TShark

Network Packet Analysis

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Abstract

TShark is a well-known network protocol analyzer that allows us to capture data packets from a live network and read or analyze previously captured data packets from a saved file.

In this report, we will cover TShark's statistical functionalities and explore different ways to sort our traffic capture for faster and more effective analysis. Additionally, we will discuss TShark's reporting functionalities and share some extra tips we discovered while experimenting with TShark.

Disclaimer: This report is provided for educational and informational purpose only (Penetration Testing). Penetration Testing refers to legal intrusion tests that aim to identify vulnerabilities and improve cybersecurity, rather than for malicious purposes.

Network Packet Analysis

Network traffic

As we know, network traffic or data traffic is the amount of data transferring across the network at some given point of time. Network data, in computer networks, is in the form of network data packets. Analyzing these network packets provides network security as it helps us to monitor traffic. As a benefit, if there is some unusual amount of data traffic in a network which is a possible sign of an attack then TShark can help us know before it too late and the attack can be terminated as data traffic reports provide insights into preventing some good attacks.

Traffic volume is a term which comes under network traffic analyzing. Network traffic volume is the measure of the total work done. It is defined as the average data traffic intensity and time period of its network data packet study.

Introduction to TShark

TShark, a well-known and powerful command-line tool and is used as a network analyzer. It is developed by Wireshark. It's working structure is quite similar to Tcpdump, but it has some powerful decoders and filters. TShark is capable of capturing the data packets information of different network layers and display them in different formats.

TShark is used to analyze real-time network traffic and it can read .pcap files to analyze the information, dig into the details of those connections, helping security professionals to identify their network problem.

TShark is a command-line based tool, which can do anything that Wireshark does. So let us start our learning process with TShark and therefore launch this tool and explore its options. To check out all the parameters, use the following command:

```
tshark -h
```

```
root@kali:~# tshark -h
Running as user "root" and group "root". This could be dangerous.
TShark (Wireshark) 3.0.5 (Git v3.0.5 packaged as 3.0.5-1)
Dump and analyze network traffic.
See https://www.wireshark.org for more information.

Usage: tshark [options] ...

Capture interface:
  -i <interface>           name or idx of interface (def: first non-loopback)
  -f <capture filter>      packet filter in libpcap filter syntax
  -s <snaplen>             packet snapshot length (def: appropriate maximum)
  -p                       don't capture in promiscuous mode
  -I                       capture in monitor mode, if available
  -B <buffer size>         size of kernel buffer (def: 2MB)
  -y <link type>           link layer type (def: first appropriate)
  --time-stamp-type <type> timestamp method for interface
  -D                       print list of interfaces and exit
  -L                       print list of link-layer types of iface and exit
  --list-time-stamp-types  print list of timestamp types for iface and exit

Capture stop conditions:
  -c <packet count>        stop after n packets (def: infinite)
  -a <autostop cond.> ...  duration:NUM - stop after NUM seconds
                           filesize:NUM - stop this file after NUM KB
                              files:NUM - stop after NUM files
Capture output:
  -b <ringbuffer opt.> ... duration:NUM - switch to next file after NUM secs
                           interval:NUM - create time intervals of NUM secs
                           filesize:NUM - switch to next file after NUM KB
                              files:NUM - ringbuffer: replace after NUM files
Input file:
  -r <infile⟼              set the filename to read from (or '-' for stdin)

Processing:
  -2                       perform a two-pass analysis
  -M <packet count>        perform session auto reset
  -R <read filter>         packet Read filter in Wireshark display filter syntax
                           (requires -2)
  -Y <display filter>      packet displaY filter in Wireshark display filter
                           syntax
  -n                       disable all name resolutions (def: all enabled)
  -N <name resolve flags>  enable specific name resolution(s): "mnNtdv"
  -d <layer_type>==<selector>,<decode_as_protocol> ...
                           "Decode As", see the man page for details
                           Example: tcp.port==8888,http
  -H <hosts file>          read a list of entries from a hosts file, which will
```

List interfaces

TShark prints a list of the interfaces whose traffic it can capture. Each interface is referred to by their serial number and as you can see it is followed by a text description of the network interface. These interfaces can be specified using **-i parameter**; which is used to specify the network whose traffic we want to capture. And to check out these interfaces you can use the **parameter -D** as shown in the image below:

```
tshark -D
```

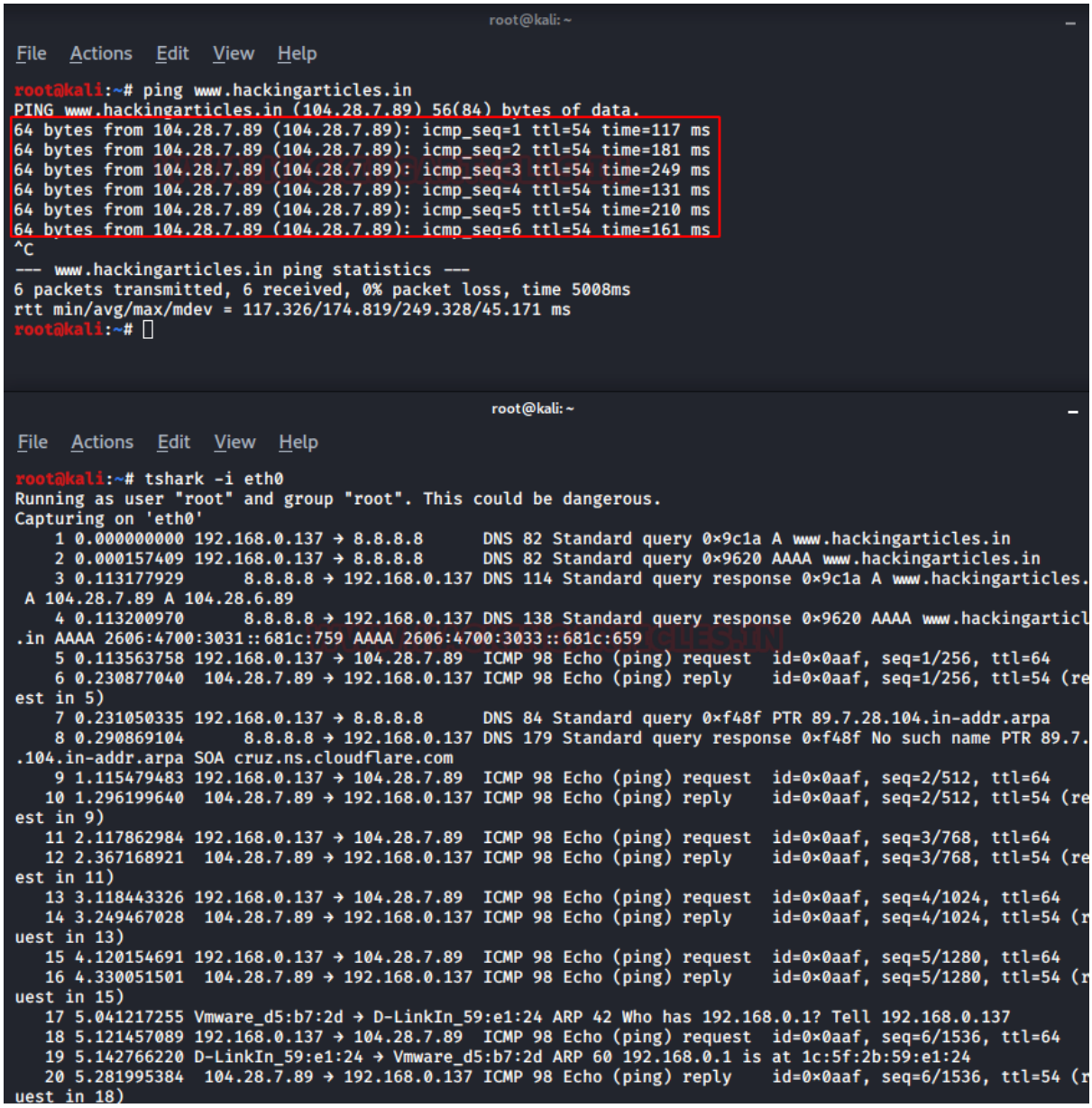
```
root@kali:~# tshark -D
Running as user "root" and group "root". This could be dangerous.
1. eth0
2. lo (Loopback)
3. any
4. nflog
5. nfqueue
6. ciscodump (Cisco remote capture)
7. dpauxmon (DisplayPort AUX channel monitor capture)
8. randpkt (Random packet generator)
9. sdjournal (systemd Journal Export)
10. sshdump (SSH remote capture)
11. udpdump (UDP Listener remote capture)
```

Capture traffic

Let's now try to capture traffic, we have various choice of interface to capture traffic and therefore one can choose whichever depending on their needs and requirement. But in our scenario, the interface which we are going to use is "eth0". In order to capture traffic, we need to initiate one too as we are testing on a controlled network and for that use ping command and then to capture traffic, we have to just specify the interface name by using -i parameter as shown in the image below:

```
ping www.hackingarticles.in

tshark -i eth0
```



As we can clearly see it is performing its three-way handshake, then starts the process of ICMP request and reply.

Promiscuous mode

In the networking, promiscuous mode is used as an interface controller that causes TShark to pass all the traffic it receives to the CPU rather than passing the frames to the promiscuous mode is normally used for packet sniffing that can take place on a router or on a computer connected to a wired network or a part of LAN.

When using this mode, we will need to configure it with the help of ifconfig so that it let us capture the data packets of the whole network. Therefore, we will start by pinging a website and try to capture its data packets.

```
victim@ubuntu:~$ ping www.hackingarticles.in
PING www.hackingarticles.in (104.28.7.89) 56(84) bytes of data.
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=1 ttl=54 time=194 ms
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=2 ttl=54 time=244 ms
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=3 ttl=54 time=301 ms
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=4 ttl=54 time=235 ms
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=5 ttl=54 time=196 ms
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=6 ttl=54 time=116 ms
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=7 ttl=54 time=183 ms
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=8 ttl=54 time=217 ms
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=9 ttl=54 time=149 ms
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=10 ttl=54 time=201 ms
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=11 ttl=54 time=177 ms
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=12 ttl=54 time=355 ms
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=13 ttl=54 time=245 ms
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=14 ttl=54 time=305 ms
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=15 ttl=54 time=153 ms
64 bytes from 104.28.7.89 (104.28.7.89): icmp_seq=16 ttl=54 time=254 ms
```

Now, configure the promiscuous mode by following these commands and try to capture the packets:

```
ifconfig eth0 promisc

tshark -i eth0
```

```
root@kali:~# ifconfig eth0 promisc
root@kali:~# tshark -i eth0
Running as user "root" and group "root". This could be dangerous.
Capturing on 'eth0'
    1 0.000000000  192.168.0.6 → 104.28.6.89  ICMP 98 Echo (ping) request  id=0×1b86, seq=95/2432
    2 0.136847861  104.28.6.89 → 192.168.0.6  ICMP 98 Echo (ping) reply    id=0×1b86, seq=95/2432
    3 0.767140702 fe80::8dcf:3961:7c07:7841 → ff02::fb     MDNS 180 Standard query 0×0000 PTR _ft
._tcp.local, "QM" question PTR _sftp-ssh._tcp.local, "QM" question PTR _webdavs._tcp.local, "QM"
    4 0.767158404  192.168.0.6 → 224.0.0.251  MDNS 160 Standard query 0×0000 PTR _ftp._tcp.local,
"QM" question PTR _sftp-ssh._tcp.local, "QM" question PTR _webdavs._tcp.local, "QM" question PTR
    5 0.767231655 fe80::20c:29ff:fed5:b72d → ff02::1:ff00:0 ICMPv6 86 Neighbor Solicitation for :
    6 1.001500570  192.168.0.6 → 104.28.6.89  ICMP 98 Echo (ping) request  id=0×1b86, seq=96/2457
    7 1.232830355  104.28.6.89 → 192.168.0.6  ICMP 98 Echo (ping) reply    id=0×1b86, seq=96/2457
    8 2.002672796  192.168.0.6 → 104.28.6.89  ICMP 98 Echo (ping) request  id=0×1b86, seq=97/2483
    9 2.534998232  104.28.6.89 → 192.168.0.6  ICMP 98 Echo (ping) reply    id=0×1b86, seq=97/2483
   10 3.003729111  192.168.0.6 → 104.28.6.89  ICMP 98 Echo (ping) request  id=0×1b86, seq=98/2508
   11 3.151781403  104.28.6.89 → 192.168.0.6  ICMP 98 Echo (ping) reply    id=0×1b86, seq=98/2508
   12 4.005684733  192.168.0.6 → 104.28.6.89  ICMP 98 Echo (ping) request  id=0×1b86, seq=99/2534
   13 4.221686910  104.28.6.89 → 192.168.0.6  ICMP 98 Echo (ping) reply    id=0×1b86, seq=99/2534
   14 4.366369429 OneplusT_55:6d:66 → Broadcast    ARP 60 Who has 192.168.0.1? Tell 192.168.0.7
^C   15 5.006460197  192.168.0.6 → 104.28.6.89  ICMP 98 Echo (ping) request  id=0×1b86, seq=100/2
```

