:22:33,105][WARN ][filewatch.tailmode.handlers.createinitial] failed to open
/var/log/suricata/eve.json: #<Errno::EACCES: Permission denied - /var/log/suricata/eve.json>,
["org/jruby/RubyFile.java:366:in `initialize'", "org/jruby/RubyIO.java:1154:in `open'",
 "/usr/share/logstash/vendor/bundle/jruby/2.3.0/gems/logstash-input-file-4.1.6
 /lib/filewatch/watched_file.rb:204:in `open'"]
```

Discussion:
Making dashboard are an art form. We will NOT start creating beautiful dashboards.

There are a lot of Dashboards available, such as:
https://github.com/StamusNetworks/KTS6

Note: they require Suricata 4.1+ so we cannot use them immediately.

If you want, there is a SELKS LiveCD dedicated to suricata which also includes more tools for administration of rules and getting alerts:
https://www.stamus-networks.com/open-source/

Exercise 34

Suricata Netflow

Objective:
Configure Suricata to do netflow logging

Purpose:
In some cases we dont know what traffic we need to analyze, but if we collect netflow data - summary data about every connection. We can go back and check for specific types of traffic, based on ports, length etc.

Suggested method:

uncomment netflow in the config file `/etc/suricata/suricata.yaml` by removing the "#" in front of this line:

```
#- netflow
```

and restart Suricata.

Hints:
Netflow logging allows efficient logging of summary data, which can be very useful.

Solution:
When you have configured Suricata for netflow, you are done.

Discussion:
Specialized tools exist for collecting and visualizing netflow data. If you have nothing, then Suricata may be a good start.

Exercise 35

Extending Zeek and Suricata

Objective:
Sometimes Zeek and Suricata by themselves will not be enough.

Investigate how to extend Zeek and Suricata, by some examples.

Purpose:
See examples of scripts and rules, evaluate the complexity.

Suggested method:
Get a patch from Henrik for VXLAN support in Suricata. The patch does not need to be installed, but how big is it, how complex is it, could you or your organisation to something similar?

Zeek scripts extend the basic engine, and are a big part of the eco-system. Some 1000s of script lines are already included. Do you have a specific need to analyze in your network which could be implemented in this?

Hints:
Earlier it was quite hard to write C programs for creating and analyzing network traffic. Today we can use the Zeek scripting and Suricata rules to analyze traffic using highly efficient engines.

Solution:
Which tool is easiest to expand, what are you missing from them?

Discussion:

To repeat:
Whenever there is a new internet wide security incident there are people providing IDS rules in Snort or Suricata format. Since Suricata can read snort rules, this is a good way to add up-to-date rules to your installation.

Would you be able to write a rule for something attacking your network?

Exercise 36

Bonus: Indicators of Compromise

Objective:
Indicators of Compromise is a term used for artifacts observed in networks or systems which indicate that a system was compromised.

This could be a known DNS domain where a specifc malware is downloaded from, a specific file name downloaded, a TCP connection to a malware control and command server.

`https://en.wikipedia.org/wiki/Indicator_of_compromise`

Purpose:
The purpose of this exercise is to look at the data gathered and to start planning how one could use this with IOCs to perform after-the-fact analysis of your network.

Goal is to answer how an attack got in, when was the first device compromised etc.

Suggested method:
Look at the data provided by Zeek and Suricata, list the files again.

Which parts will be of greatest interest in your networks? Could some of these facts have helped prevent, restrict, limit or otherwise improve your security stance?

Hints:
I think Suricata and Zeek has excellent value just by turning them on.

Solution:
There is no one solution fits all, results are expected to vary from network to network.

Discussion:
Zeek can include data from other sources, check the intel module
https://www.bro.org/sphinx/frameworks/intel.html

and the exercise https://www.bro.org/current/exercises/intel/index.html

Would this need to be updated every day to have value? How do we demonstrate return on investment and benefit from looking at traffic?

Exercise 37

Bonus: VXLAN Detection

Objective:
One recent addition to many networks are cloud environments using tunneling and encapsulation to connect islands of containers and virtual systems.

One such protocol named VXLAN can be used without the network people being involved, which can be bad for security. Also it would be easy for an attacker which have compromised a system to use this for exfiltration of data.

So, do you have any VXLAN traffic in your network?

Purpose:
The main idea of this exercise is to talk about unknown traffic, that which you dont even know exist in your network. Some networks have tunnels and IPv6, but the network and security might not be fully aware of this.

Suggested method:
VXLAN traffic will most likely use the default port 4789, which is not used by much other traffic.

VXLAN is also UDP packets, so analysing if a few endpoints use a LOT of UDP might reveal interesting stuff.

Hints:
The conn.log might show you interesting things about such traffic.

Solution:
We dont have a VXLAN tunnel, but it is very easy to add a VXLAN interface to a Linux server, and start sending data out.

Discussion:
Which protocols are the most dangerous, and why?

Exercise 38

Logning med syslogd og syslog.conf

Objective:
See how server syslog is configured on regular Unix/Linux

Purpose:
The main idea of this exercise is to understand how easy network connected systems can send log data.

Suggested method:
Log into your local Linux systems or network devices, see how syslog is configured.

Hints:
Look in the config file, may be in /etc/syslog or /etc/syslog-ng/syslog-ng.conf

Sample output from old-skool syslogd

```
*.err;kern.debug;auth.notice;authpriv.none;mail.crit    /dev/console
*.notice;auth,authpriv,cron,ftp,kern,lpr,mail,user.none /var/log/messages
kern.debug;user.info;syslog.info                        /var/log/messages
auth.info                                               /var/log/authlog
authpriv.debug                                          /var/log/secure
...
# Uncomment to log to a central host named "loghost".
#*.notice;auth,authpriv,cron,ftp,kern,lpr,mail,user.none        @loghost
#kern.debug,user.info,syslog.info                               @loghost
#auth.info,authpriv.debug,daemon.info                           @loghost
```

Solution:
When you understand how to configure syslog from a couple of devices and has looked up which protocol and port it uses. (default is 514/udp)

Discussion:
There are syslog senders for Windows too.

Appendix A

Host information

- You should note the IP-addresses used for servers and devices
- The web server for installing programs:
  http:// . . . /public/windows/
- Server used for team login: . . .
  Available usernames: team1, team2, ... team10 password: `team`
- You can obtain root access using: `sudo -s`

Available servers and devices:

- IP: . . . - OpenBSD router
- IP: . . . - Your laptop
- IP: . . . - Your laptop VM
- IP: . . . -
- IP: . . . -