Packet count

TShark has amazing features with which we can work more efficiently and we can access these features using various parameters. One such parameter is '-c', it lets us capture the exact amount of data that we require and it will display only those. This option helps us to refine the outcome of captured traffic.

```
tshark -i eth0 -c 10
```

```
root@kali:~# tshark -i eth0 -c 10
Running as user "root" and group "root". This could be dangerous.
Capturing on 'eth0'
    1 0.000000000  192.168.0.6 → 104.28.6.89  ICMP 98 Echo (ping) request  id=0x1b86, seq=229/58624, ttl=64
    2 0.127784373  104.28.6.89 → 192.168.0.6  ICMP 98 Echo (ping) reply    id=0x1b86, seq=229/58624, ttl=54
    3 1.002006605  192.168.0.6 → 104.28.6.89  ICMP 98 Echo (ping) request  id=0x1b86, seq=230/58880, ttl=64
    4 1.593946941  104.28.6.89 → 192.168.0.6  ICMP 98 Echo (ping) reply    id=0x1b86, seq=230/58880, ttl=54
    5 2.001915094  192.168.0.6 → 104.28.6.89  ICMP 98 Echo (ping) request  id=0x1b86, seq=231/59136, ttl=64
    6 2.128636261  104.28.6.89 → 192.168.0.6  ICMP 98 Echo (ping) reply    id=0x1b86, seq=231/59136, ttl=54
    7 3.004203532  192.168.0.6 → 104.28.6.89  ICMP 98 Echo (ping) request  id=0x1b86, seq=232/59392, ttl=64
    8 3.223162729  104.28.6.89 → 192.168.0.6  ICMP 98 Echo (ping) reply    id=0x1b86, seq=232/59392, ttl=54
    9 4.005788203  192.168.0.6 → 104.28.6.89  ICMP 98 Echo (ping) request  id=0x1b86, seq=233/59648, ttl=64
   10 4.152214242  104.28.6.89 → 192.168.0.6  ICMP 98 Echo (ping) reply    id=0x1b86, seq=233/59648, ttl=54
10 packets captured
```

As we can clearly see in the image above that it stops after the 10 counts.

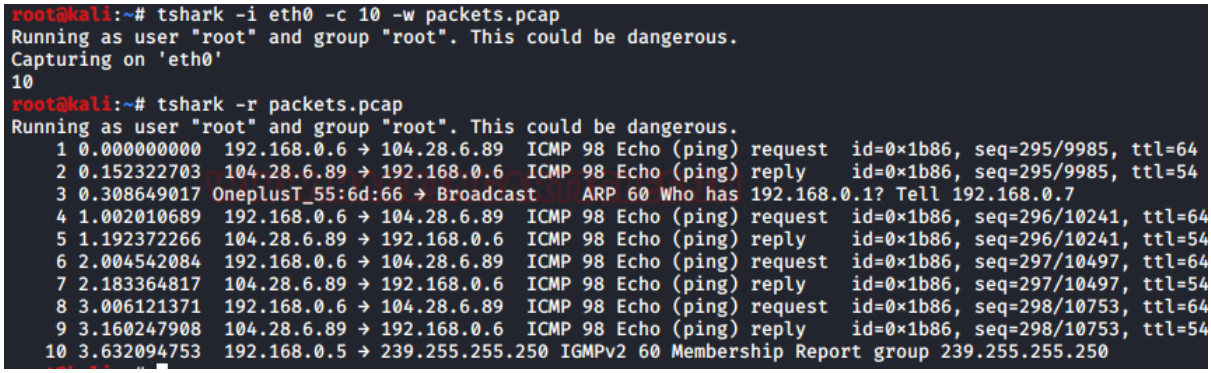
Read and Write in a file

In TShark we can write and read into .pcap file. Write option (-w) allows us to write raw packet data output to a standard .pcap file whereas read option (-r) help us to read that raw output data packets in our desired manner. To write the packets into a .pcap file use the following command:

```
tshark -i eth0 -c 10 -w packets.pcap
```

And to read the said .pcap file use the following command:

```
tshark -r packets.pcap
```



Verbose mode

The verbose mode provides us with additional details of a packet in traffic. Using the verbose mode, we can see the information that each packet contains and for this option we can use the **parameter -V.**

```
tshark -r packets.pcap -V
```

```
root@kali:~# tshark -r packets.pcap -V
Running as user "root" and group "root". This could be dangerous.
Frame 1: 98 bytes on wire (784 bits), 98 bytes captured (784 bits)
    Interface id: 0 (eth0)
        Interface name: eth0
    Encapsulation type: Ethernet (1)
    Arrival Time: Jan 28, 2020 11:38:48.841685525 EST
    [Time shift for this packet: 0.000000000 seconds]
    Epoch Time: 1580229528.841685525 seconds
    [Time delta from previous captured frame: 0.000000000 seconds]
    [Time delta from previous displayed frame: 0.000000000 seconds
    [Time since reference or first frame: 0.000000000 seconds]
    Frame Number: 1
    Frame Length: 98 bytes (784 bits)
    Capture Length: 98 bytes (784 bits)
    [Frame is marked: False]
    [Frame is ignored: False]
    [Protocols in frame: eth:ethertype:ip:icmp:data]
Ethernet II, Src: D-LinkIn_59:e1:24 (1c:5f:2b:59:e1:24), Dst: Vmwa
    Destination: Vmware_10:c6:1b (00:0c:29:10:c6:1b)
        Address: Vmware_10:c6:1b (00:0c:29:10:c6:1b)
        .... ..0. .... .... .... .... = LG bit: Globally unique ad
        .... ...0 .... .... .... .... = IG bit: Individual address
    Source: D-LinkIn_59:e1:24 (1c:5f:2b:59:e1:24)
        Address: D-LinkIn_59:e1:24 (1c:5f:2b:59:e1:24)
        .... ..0. .... .... .... .... = LG bit: Globally unique ad
        .... ...0 .... .... .... .... = IG bit: Individual address
    Type: IPv4 (0x0800)
Internet Protocol Version 4, Src: 104.28.6.89, Dst: 192.168.0.6
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
        0000 00.. = Differentiated Services Codepoint: Default (0)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capa
    Total Length: 84
    Identification: 0x1f72 (8050)
    Flags: 0x0000
        0... .... .... .... = Reserved bit: Not set
        .0.. .... .... .... = Don't fragment: Not set
        ..0. .... .... .... = More fragments: Not set
        ...0 0000 0000 0000 = Fragment offset: 0
    Time to live: 54
```

Output formats

For our convenience, in TShark, we have -T option that lets us save decoded packets in various output formats. It can set the format of the output in the way that it becomes easy to understand. To see all the available options, type the following command:

```
tshark -T x
```

```
root@kali:~# tshark -T x
Running as user "root" and group "root". This could be dangerous.
tshark: Invalid -T parameter "x"; it must be one of:
        "fields"  The values of fields specified with the -e option, in a form
                  specified by the -E option.
        "pdml"    Packet Details Markup Language, an XML-based format for the
                  details of a decoded packet. This information is equivalent to
                  the packet details printed with the -V flag.
        "ps"      PostScript for a human-readable one-line summary of each of
                  the packets, or a multi-line view of the details of each of
                  the packets, depending on whether the -V flag was specified.
        "psml"    Packet Summary Markup Language, an XML-based format for the
                  summary information of a decoded packet. This information is
                  equivalent to the information shown in the one-line summary
                  printed by default.
        "json"    Packet Summary, an JSON-based format for the details
                  summary information of a decoded packet. This information is
                  equivalent to the packet details printed with the -V flag.
        "jsonraw" Packet Details, a JSON-based format for machine parsing
                  including only raw hex decoded fields (same as -T json -x but
                  without text decoding, only raw fields included).
        "ek"      Packet Details, an EK JSON-based format for the bulk insert
                  into elastic search cluster. This information is
                  equivalent to the packet details printed with the -V flag.
        "text"    Text of a human-readable one-line summary of each of the
                  packets, or a multi-line view of the details of each of the
                  packets, depending on whether the -V flag was specified.
                  This is the default.
        "tabs"    Similar to the text report except that each column of the
                  human-readable one-line summary is delimited with an ASCII
                  horizontal tab character.
```

PDML

PDML stands for **Packet Details Mark-Up Language** which is an XML based. This information is quite equivalent to the verbose mode which we used earlier. And to have output in this format type the following command:

```
tshark -r packets.pcap -T pdml
```

```
root@kali:~# tshark -r packets.pcap -T pdml
Running as user "root" and group "root". This could be dangerous.
<?xml version="1.0" encoding="utf-8"?>
<?xml-stylesheet type="text/xsl" href="pdml2html.xsl"?>
<!-- You can find pdml2html.xsl in /usr/share/wireshark or at https://code.wireshark.org/
w/gitweb?p=wireshark.git;a=blob_plain;f=pdml2html.xsl. -->
<pdml version="0" creator="wireshark/3.0.5" time="Tue Jan 28 11:46:48 2020" capture_file=
ets.pcap">
<packet>
  <proto name="geninfo" pos="0" showname="General information" size="98">
    <field name="num" pos="0" show="1" showname="Number" value="1" size="98" />
    <field name="len" pos="0" show="98" showname="Frame Length" value="62" size="98" />
    <field name="caplen" pos="0" show="98" showname="Captured Length" value="62" size="98
    <field name="timestamp" pos="0" show="Jan 28, 2020 11:46:40.459901028 EST" showname="
red Time" value="1580230000.459901028" size="98" />
  </proto>
  <proto name="frame" showname="Frame 1: 98 bytes on wire (784 bits), 98 bytes captured (
its) on interface 0" size="98" pos="0">
    <field name="frame.interface_id" showname="Interface id: 0 (eth0)" size="0" pos="0" s
0">
      <field name="frame.interface_name" showname="Interface name: eth0" size="0" pos="0"
="eth0" />
    </field>
    <field name="frame.encap_type" showname="Encapsulation type: Ethernet (1)" size="0" p
" show="1" />
    <field name="frame.time" showname="Arrival Time: Jan 28, 2020 11:46:40.459901028 EST"
="0" pos="0" show="Jan 28, 2020 11:46:40.459901028 EST" />
    <field name="frame.offset_shift" showname="Time shift for this packet: 0.000000000 se
" size="0" pos="0" show="0.000000000" />
    <field name="frame.time_epoch" showname="Epoch Time: 1580230000.459901028 seconds" si
" pos="0" show="1580230000.459901028" />
```

PS

PS stands for **PostScript**. This output is in a form of one-liner summary of each data packets or multi-line detail view of each data packets depending upon each data packet specification. These one-liners are very quick to understand as well as reliable. For this, use the following command:

```
tshark -r packets.pcap -T ps
```

```
root@kali:~# tshark -r packets.pcap -T ps
Running as user "root" and group "root". This could be dangerous.
%!
%!PS-Adobe-2.0
%
% Wireshark - Network traffic analyzer
% By Gerald Combs <gerald@wireshark.org>
% Copyright 1998 Gerald Combs
%
%%Creator: Wireshark
%%Title: Wireshark output
%%DocumentFonts: Helvetica Monaco
%%EndComments
%!

%
% Ghostscript http://ghostscript.com/ can convert postscript to pdf files.
%
% To convert this postscript file to pdf, type (for US letter format):
% ps2pdf filename.ps
%
% or (for A4 format):
% ps2pdf -sPAPERSIZE=a4 filename.ps
%
%  ... and of course replace filename.ps by your current filename.
%
% The pdfmark's below will help converting to a pdf file, and have no
% effect when printing the postscript directly.
%
```


PSML

PSML stands for **Packet Summary Mark-Up Language**. It is also an XML based format like PDML which summarises the detailed information of the packets. And for this format type:

```
tshark -r packets.pcap -T psml
```

```
root@kali:~# tshark -r packets.pcap -T psml
Running as user "root" and group "root". This could be dangerous.
<?xml version="1.0" encoding="utf-8"?>
<psml version="0" creator="wireshark/3.0.5">
<structure>
<section>No.</section>
<section>Time</section>
<section>Source</section>
<section>Destination</section>
<section>Protocol</section>
<section>Length</section>
<section>Info</section>
</structure>

<packet>
<section>1</section>
<section>0.000000000</section>
<section>192.168.0.6</section>
<section>104.28.6.89</section>
<section>ICMP</section>
<section>98</section>
<section>Echo (ping) request  id=0x1b86, seq=1541/1286, ttl=64</s
</packet>

<packet>
<section>2</section>
<section>0.209711164</section>
<section>104.28.6.89</section>
<section>192.168.0.6</section>
```

JSON

JSON stands for Java-Script Object Notation. It is an open standard file format that displays text in a readable form. The information in this format is fully documented and referred at wolfram. To see that packet in this format, type:

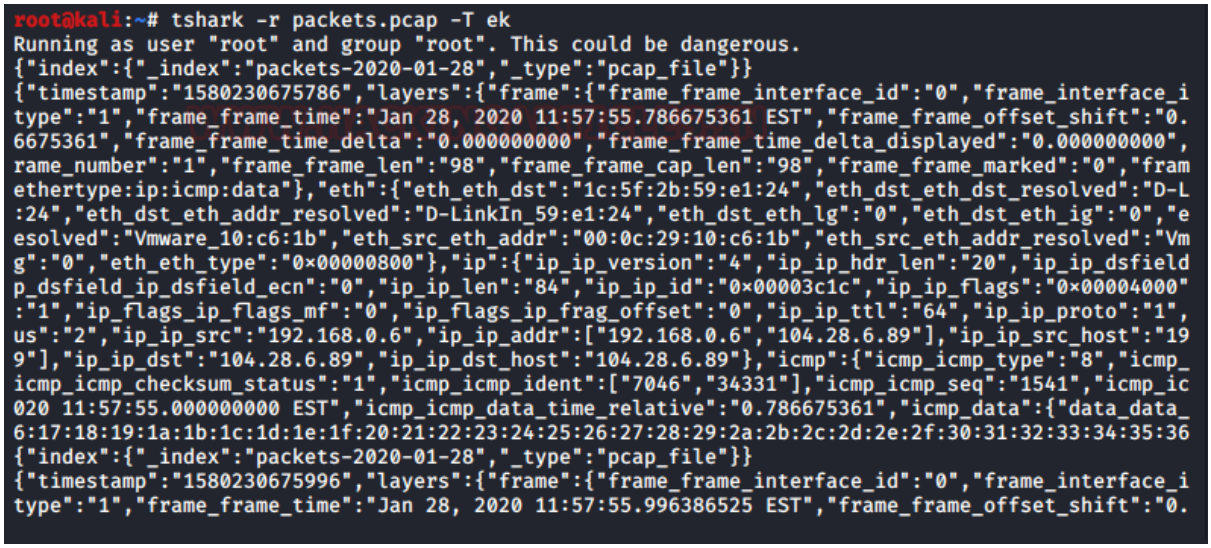
```
tshark -r packets.pcap -T json
```

```
root@kali:~# tshark -r packets.pcap -T json
Running as user "root" and group "root". This could be dangerous.
[
  {
    "_index": "packets-2020-01-28",
    "_type": "pcap_file",
    "_score": null,
    "_source": {
      "layers": {
        "frame": {
          "frame.interface_id": "0",
          "frame.interface_id_tree": {
            "frame.interface_name": "eth0"
          },
          "frame.encap_type": "1",
          "frame.time": "Jan 28, 2020 11:57:55.786675361 EST",
          "frame.offset_shift": "0.000000000",
          "frame.time_epoch": "1580230675.786675361",
          "frame.time_delta": "0.000000000",
          "frame.time_delta_displayed": "0.000000000",
          "frame.time_relative": "0.000000000",
          "frame.number": "1",
          "frame.len": "98",
          "frame.cap_len": "98",
          "frame.marked": "0",
          "frame.ignored": "0",
          "frame.protocols": "eth:ethertype:ip:icmp:data"
        },
        "eth": {
          "eth.dst": "1c:5f:2b:59:e1:24",
          "eth.dst_tree": {
```

EK

It is newline delimited JSON format function for bulk import into the elastic search option. And for this format use the following command:

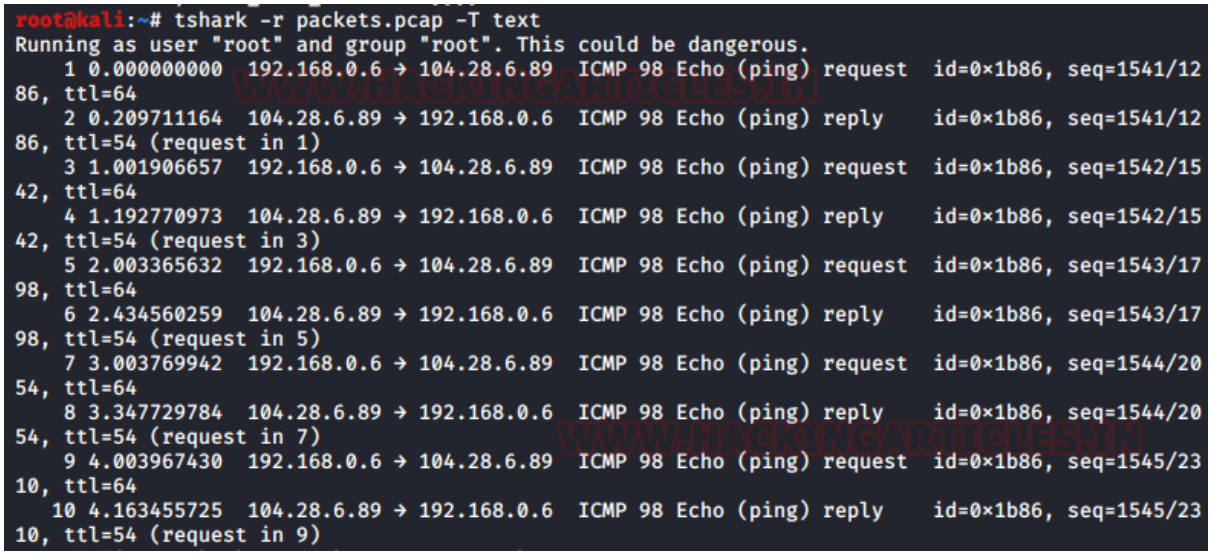
```
tshark -r packets.pcap -T ek
```



Text

Text is a human-readable one lines summary of each of the packets. This is the simplest of the formats. And for this, use the following command:

```
tshark -r packets.pcap -T text
```



Tabs

This option is quite similar to the text except, it includes an ASCII horizontal tab (oxo9) character as the delimiter between each column. To try this, type:

```
tshark -r packets.pcap -T tabs
```

```
root@kali:~# tshark -r packets.pcap -T tabs
Running as user "root" and group "root". This could be dangerous.
    1   0.000000000      192.168.0.6    →       104.28.6.89     ICMP    98      Echo (ping) reque
st  id=0x1b86, seq=1541/1286, ttl=64
    2   0.209711164      104.28.6.89    →       192.168.0.6     ICMP    98      Echo (ping) reply
    id=0x1b86, seq=1541/1286, ttl=54 (request in 1)
    3   1.001906657      192.168.0.6    →       104.28.6.89     ICMP    98      Echo (ping) reque
st  id=0x1b86, seq=1542/1542, ttl=64
    4   1.192770973      104.28.6.89    →       192.168.0.6     ICMP    98      Echo (ping) reply
    id=0x1b86, seq=1542/1542, ttl=54 (request in 3)
    5   2.003365632      192.168.0.6    →       104.28.6.89     ICMP    98      Echo (ping) reque
st  id=0x1b86, seq=1543/1798, ttl=64
    6   2.434560259      104.28.6.89    →       192.168.0.6     ICMP    98      Echo (ping) reply
    id=0x1b86, seq=1543/1798, ttl=54 (request in 5)
    7   3.003769942      192.168.0.6    →       104.28.6.89     ICMP    98      Echo (ping) reque
st  id=0x1b86, seq=1544/2054, ttl=64
    8   3.347729784      104.28.6.89    →       192.168.0.6     ICMP    98      Echo (ping) reply
    id=0x1b86, seq=1544/2054, ttl=54 (request in 7)
    9   4.003967430      192.168.0.6    →       104.28.6.89     ICMP    98      Echo (ping) reque
st  id=0x1b86, seq=1545/2310, ttl=64
   10   4.163455725      104.28.6.89    →       192.168.0.6     ICMP    98      Echo (ping) reply
    id=0x1b86, seq=1545/2310, ttl=54 (request in 9)
```

Decoded Packets Vs. Encoded Packets

When we try to write the live data packets in a pcap format file; we compress all that data packets in smaller segments. To better understand these data packets, we need to decode them which leads to a difference in the size of the file and to check the size of any given file at the given moment use the following command:

```
ls -lh packets.p*
```

```
root@kali:~# ls -lh packets.p*
-rw------- 1 root root 624 Jan 28 11:46 packets.pcap
-rw-r--r-- 1 root root 21K Jan 28 11:49 packets.pdml
```

Like we discussed there is a huge difference in these files, that's why we use decoding techniques to extract this information.

Converting PDML file HTML page

The only difference between the Wireshark and TShark is that Wireshark is a GUI based tool and TShark is a command-line based tool. But with the help of some external source, we can also view our data packets in HTML. So, to achieve that first, we need to save our data packets in PDML format and then convert it into an XML file using the following command:

```
tshark -r packets.pcap -T pdml > packets.xml
```

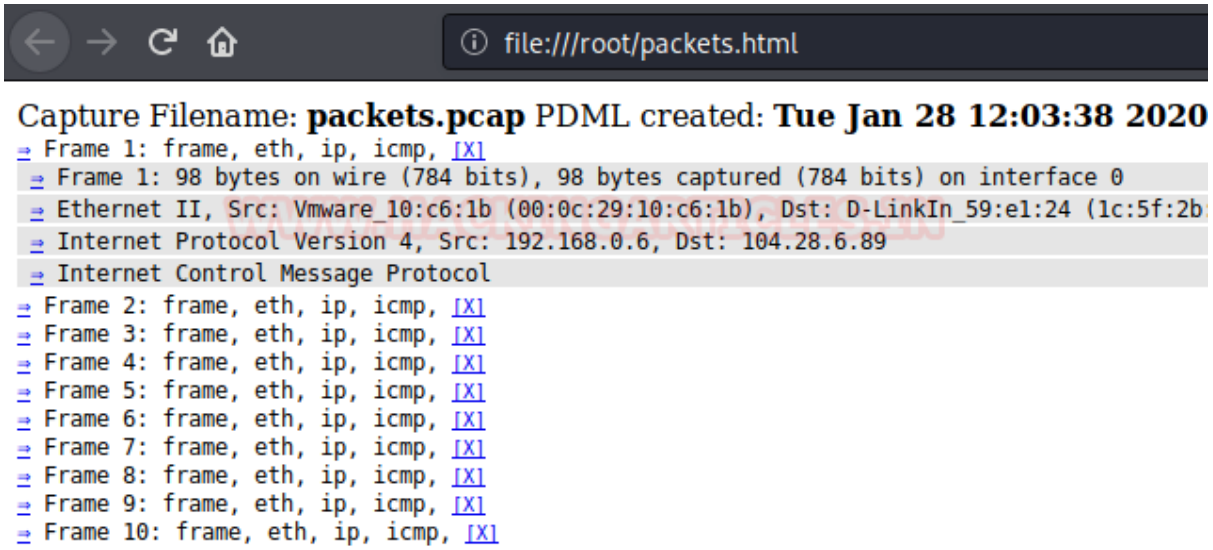
The XML file will be saved at location **/usr/share/wireshark/pdml2html.xsl.** So, we are going to use **xsltproc tool** to execute this file it which will help us to create our HTML page. Creating the HTML page will format all the unnecessary information and only let us view the usable data. To create the HTML use following command:

```
xsltproc /usr/share/wireshark/pdml2html.xsl packets.xml > packets.html
```

```
root@kali:~# tshark -r packets.pcap -T pdml > packets.xml
Running as user "root" and group "root". This could be dangerous.
root@kali:~# xsltproc /usr/share/wireshark/pdml2html.xsl packets.xml > packets.html
root@kali:~# firefox packets.html &
[1] 3554
```

To open the HTML page in the browser, refer to the above image and use the following command:

```
firefox packets.html &
```



Capturing packets of a particular port

A lot of times we use Wireshark on a dedicated port. And by using the -f option we can capture data packets of a particular port. It helps us to better analyze the data packets of the network. We are using this feature to capture TCP port 80 and the command for this is:

```
tshark -i eth0 -c 5 -f "tcp port 80"
```

```
root@kali:~# tshark -i eth0 -c 5 -f "tcp port 80"
Running as user "root" and group "root". This could be dangerous.
Capturing on 'eth0'
    1 0.000000000 192.168.0.137 → 216.58.196.99 TCP 66 44084 → 80 [ACK] Seq=1 Ack=1 Win=501 Le
n=0 TSval=1654711984 TSecr=2257786848
    2 0.000114735 192.168.0.137 → 216.58.196.99 TCP 66 44088 → 80 [ACK] Seq=1 Ack=1 Win=501 Le
n=0 TSval=1654711984 TSecr=1873411796
    3 0.000181040 192.168.0.137 → 216.58.196.99 TCP 66 44020 → 80 [ACK] Seq=1 Ack=1 Win=501 Le
n=0 TSval=1654711984 TSecr=1912130170
    4 0.082268726 216.58.196.99 → 192.168.0.137 TCP 66 [TCP ACKed unseen segment] 80 → 44084 [
ACK] Seq=1 Ack=2 Win=248 Len=0 TSval=2257797106 TSecr=1654660892
    5 0.082288921 216.58.196.99 → 192.168.0.137 TCP 66 [TCP ACKed unseen segment] 80 → 44020 [
ACK] Seq=1 Ack=2 Win=252 Len=0 TSval=1912140428 TSecr=1654660942
5 packets captured
```

Display filter

Display filter was introduced by Wireshark. It helps us to filter the captured data packets or live data packets. With the help of this filter, we can request for any kind of filter that we want to capture in the live environment.

In our scenario, we apply the GET request filter to capture only GET request from the traffic and for, use the following command:

```
tshark -i eth0 -c 5 -f "tcp port 80" -Y 'http.request.method == "GET"'
```

```
root@kali:~# tshark -i eth0  -f "tcp port 80" -Y 'http.request.method == "GET" '
Running as user "root" and group "root". This could be dangerous.
Capturing on 'eth0'
   10 2.409241258 192.168.0.137 → 176.28.50.165 HTTP 445 GET / HTTP/1.1
   14 2.660232261 192.168.0.137 → 176.28.50.165 HTTP 465 GET /style.css HTTP/1.1
   18 2.916155632 192.168.0.137 → 176.28.50.165 HTTP 467 GET /images/logo.gif HTT
   22 4.140393060 192.168.0.137 → 176.28.50.165 HTTP 445 GET / HTTP/1.1
   26 4.381818253 192.168.0.137 → 176.28.50.165 HTTP 465 GET /style.css HTTP/1.1
   30 4.666101908 192.168.0.137 → 176.28.50.165 HTTP 467 GET /images/logo.gif HTT
   35 5.862037621 192.168.0.137 → 176.28.50.165 HTTP 445 GET / HTTP/1.1
   43 6.349299450 192.168.0.137 → 176.28.50.165 HTTP 465 GET /style.css HTTP/1.1
   49 6.659285080 192.168.0.137 → 176.28.50.165 HTTP 467 GET /images/logo.gif HTT
   56 8.452166611 192.168.0.137 → 176.28.50.165 HTTP 445 GET / HTTP/1.1
   61 8.747440415 192.168.0.137 → 176.28.50.165 HTTP 465 GET /style.css HTTP/1.1
   64 9.021046798 192.168.0.137 → 176.28.50.165 HTTP 467 GET /images/logo.gif HTT
```

Statistical Functionalities

Statistical Options

TShark collects different types of Statistics and displays their result after finishing the reading of the captured file. To accomplish this, we will be using the "-z" parameter with TShark. Initially, to learn about all the different options inside the "-z" parameter, we will be running the TShark with the "-z" parameter followed by the help keyword. This gives us an exhaustive list of various supported formats as shown in the image given below.

```
root@kali:~# tshark -z help
Running as user "root" and group "root". This could be dangerous.
tshark: The available statistics for the "-z" option are:
     afp,srt
     ancp,tree
     ansi_a,bsmap
     ansi_a,dtap
     ansi_map
     bacapp_instanceid,tree
     bacapp_ip,tree
     bacapp_objectid,tree
     bacapp_service,tree
     camel,counter
     camel,srt
     collectd,tree
     conv,bluetooth
     conv,eth
     conv,fc
     conv,fddi
     conv,ip
     conv,ipv6
     conv,ipx
     conv,jxta
     conv,mptcp
     conv,ncp
     conv,rsvp
     conv,sctp
     conv,sll
     conv,tcp
     conv,tr
     conv,udp
     conv,usb
     conv,wlan
     dcerpc,srt
     dests,tree
     dhcp,stat
     diameter,avp
     diameter,srt
     dns,tree
     endpoints,bluetooth
```

Protocol Hierarchy Statistics

Using the TShark we can create a Protocol based Hierarchy Statistics listing the number of packets and bytes using the “io,phs” option in the “-z” parameter. In the case where no filter is given after the “io,phs” option, the statistics will be calculated for all the packets in the scope. But if a specific filter is provided than the TShark will calculate statistics for those packets that match the filter provided by the user. For our demonstration, we first captured some traffic and wrote the contents on a pcap file using the techniques that we learned in part 1 of this article series. Then we will be taking the traffic from the file, and then sort the data into a Protocol Hierarchy. Here we can observe that we have the frames count, size of packets in bytes and the Protocol used for the transmission.

```
tshark -r wlan.pcap -z io,phs
```

```
===================================================================
Protocol Hierarchy Statistics
Filter:

radiotap                                 frames:66690 bytes:15014549
  wlan_radio                             frames:66690 bytes:15014549
    wlan                                 frames:66690 bytes:15014549
      wlan                               frames:6873 bytes:1923747
      data                               frames:14539 bytes:9494059
      llc                                frames:3158 bytes:1295577
        eapol                            frames:6 bytes:1162
        ipv6                             frames:16 bytes:2136
          icmpv6                         frames:16 bytes:2136
        ip                               frames:3124 bytes:1291079
          udp                            frames:143 bytes:25311
            dhcp                         frames:6 bytes:2448
            dns                          frames:126 bytes:21131
            ntp                          frames:3 bytes:444
            mdns                         frames:8 bytes:1288
          icmp                           frames:2 bytes:240
          tcp                            frames:2979 bytes:1265528
            tls                          frames:781 bytes:455386
              tcp.segments               frames:74 bytes:60600
                tls                      frames:62 bytes:53122
            http                         frames:248 bytes:123041
              data-text-lines            frames:9 bytes:6487
                tcp.segments             frames:4 bytes:2696
              image-jfif                 frames:6 bytes:4156
                tcp.segments             frames:6 bytes:4156
              image-gif                  frames:2 bytes:1352
              tcp.segments               frames:3 bytes:1402
            data                         frames:2 bytes:2924
            tcp.segments                 frames:1 bytes:1462
            _ws.malformed                frames:5 bytes:2666
        arp                              frames:12 bytes:1200
===================================================================
```

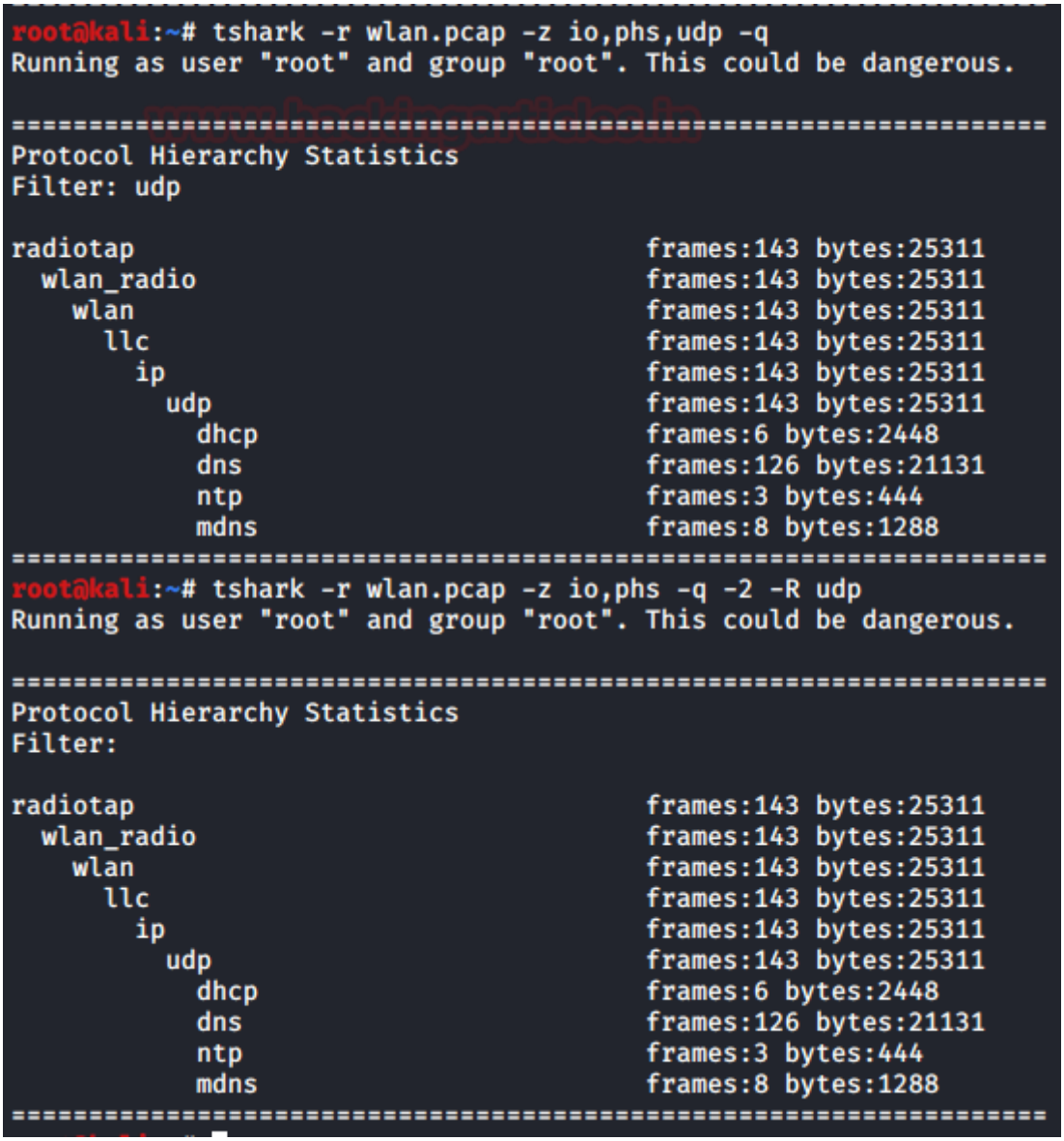
Read Filter Analysis

During the first pass analysis of the packet, the specified filter (which uses the syntax of read/display filters, rather than that of capture filters) has to be applied. Packets which are not matching the filter are not considered for future passes. This parameter makes sense with multiple passes. Note that forward-looking fields such as 'response in frame #' cannot be used with this filter since they will not have been calculated when this filter is applied. The "-2" parameter performs a two-pass analysis. This causes TShark to buffer output until the entire

first pass is done, but allows it to fill in fields that require future knowledge, it also permits reassembly frame dependencies to be calculated correctly. Here we can see two different analysis one of them is first-pass analysis and the latter is the two-pass analysis.

```
tshark -r wlan.pcap -z io,phs,udp -q

tshark -r wlan.pcap -z io,phs -q -2 -R udp
```



Endpoint Analysis

Our next option which helps us with the statistics is the "endpoints". It will create a table that will list all endpoints that could be seen in the capture. The type function which can be used with the endpoint option will specify the endpoint type for which we want to generate the statistics.

The list of Endpoints that are supported by TShark is:

Sno.	Filter	Description
1	**"bluetooth"**	Bluetooth Addresses
2	**"eth"**	Ethernet Addresses
3	**"fc"**	Fiber Channel Addresses
4	**"fddi"**	FDDI Addresses
5	**"ip"**	IPv4 Addresses
6	**"ipv6"**	IPv6 Addresses
7	**"ipx"**	IPX Addresses
8	**"jxta"**	JXTS Addresses
9	**"ncp"**	NCP Addresses
10	**"rsvp"**	RSVP Addresses
11	**"sctp"**	SCTP Addresses
12	**"tcp"**	TCP/IP socket pairs Both IPv4 and IPv6 supported
13	**"tr"**	Token Ring Addresses
14	**"usb"**	USB Addresses
15	**"udp"**	UDP/IP socket pairs Both IPv4 and IPv6 supported
16	**"wlan"**	IEEE 802.11 addresses

In case that we have specified the filter option then the statistics calculations are done for that

```
tshark -r wlan.pcap -z endpoints,wlan -q | head
```

particular specified filter. The table like the one generated in the image shown below is generated by picking up single line form each conversation and displayed against the number of packets per byte in each direction as well as the total number of packets per byte. This table is by default sorted according to the total number of frames.

```
root@kali:~# tshark -r wlan.pcap -z endpoints,wlan -q | head
Running as user "root" and group "root". This could be dangerous.
================================================================================
IEEE 802.11 Endpoints
Filter:<No Filter>
                      |  Packets  | |  Bytes  | | Tx Packets | | Tx Bytes | | Rx Packets
AsustekC_c3:5e:01          18320       9311075        9843        8435055        8477
Tp-LinkT_16:87:18           8962       1644801        4024        1124143        4938
D-LinkIn_5f:81:6b           8122        950847          50           5484        8072
Motorola_31:a0:3b           8079       2137351        6262        1139916        1817
Tp-LinkT_09:7f:d3           7894       6218261        2930         453787        4964
Broadcast                   6444       1728228          18           1164        6426
```

Conversation Analysis

Let's move on to the next option which is quite similar to the previous option. It helps us with the statistics is the "conversation". It will create a table that will list all conversation that could be seen in the capture. The type function which can be used with the conversation option will specify the conversation type for which we want to generate the statistics.

If we have specified the filter option then the statistics calculations are done for that particular specified filter. The table generated by picking up single line form each conversation and displayed against the number of packets per byte in each direction, the total number of packets per byte as well as the direction of the conversation travel. This table is by default sorted according to the total number of frames.

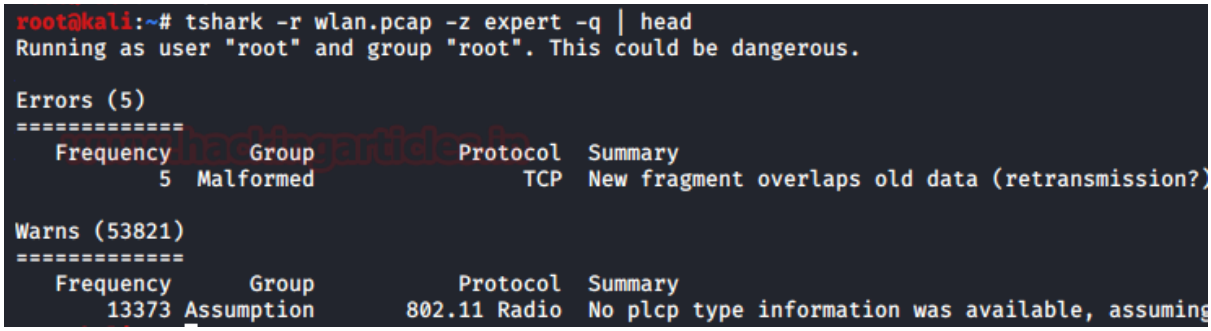
```
tshark -r wlan.pcap -z conv,wlan -q | head
```

```
root@kali:~# tshark -r wlan.pcap -z conv,wlan -q | head
Running as user "root" and group "root". This could be dangerous.
================================================================================
IEEE 802.11 Conversations
Filter:<No Filter>
                                                |       ←       |       →       |     Total     |
                                                | Frames  Bytes | Frames  Bytes | Frames  Bytes |
AsustekC_c3:5e:01     ↔ Tp-LinkT_09:7f:d3         2841   441682    4753  5753274    7594  6194956  15
Motorola_31:a0:3b     ↔ D-LinkIn_5f:81:6b             3      431    3455   696782    3458   697213
Motorola_31:a0:3b     ↔ Tp-LinkT_16:87:18         1566   937369    1689   358208    3255  1295577  15
AsustekC_c3:5e:01     ↔ IntelCor_96:a1:a9          721    91683    2372  2046278    3093  2137961  15
00:51:88:31:a0:3b     ↔ D-LinkIn_5f:81:6b            0        0    2898   144900    2898   144900
```

Expert Mode Analysis

The TShark Statistics Module have an Expert Mode. It collects a huge amount of data based on Expert Info and then prints this information in a specific order. All this data is grouped in the sets of severity like Errors, Warnings, etc., We can use the expert mode with a particular protocol as well. In that case, it will display all the expert items of that particular protocol.

```
tshark -r wlan.pcap -z expert -q | head
```



Packet Distribution Tree

In this option, we take the traffic form a packet and then drive it through the "http,tree" option under the "-z" parameter to count the number of the HTTP requests, their mods as well as the status code. This is a rather modular approach that is very easy to understand and analyse. Here in our case, we took the packet that we captured earlier and then drove it through the tree option that gave us the Information that a total of 126 requests were generated out of which 14 gave back the "200 OK". It means that the rest of them either gave back an error or were redirected to another server giving back a 3XX series status code.

```
tshark -r wlan.pcap -z http,tree -q
```

```
root@kali:~# tshark -r wlan.pcap -z http,tree -q
Running as user "root" and group "root". This could be dangerous.

================================================================================
HTTP/Packet Counter:
Topic / Item                  Count         Average       Min val       Max val       Rate (ms)     Percent
--------------------------------------------------------------------------------
Total HTTP Packets            248                                                   0.0038        100%
 HTTP Request Packets         126                                                   0.0019        50.81%
  GET                         126                                                   0.0019        100.00%
 HTTP Response Packets        122                                                   0.0019        49.19%
  3xx: Redirection            105                                                   0.0016        86.07%
   304 Not Modified           101                                                   0.0015        96.19%
   302 Found                  3                                                     0.0000        2.86%
   301 Moved Permanently      1                                                     0.0000        0.95%
  2xx: Success                17                                                    0.0003        13.93%
   200 OK                     14                                                    0.0002        82.35%
   204 No Content             3                                                     0.0000        17.65%
  ???: broken                 0                                                     0.0000        0.00%
  5xx: Server Error           0                                                     0.0000        0.00%
  4xx: Client Error           0                                                     0.0000        0.00%
  1xx: Informational          0                                                     0.0000        0.00%
 Other HTTP Packets           0                                                     0.0000        0.00%
```

Packet Length Tree

As long as we are talking about the Tree option, let's explore it a bit. We have a large variety of ways in which we can use the tree option in combination with other option. To demonstrate that, we decided to use the packet length option with the tree option. This will sort the data on the basis of the size of the packets and then generate a table with it. Now, this table will not only consist of the length of the packets, but it will also have the count of the packet. The minimum value of the length in the range of the size of the packets. It will also calculate the size as well as the Percentage of the packets inside the range of packet length.

```
tshark -r wlan.pcap -z plen,tree -q
```

```
root@kali:~# tshark -r wlan.pcap -z plen,tree -q
Running as user "root" and group "root". This could be dangerous.

================================================================================
Packet Lengths:
Topic / Item       Count         Average       Min val       Max val       Rate (ms)     Percent
--------------------------------------------------------------------------------
Packet Lengths     66690         225.14        50            1582          0.0004        100%
 0-19              0             -             -             -             0.0000        0.00%
 20-39             0             -             -             -             0.0000        0.00%
 40-79             42235         54.68         50            76            0.0003        63.33%
 80-159            9477          134.43        86            159           0.0001        14.21%
 160-319           6071          257.61        160           317           0.0000        9.10%
 320-639           2724          390.89        320           639           0.0000        4.08%
 640-1279          456           844.38        640           1278          0.0000        0.68%
 1280-2559         5727          1469.77       1280          1582          0.0000        8.59%
 2560-5119         0             -             -             -             0.0000        0.00%
 5120 and greater  0             -             -             -             0.0000        0.00%
```

Color Based Output Analysis

Note: Your terminal must support color output in order for this option to work correctly.

We can enable the coloring of packets according to standard Wireshark color filters. On Windows, colors are limited to the standard console character attribute colors. In this option, we can set up the colors according to the display filter. This helps in quickly locating a specific packet in the bunch of similar packets. It also helps in locating Handshakes in communication traffic. This can be enabled using the following command.

```
tshark -r color.pcap --color
```

```
root@kali:~# tshark -r color.pcap --color
Running as user "root" and group "root". This could be dangerous.
    1 0.000000000  192.168.0.6 → 224.0.0.252  IGMPv2 60 Membership Report group 2
    2 1.308991630 192.168.0.137 → 8.8.8.8      DNS 84 Standard query 0×bd04 A det
    3 1.309108098 192.168.0.137 → 8.8.8.8      DNS 84 Standard query 0×d70e AAAA
    4 1.314734876      8.8.8.8 → 192.168.0.137 DNS 248 Standard query response 0×
cd.akamai.net A 23.32.28.31 A 23.32.28.42
    5 1.317061896      8.8.8.8 → 192.168.0.137 DNS 272 Standard query response 0×
.dscd.akamai.net AAAA 2600:140f:3400::1720:1c1f AAAA 2600:140f:3400::1720:1c2a
    6 1.351099604 192.168.0.137 → 23.32.28.31  TCP 74 33274 → 80 [SYN] Seq=0 Win=
    7 1.360371655  23.32.28.31 → 192.168.0.137 TCP 74 80 → 33274 [SYN, ACK] Seq=0
    8 1.360407102 192.168.0.137 → 23.32.28.31  TCP 66 33274 → 80 [ACK] Seq=1 Ack=
    9 1.360667272 192.168.0.137 → 23.32.28.31  HTTP 354 GET /success.txt HTTP/1.1
   10 1.366231541  23.32.28.31 → 192.168.0.137 TCP 66 80 → 33274 [ACK] Seq=1 Ack=
   11 1.368532386  23.32.28.31 → 192.168.0.137 HTTP 473 HTTP/1.1 200 OK  (text/pl
   12 1.368576332 192.168.0.137 → 23.32.28.31  TCP 66 33274 → 80 [ACK] Seq=289 Ac
   13 1.714041355 192.168.0.137 → 8.8.8.8      DNS 72 Standard query 0×2172 A www
   14 1.714151234 192.168.0.137 → 8.8.8.8      DNS 72 Standard query 0×6d77 AAAA
   15 1.715114796 192.168.0.137 → 8.8.8.8      DNS 73 Standard query 0×3b2e A kal
   16 1.715179313 192.168.0.137 → 8.8.8.8      DNS 73 Standard query 0×af30 AAAA
   17 1.715291271 192.168.0.137 → 8.8.8.8      DNS 74 Standard query 0×99d0 A too
   18 1.715336702 192.168.0.137 → 8.8.8.8      DNS 74 Standard query 0×a3d2 AAAA
   19 1.726762319      8.8.8.8 → 192.168.0.137 DNS 132 Standard query response 0×
   20 1.730538887      8.8.8.8 → 192.168.0.137 DNS 133 Standard query response 0×
   21 1.780500105 192.168.0.137 → 8.8.8.8      DNS 84 Standard query 0×97f4 A sni
   22 1.780608110 192.168.0.137 → 8.8.8.8      DNS 84 Standard query 0×39f9 AAAA
   23 1.786609781      8.8.8.8 → 192.168.0.137 DNS 191 Standard query response 0×
   24 1.786635886      8.8.8.8 → 192.168.0.137 DNS 211 Standard query response 0×
   25 1.790627044 192.168.0.137 → 13.33.169.121 TCP 74 38962 → 443 [SYN] Seq=0 Wi
   26 1.833760308 13.33.169.121 → 192.168.0.137 TCP 74 443 → 38962 [SYN, ACK] Seq
   27 1.833783843 192.168.0.137 → 13.33.169.121 TCP 66 38962 → 443 [ACK] Seq=1 Ac
```

Ring Buffer Analysis

By default, the TShark to runs in the "multiple files" mode. In this mode, the TShark writes into several capture files. When the first capture file fills up to a certain capacity, the TShark switches to the next file and so on. The file names that we want to create can be stated using the -w parameter. The number of files, creation data and creation time will be concatenated with the name provided next to -w parameter to form the complete name of the file.

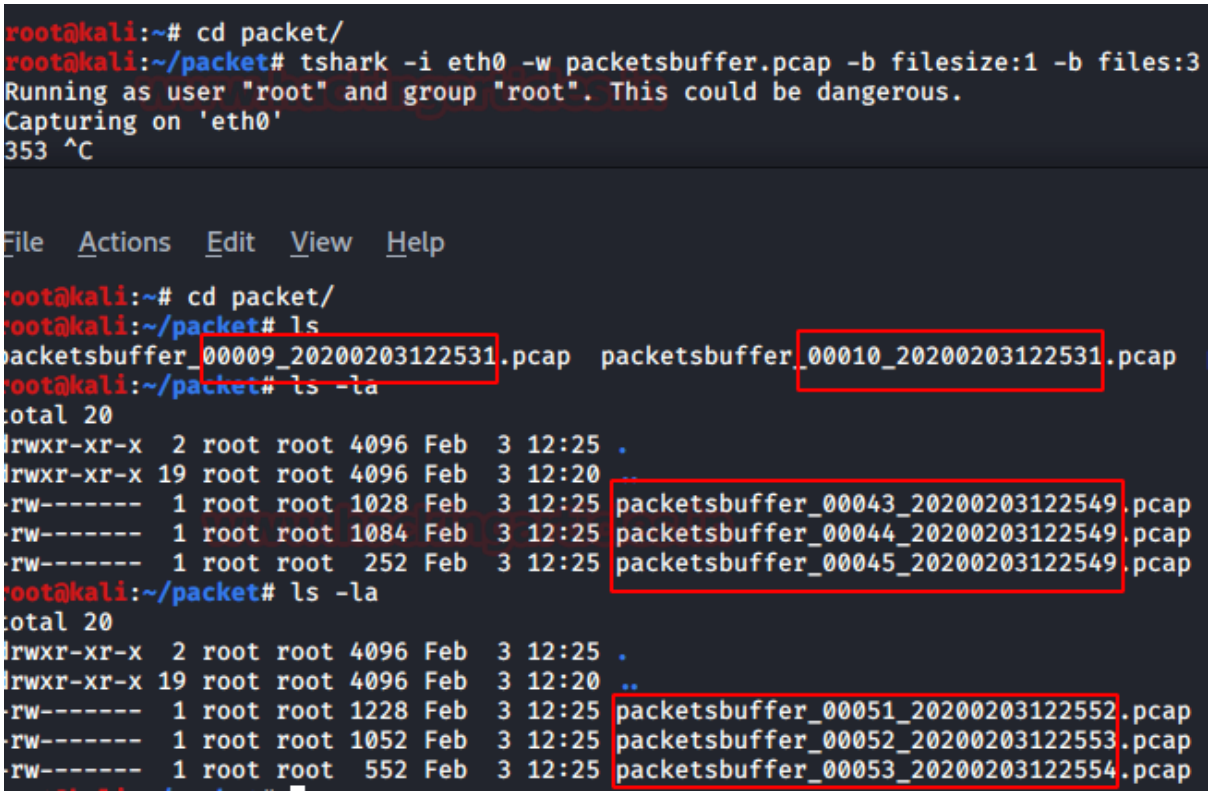
The files option will fill up new files until the number of files is specified. at that moment the TShark will discard data in the first file and start writing to that file and so on. If the files option is not set, new files filled up until one of the captures stops conditions matches or until the disk is full.

There are a lot of criteria upon which the ring buffer works but, in our demonstration, we used 2 of them. Files and the Filesize.

files: value begin again with the first file after value number of files were written (form a ring buffer). This value must be less than 100000.

filesize: value switches to the next file after it reaches a size of value kB. Note that the file size is limited to a maximum value of 2 GiB.

```
tshark -I eth0 -w packetsbuffer.pcap -b filesize:1 -b file:3
```



Auto-Stop

Under the huge array of the options, we have one option called auto-stop. As the name tells us that it will stop the traffic capture after the criteria are matched.

Duration

We have a couple of options, in our demonstration, we used the duration criteria. We specified the duration to 10. This value is in seconds. So, the capture tells us that in the time of 10 seconds, we captured 9 packets.

```
tshark -i eth0 -a duration:10
```

```
root@kali:~# tshark -i eth0 -a duration:10
Running as user "root" and group "root". This could be dangerous.
Capturing on 'eth0'
    1 0.000000000 192.168.0.137 → 52.73.26.88  TLSv1.2 841 Application Data
    2 0.228521540  52.73.26.88 → 192.168.0.137 TLSv1.2 191 Application Data
    3 0.228547939 192.168.0.137 → 52.73.26.88  TCP 66 50990 → 443 [ACK] Seq
    4 0.228611423  52.73.26.88 → 192.168.0.137 TCP 66 443 → 50990 [ACK] Seq
    5 0.228615310 192.168.0.137 → 52.73.26.88  TCP 66 [TCP Dup ACK 3#1] 509
    6 4.977273190 192.168.0.137 → 13.249.226.169 TCP 66 34476 → 443 [ACK] S
    7 5.010827964 13.249.226.169 → 192.168.0.137 TCP 66 [TCP ACKed unseen s
    8 6.512880036 192.168.0.137 → 104.79.123.250 TCP 66 37426 → 443 [ACK] S
    9 6.623442093 104.79.123.250 → 192.168.0.137 TCP 66 [TCP ACKed unseen s
9 packets captured
```

File Size

Now another criterion for the auto-stop option is the file size. The TShark will stop writing to the specified capture file after it reaches a size provided by the user. In our demonstration, we set the filesize to 1. This value is in kB. We used the directory listing command to show that the capture was terminated as soon as the file reached the size of 1 kB.

```
tshark -i eth0 -w 1.pcap -a filesize:1
```

```
root@kali:~# tshark -i eth0 -w 1.pcap  -a filesize:1
Running as user "root" and group "root". This could be dange
Capturing on 'eth0'
6
root@kali:~# ls -la
total 16156
drwxr-xr-x 19 root root     4096 Feb  3 12:33 .
drwxr-xr-x 18 root root     4096 Nov 25 12:38 ..
-rw-------  1 root root     1172 Feb  3 12:33 1.pcap
-rw-r--r--  1 root root     5161 Feb  3 12:24 .bash_history
```

Data-Link Types

At last, we can also modify the statistics of the captured traffic data based on the Data-Link Types. For that we will have to use an independent parameter, "-L". In our demonstration, we used the "-L" parameter to show that we have data links like EN10MB specified for the Ethernet Traffic and others.

```
tshark -L
```

```
root@kali:~/packet# tshark -L
Running as user "root" and group "root". This could be da
Data link types of interface eth0 (use option -y to set)
  EN10MB (Ethernet)
  DOCSIS (DOCSIS)
```

Reporting Functionalities

Version Information

Let's begin with the very simple command so that we can understand and correlate that all the practical performed during this article and the previous articles are of the version depicted in the image given below. This parameter prints the Version information of the installed Tshark.

```
tshark -v
```

```
root@kali:~# tshark -v
Running as user "root" and group "root". This could be dangerous.
TShark (Wireshark) 3.0.5 (Git v3.0.5 packaged as 3.0.5-1)

Copyright 1998-2019 Gerald Combs <gerald@wireshark.org> and contributors.
License GPLv2+: GNU GPL version 2 or later <http://www.gnu.org/licenses/old-li
This is free software; see the source for copying conditions. There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

Compiled (64-bit) with libpcap, with POSIX capabilities (Linux), with libnl 3,
with GLib 2.60.6, with zlib 1.2.11, with SMI 0.4.8, with c-ares 1.15.0, with L
5.2.4, with GnuTLS 3.6.9 and PKCS #11 support, with Gcrypt 1.8.5, with MIT
Kerberos, with MaxMind DB resolver, with nghttp2 1.39.2, with LZ4, with Snappy
with libxml2 2.9.4.

Running on Linux 5.3.0-kali2-amd64, with Intel(R) Core(TM) i7-9750H CPU @
2.60GHz (with SSE4.2), with 3934 MB of physical memory, with locale en_US.utf8
with libpcap version 1.9.1 (with TPACKET_V3), with GnuTLS 3.6.10, with Gcrypt
1.8.5, with zlib 1.2.11, binary plugins supported (0 loaded).

Built using gcc 9.2.1 20190909.
```

Reporting Options

During any Network capture or investigation, there is a dire need of the reports so that we can share the findings with the team as well as superiors and have a validated proof of any activity inside the network. For the same reasons, TShark has given us a beautiful option (**-G**). This option will make the TShark print a list of several types of reports that can be generated. Official Manual of TShark used the word Glossaries for describing the types of reports.

```
tshark -G help
```

```
root@kali:~# tshark -G help
Running as user "root" and group "root". This could be dangerous.
TShark (Wireshark) 3.0.5 (Git v3.0.5 packaged as 3.0.5-1)

Usage: tshark -G [report]

Glossary table reports:
  -G column-formats         dump column format codes and exit
  -G decodes                dump "layer type"/"decode as" associations and exit
  -G dissector-tables       dump dissector table names, types, and properties
  -G elastic-mapping        dump ElasticSearch mapping file
  -G fieldcount             dump count of header fields and exit
  -G fields                 dump fields glossary and exit
  -G ftypes                 dump field type basic and descriptive names
  -G heuristic-decodes      dump heuristic dissector tables
  -G plugins                dump installed plugins and exit
  -G protocols              dump protocols in registration database and exit
  -G values                 dump value, range, true/false strings and exit

Preference reports:
  -G currentprefs           dump current preferences and exit
  -G defaultprefs           dump default preferences and exit
  -G folders                dump about:folders
```

Column Formats

From our previous practical, we saw that we have the Column Formats option available in the reporting section of TShark. To explore its contents, we ran the command as shown in the image given below. We see that it prints a list of wildcards that could be used while generating a report. We have the VLAN id, Date, Time, Destination Address, Destination Port, Packet Length, Protocol, etc.

```
tshark -G column-formats
```

```
root@kali:~# tshark -G column-formats
Running as user "root" and group "root". This could
%q      802.1Q VLAN id
%Yt     Absolute date, as YYYY-MM-DD, and time
%YDOYt  Absolute date, as YYYY/DOY, and time
%At     Absolute time
%V      Cisco VSAN
%B      Cumulative Bytes
%Cus    Custom
%y      DCE/RPC call (cn_call_id / dg_seqnum)
%Tt     Delta time
%Gt     Delta time displayed
%rd     Dest addr (resolved)
%ud     Dest addr (unresolved)
%rD     Dest port (resolved)
%uD     Dest port (unresolved)
%d      Destination address
%D      Destination port
%a      Expert Info Severity
%I      FW-1 monitor if/direction
%F      Frequency/Channel
%hd     Hardware dest addr
%hs     Hardware src addr
%rhd    Hw dest addr (resolved)
%uhd    Hw dest addr (unresolved)
%rhs    Hw src addr (resolved)
%uhs    Hw src addr (unresolved)
%e      IEEE 802.11 RSSI
%x      IEEE 802.11 TX rate
%f      IP DSCP Value
%i      Information
%rnd    Net dest addr (resolved)
%und    Net dest addr (unresolved)
%rns    Net src addr (resolved)
%uns    Net src addr (unresolved)
%nd     Network dest addr
%ns     Network src addr
%m      Number
%L      Packet length (bytes)
%p      Protocol
%Rt     Relative time
```

Decodes

This option generates 3 Fields related to Layers as well as the protocol decoded. There is a restriction enforced for one record per line with this option. The first field that has the "s1ap.proc.sout" tells us the layer type of the network packets. Followed by that we have the value of selector in decimal format. At last, we have the decoding that was performed on the capture. We used the head command as the output was rather big to fit in the screenshot.

```
tshark -G decodes | head
```

```
root@kali:~# tshark -G decodes | head
Running as user "root" and group "root". This could be dangerous.
s1ap.proc.sout  17      s1ap
s1ap.proc.sout  3       s1ap
s1ap.proc.sout  6       s1ap
s1ap.proc.sout  23      s1ap
s1ap.proc.sout  9       s1ap
s1ap.proc.sout  48      s1ap
s1ap.proc.sout  43      s1ap
s1ap.proc.sout  29      s1ap
s1ap.proc.sout  4       s1ap
s1ap.proc.sout  21      s1ap
```

Dissector Tables

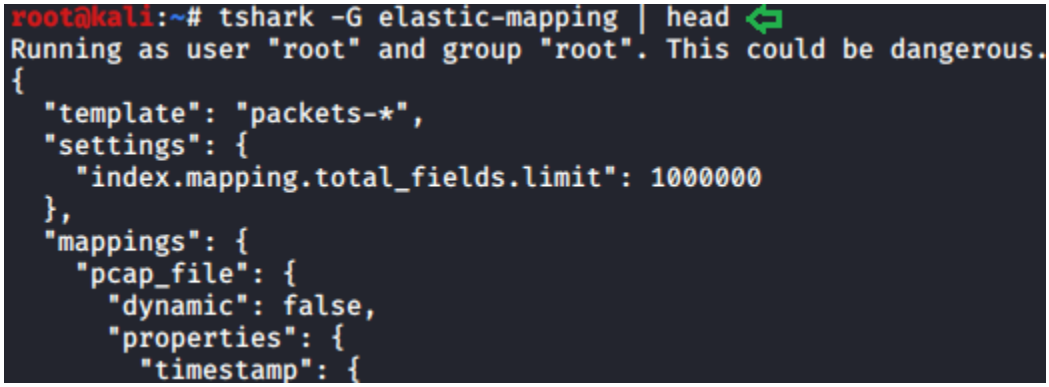
Most of the users reading this article are already familiar with the concept of Dissector. If not, in simple words Dissector is simply a protocol parser. The output generated by this option consists of 6 fields. Starting from the Dissector Table Name then the name is used for the dissector table in the GUI format. Next, we have the type and the base for the display and the Protocol Name. Lastly, we have the decode as a format.

```
root@kali:~# tshark -G dissector-tables
Running as user "root" and group "root". This could be dangerous.
amqp.version    AMQP versions   FT_UINT8        BASE_DEC        AMQP    Decode As supported
ansi_637.tele_id        ANSI IS-637-A Teleservice ID    FT_UINT8        BASE_DEC        ANSI IS-637-A Te
ted
ansi_a.ota      IS-683-A (OTA)  FT_UINT8        BASE_DEC        ANSI BSMAP      Decode As not supported
ansi_a.pld      IS-801 (PLD)    FT_UINT8        BASE_DEC        ANSI BSMAP      Decode As not supported
ansi_a.sms      IS-637-A (SMS)  FT_UINT8        BASE_DEC        ANSI BSMAP      Decode As not supported
ansi_map.ota    IS-683-A (OTA)  FT_UINT8        BASE_DEC        ANSI MAP        Decode As not supported
ansi_map.pld    IS-801 (PLD)    FT_UINT8        BASE_DEC        ANSI MAP        Decode As not supported
ansi_map.tele_id        IS-637 Teleservice ID   FT_UINT8        BASE_DEC        ANSI MAP        Decode A
ansi_tcap.nat.opcode    ANSI TCAP National Opcodes      FT_UINT16       BASE_DEC        ANSI_TCAP
ansi_tcap.ssn   ANSI SSN        FT_UINT8        BASE_DEC        TCAP    Decode As not supported
arcnet.protocol_id      ARCNET Protocol ID      FT_UINT8        BASE_HEX        ARCNET  Decode As not su
aruba_erm.type  Aruba ERM Type  FT_NONE ARUBA_ERM       Decode As supported
atm.aal2.type   ATM AAL_2 type  FT_UINT32       BASE_DEC        ATM     Decode As supported
atm.aal5.type   ATM AAL_5 type  FT_UINT32       BASE_DEC        ATM     Decode As not supported
atm.cell_payload.vpi_vci        ATM Cell Payload VPI VCI        FT_UINT32       BASE_DEC        ATM
atm.reassembled.vpi_vci ATM Reassembled VPI VCI FT_UINT32       BASE_DEC        ATM     Decode As not su
awdl.tag.number AWDL Tags       FT_UINT8        BASE_DEC        AWDL    Decode As not supported
ax25.pid        AX.25 protocol ID       FT_UINT8        BASE_HEX        AX.25   Decode As not supported
bacapp.vendor_identifier        BACapp Vendor Identifier        FT_UINT8        BASE_HEX        BACapp
bacnet.vendor   BACnet Vendor Identifier        FT_UINT8        BASE_HEX        BACnet  Decode As not su
bacp.option     PPP BACP Options        FT_UINT8        BASE_DEC        PPP BACP        Decode As not su
bap.option      PPP BAP Options FT_UINT8        BASE_DEC        PPP BAP Decode As not supported
bcp_ncp.option  PPP BCP NCP Options     FT_UINT8        BASE_DEC        PPP BCP NCP     Decode As not su
bctp.tpi        BCTP Tunneled Protocol Indicator        FT_UINT32       BASE_DEC        BCTP    Decode A
```

Elastic Mapping

Mapping is the outline of the documents stored in the index. Elasticsearch supports different data types for the fields in a document. The elastic-mapping option of the TShark prints out the data stored inside the ElasticSearch mapping file. Due to a large amount of data getting printed, we decided to use the head command as well.

```
tshark -G elastic-mapping | head
```



Field Count

There are times in a network trace, where we need to get the count of the header fields travelling at any moment. In such scenarios, TShark got our back. With the fieldcount option, we can print the number of header fields with ease. As we can observe in the image given below that we have 2522 protocols and 215000 fields were pre-allocated.

```
tshark -G fieldcount
```

```
root@kali:~# tshark -G fieldcount
Running as user "root" and group "root". This could be dangerous
There are 214494 header fields registered, of which:
        0 are deregistered
        2522 are protocols
        16070 have the same name as another field

215000 fields were pre-allocated.

The header field table consumes 1679 KiB of memory.
The fields themselves consume 15081 KiB of memory.
```

Fields

TShark can also get us the contents of the registration database. The output generated by this option is not as easy to interpret as the others. For some users, they can use any other parsing tool for generating a better output. Each record in the output is a protocol or a header file. This can be differentiated by the First field of the record. If the Field is P then it is a Protocol and if it is F then it's a header field. In the case of the Protocols, we have 2 more fields. One tells us about the Protocol and other fields show the abbreviation used for the said protocol. In the case of Header, the facts are a little different. We have 7 more fields. We have the Descriptive Name, Abbreviation, Type, Parent Protocol Abbreviation, Base for Display, Bitmask, Blurb Describing Field, etc.

```
tshark -G fields | head
```

```
root@kali:~# tshark -G fields | head
Running as user "root" and group "root". This could be dangerous.
P       Short Frame     _ws.short
P       Malformed Packet        _ws.malformed
P       Unreassembled Fragmented Packet _ws.unreassembled
F       Dissector bug   _ws.malformed.dissector_bug     FT_NONE _ws.malformed
F       Reassembly error        _ws.malformed.reassembly        FT_NONE _ws.malformed
F       Malformed Packet (Exception occurred)   _ws.malformed.expert    FT_NONE _ws.ma
P       Type Length Mismatch    _ws.type_length
F       Trying to fetch X with length Y _ws.type_length.mismatch        FT_NONE _ws.ty
P       Number-String Decoding Error    _ws.number_string.decoding_error
F       Failed to decode number from string     _ws.number_string.decoding_error.faile
x0
```

Fundamental Types

TShark also helps us generate a report centralized around the fundamental types of network protocol. This is abbreviated as ftype. This type of report consists of only 2 fields. One for the FTYPE and other for its description.

```
tshark -G ftypes
```

```
root@kali:~# tshark -G ftypes
Running as user "root" and group "root". This could be dangerous
FT_NONE Label
FT_PROTOCOL      Protocol
FT_BOOLEAN       Boolean
FT_CHAR Character, 1 byte
FT_UINT8         Unsigned integer, 1 byte
FT_UINT16        Unsigned integer, 2 bytes
FT_UINT24        Unsigned integer, 3 bytes
FT_UINT32        Unsigned integer, 4 bytes
FT_UINT40        Unsigned integer, 5 bytes
FT_UINT48        Unsigned integer, 6 bytes
FT_UINT56        Unsigned integer, 7 bytes
FT_UINT64        Unsigned integer, 8 bytes
FT_INT8 Signed integer, 1 byte
FT_INT16         Signed integer, 2 bytes
FT_INT24         Signed integer, 3 bytes
FT_INT32         Signed integer, 4 bytes
FT_INT40         Signed integer, 5 bytes
FT_INT48         Signed integer, 6 bytes
FT_INT56         Signed integer, 7 bytes
FT_INT64         Signed integer, 8 bytes
FT_IEEE_11073_SFLOAT    IEEE-11073 Floating point (16-bit)
FT_IEEE_11073_FLOAT     IEEE-11073 Floating point (32-bit)
FT_FLOAT         Floating point (single-precision)
FT_DOUBLE        Floating point (double-precision)
FT_ABSOLUTE_TIME         Date and time
FT_RELATIVE_TIME         Time offset
FT_STRING        Character string
FT_STRINGZ       Character string
FT_UINT_STRING   Character string
FT_ETHER         Ethernet or other MAC address
FT_BYTES         Sequence of bytes
FT_UINT_BYTES    Sequence of bytes
FT_IPv4 IPv4 address
FT_IPv6 IPv6 address
FT_IPXNET        IPX network number
FT_FRAMENUM      Frame number
FT_PCRE Compiled Perl-Compatible Regular Expression (GRegex) obj
FT_GUID Globally Unique Identifier
FT_OID  ASN.1 object identifier
```

Heuristic Decodes

Sorting the Dissectors based on the heuristic decodes is one of the things that need to be easily and readily available. For the same reason, we have the option of heuristic decodes in TShark. This option prints all the heuristic decodes which are currently installed. It consists of 3 fields. First, one representing the underlying dissector, the second one representing the name of the heuristic decoded and the last one tells about the status of the heuristic. It will be T in case it is heuristics and F otherwise.

```
tshark -G heuristic-decodes
```

```
root@kali:~# tshark -G heuristic-decodes
Running as user "root" and group "root".
rtsp    rtp     F
sctp    sip     T
sctp    nbap    T
sctp    jxta    T
udp     xml     F
udp     wol     T
udp     wg      T
udp     waveagent       T
udp     wassp   F
udp     udt     T
udp     teredo  F
udp     stun    T
udp     srt     T
udp     sprt    T
udp     skype   F
udp     sip     T
udp     rtps    T
udp     rtp     F
udp     rtcp    T
udp     rpcap   T
udp     rpc     T
udp     rlm     T
udp     rlc-nr  F
udp     rlc-lte F
udp     rlc     F
udp     rftap   T
udp     reload-framing  T
udp     reload  T
udp     redbackli       T
udp     raknet  T
udp     quic    T
udp     proxy   T
udp     pktgen  T
udp     peekremote      T
udp     pdcp-nr F
```

Plugins

Plugins are a very important kind of option that was integrated with Tshark Reporting options. As the name states it prints the name of all the plugins that are installed. The field that this report consists of is made of the Plugin Library, Plugin Version, Plugin Type and the path where the plugin is located.

```
tshark -G plugins
```

```
root@kali:~# tshark -G plugins
Running as user "root" and group "root". This could be dangerous.
ethercat.so              0.1.0   dissector       /usr/lib/x86_64-linux-gnu/wireshark/plugins/3
gryphon.so               0.0.4   dissector       /usr/lib/x86_64-linux-gnu/wireshark/plugins/3
irda.so                  0.0.6   dissector       /usr/lib/x86_64-linux-gnu/wireshark/plugins/3
mate.so                  1.0.1   dissector       /usr/lib/x86_64-linux-gnu/wireshark/plugins/3
opcua.so                 1.0.0   dissector       /usr/lib/x86_64-linux-gnu/wireshark/plugins/3
profinet.so              0.2.4   dissector       /usr/lib/x86_64-linux-gnu/wireshark/plugins/3
stats_tree.so            0.0.1   dissector       /usr/lib/x86_64-linux-gnu/wireshark/plugins/3
transum.so               2.0.4   dissector       /usr/lib/x86_64-linux-gnu/wireshark/plugins/3
unistim.so               0.0.2   dissector       /usr/lib/x86_64-linux-gnu/wireshark/plugins/3
usbdump.so               0.0.1   file type       /usr/lib/x86_64-linux-gnu/wireshark/plugins/3
wimax.so                 1.2.0   dissector       /usr/lib/x86_64-linux-gnu/wireshark/plugins/3
wimaxasncp.so            0.0.1   dissector       /usr/lib/x86_64-linux-gnu/wireshark/plugins/3
wimaxmacphy.so           0.0.1   dissector       /usr/lib/x86_64-linux-gnu/wireshark/plugins/3
```

Protocols

If the users want to know the details about the protocols that are recorded in the registration database, then, they can use the protocols parameter. This output is also a bit less readable so that the user can take the help of any third-party tool to beautify the report. This parameter prints the data in 3 fields. We have the protocol name, short name, and the filter name.

```
tshark -G protocols | head
```

```
root@kali:~# tshark -G protocols | head
Running as user "root" and group "root". This could be dangerous.
Lua Dissection  Lua Dissection  _ws.lua
Expert Info     Expert  _ws.expert
IEC 60870-5-104-Apci    104apci 104apci
IEC 60870-5-104-Asdu    104asdu 104asdu
29West Protocol 29West  29west
Pro-MPEG Code of Practice #3 release 2 FEC Protocol     2dparityfec     2dparityfec
3Com XNS Encapsulation  3COMXNS 3comxns
3GPP2 A11       3GPP2 A11       a11
IPv6 over Low power Wireless Personal Area Networks     6LoWPAN 6lowpan
802.11 radio information        802.11 Radio    wlan_radio
```

Values

Let's talk about the values report. It consists of value strings, range strings, true/false strings. There are three types of records available here. The first field can consist of one of these three characters representing the following:

V: Value Strings

R: Range Strings

T: True/False Strings

Moreover, in the value strings, we have the field abbreviation, integer value, and the string. In the range strings, we have the same values except it holds the lower bound and upper bound values.

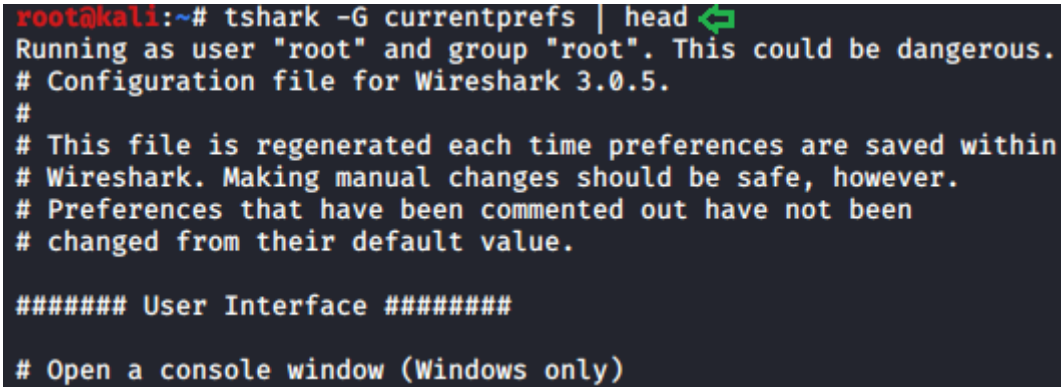
```
tshark -G values | head
```

```
root@kali:~# tshark -G values | head
Running as user "root" and group "root". This could be dangerous.
R       ieee1722.subtype        0x0     0x0     IEC 61883/IIDC Format
R       ieee1722.subtype        0x1     0x1     MMA Streams
R       ieee1722.subtype        0x2     0x2     AVTP Audio Format
R       ieee1722.subtype        0x3     0x3     Compressed Video Format
R       ieee1722.subtype        0x4     0x4     Clock Reference Format
R       ieee1722.subtype        0x5     0x5     Time Synchronous Control Format
R       ieee1722.subtype        0x6     0x6     SDI Video Format
R       ieee1722.subtype        0x7     0x7     Raw Video Format
R       ieee1722.subtype        0x8     0x6d    Reserved for future protocols
R       ieee1722.subtype        0x6e    0x6e    AES Encrypted Format Continuous
```

Preferences

In case the user requires to revise the current preferences that are configured on the system, they can use the currentprefs options to read the preference saved in the file.

```
tshark -G currentprefs | head
```



Folders

Suppose the user wants to manually change the configurations or get the program information or want to take a look at the lua configuration or some other important files. The users need the path of those files to take a peek at them. Here the folders option comes a little handy.

```
tshark -G folders
```

```
root@kali:~# tshark -G folders
Running as user "root" and group "root". This could be dangerous.
Temp:                     /tmp
Personal configuration:   /root/.config/wireshark
Global configuration:     /usr/share/wireshark
System:                   /etc
Program:                  /usr/bin
Personal Plugins:         /root/.local/lib/wireshark/plugins/3.0
Global Plugins:           /usr/lib/x86_64-linux-gnu/wireshark/plugins/3.0
Personal Lua Plugins:     /root/.local/lib/wireshark/plugins
Global Lua Plugins:       /usr/lib/x86_64-linux-gnu/wireshark/plugins
Extcap path:              /usr/lib/x86_64-linux-gnu/wireshark/extcap
MaxMind database path:    /usr/share/GeoIP
MaxMind database path:    /var/lib/GeoIP
MaxMind database path:    /usr/share/GeoIP
MaxMind database path:    /var/lib/GeoIP
```

Since we talked so extensively about TShark, It won't be justice if we won't talk about the tool that is heavily dependent on the data from TShark. Let's talk about PyShark.

PyShark

It is essentially a wrapper that is based on Python. Its functionality is that allows the python packet parsing using the TShark dissectors. Many tools do the same job more or less but the difference is that this tool can export XMLs to use its parsing. You can read more about it from its GitHub page.

Installation

As the PyShark was developed using Python 3 and we don't Python 3 installed on our machine. We installed Python3 as shown in the image given below.

```
apt install python3
```

```
root@kali:~# apt install python3
Reading package lists ... Done
Building dependency tree
Reading state information ... Done
The following additional packages will be installed:
  libpython3-stdlib python3-minimal
Suggested packages:
  python3-doc python3-venv
The following packages will be upgraded:
  libpython3-stdlib python3 python3-minimal
3 upgraded, 0 newly installed, 0 to remove and 673 not upgrade
Need to get 119 kB of archives.
After this operation, 1,024 B of additional disk space will be
Do you want to continue? [Y/n] y
Get:1 http://ftp.harukasan.org/kali kali-rolling/main amd64 py
Get:2 http://ftp.harukasan.org/kali kali-rolling/main amd64 py
Get:3 http://ftp.harukasan.org/kali kali-rolling/main amd64 li
Fetched 119 kB in 10s (11.7 kB/s)
```

PyShark is available through the pip. But we don't have the pip for python 3 so we need to install it as well.

```
apt install python3-pip
```

```
root@kali:~# apt install python3-pip
Reading package lists ... Done
Building dependency tree
Reading state information ... Done
The following additional packages will be installed:
  libc-dev-bin libc6 libc6-dev libc6-i386 libcrypt-dev libc
  libpython3.7-stdlib python-pip-whl python3-dev python3-en
  python3-secretstorage python3-setuptools python3-wheel py
Suggested packages:
  glibc-doc libkf5wallet-bin gir1.2-gnomekeyring-1.0 python-
The following NEW packages will be installed:
  libcrypt-dev libcrypt1 libpython3-dev libpython3.7-dev py
  python3-keyrings.alt python3-pip python3-secretstorage py
The following packages will be upgraded:
  libc-dev-bin libc6 libc6-dev libc6-i386 libpython3.7 libp
  python3.7-minimal
10 upgraded, 15 newly installed, 0 to remove and 663 not up
Need to get 59.3 MB of archives.
```

Since we have the python3 with pip we will install pyshark using pip command. You can also install PyShark by cloning the git and running the setup.

```
pip3 install pyshark
```

```
root@kali:~# pip3 install pyshark
Collecting pyshark
  Retrying (Retry(total=4, connect=None, read=None, redirect=None, status=None)) after conne
nnection.VerifiedHTTPSConnection object at 0x7fd92b76d610>: Failed to establish a new connec
ution')': /packages/b9/b0/ef87c71f7937ea8124944b2081210f9df10e47d2faa57d7c30d3e12af064/pysha
  Downloading https://files.pythonhosted.org/packages/b9/b0/ef87c71f7937ea8124944b2081210f9d
-none-any.whl
Collecting py (from pyshark)
  Downloading https://files.pythonhosted.org/packages/99/8d/21e1767c009211a62a8e3067280bfce7
ne-any.whl (83kB)
    100% |████████████████████████████████| 92kB 1.5MB/s
Requirement already satisfied: lxml in /usr/lib/python3/dist-packages (from pyshark) (4.4.1)
Installing collected packages: py, pyshark
Successfully installed py-1.8.1 pyshark-0.4.2.9
```

Live Capture

Now to get started, we need the python interpreter. To get this we write python3 and press enter. Now that we have the interpreter, the very first thing that we plan on doing is importing PyShark. Then we define network interface for the capture. Followed by that we will define the value of the timeout parameter for the capture.sniff function. At last, we will begin the capture. Here we can see that in the timeframe that we provided PyShark captured 9 packets.

```
python3
import pyshark
capture =
pyshark.LiveCapture(interface='eth0')
capture.sniff(timeout=5)
capture
```

```
root@kali:~# python3
Python 3.7.6 (default, Jan 19 2020, 22:34:52)
[GCC 9.2.1 20200117] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> import pyshark
>>> capture = pyshark.LiveCapture(interface='eth0')
>>> capture.sniff(timeout=5)
>>> capture
<LiveCapture (9 packets)>
```

Pretty Representation

There are multiple ways in which PyShark can represent data inside the captured packet. In the previous practical, we captured 9 packets. Let's take a look at the first packet that was captured with PyShark. Here we can see that we have a layer-wise analysis with the ETH Layer, IP Layer, and the TCP Layer.

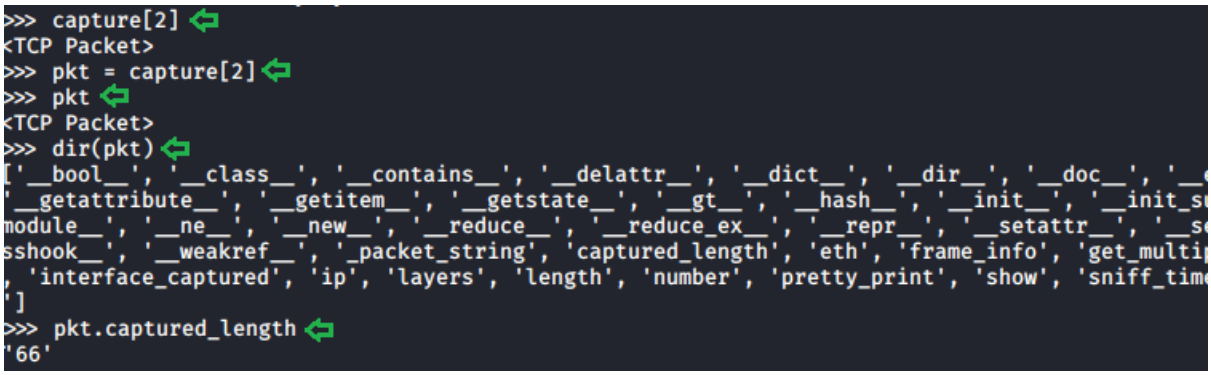
```
capture[1].pretty_print()
```

```
>>> capture[1].pretty_print()
Layer ETH:
        Destination: 1c:5f:2b:59:e1:24
        Address: 1c:5f:2b:59:e1:24
        .... ..0. .... .... .... .... = LG bit: Globally unique address (facto
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
        Source: 00:0c:29:d5:b7:2d
        Type: IPv4 (0x0800)
        Address: 00:0c:29:d5:b7:2d
        .... ..0. .... .... .... .... = LG bit: Globally unique address (facto
        .... ...0 .... .... .... .... = IG bit: Individual address (unicast)
Layer IP:
        0100 .... = Version: 4
        .... 0101 = Header Length: 20 bytes (5)
        Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
        0000 00.. = Differentiated Services Codepoint: Default (0)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transpor
        Total Length: 52
        Identification: 0x4b7c (19324)
        Flags: 0x4000, Don't fragment
        0... .... .... .... = Reserved bit: Not set
        .1.. .... .... .... = Don't fragment: Set
        ..0. .... .... .... = More fragments: Not set
        ...0 0000 0000 0000 = Fragment offset: 0
        Time to live: 64
        Protocol: TCP (6)
        Header checksum: 0x62cb [validation disabled]
        Header checksum status: Unverified
        Source: 192.168.0.137
        Destination: 13.35.190.40
Layer TCP:
        Source Port: 38820
        Destination Port: 443
        Stream index: 1
        TCP Segment Len: 0
        Sequence number: 1    (relative sequence number)
        Next sequence number: 1    (relative sequence number)
        Acknowledgment number: 1    (relative ack number)
        1000 .... = Header Length: 32 bytes (8)
        Flags: 0x010 (ACK)
        000. .... .... = Reserved: Not set
        ...0 .... .... = Nonce: Not set
        .... 0... .... = Congestion Window Reduced (CWR): Not set
        .... .0.. .... = ECN-Echo: Not set
        .... ..0. .... = Urgent: Not set
        .... ...1 .... = Acknowledgment: Set
        .... .... 0... = Push: Not set
```

Captured Length Field

In our capture, we saw some data that can consist of multiple attributes. These attributes need fields to get stored. To explore this field, we will be using the dir function in Python. We took the packet and then defined the variable named pkt with the value of that packet and saved it. Then using the dir function, we saw explored the fields inside that particular capture. Here we can see that we have the pretty_print function which we used in the previous practical. We also have one field called captured_length to read into that we will write the name of the variable followed by the name of the field with a period (.) in between as depicted in the image below.

```
capture[2]
pkt = capture[2]
pkt
dir(pkt)
pkt.captured_length
```



Layers, Src and Dst Fields

As we listed the fields in the previous step, we saw that we have another field named layers. We read its contents as we did earlier to find out that we have 3 layers in this capture. Now to look into the individual layer, we need to get the fields of that individual layer. For that, we will again use the dir function. We used the dir function on the ETH layer as shown in the

image given below. We observe that we have a field named src which means source, dst which means destination. We checked the value on those fields to find the physical address of the source and destination respectively.

```
pkt.layers
pkt.eth.src
pkt.eth.dst
pkt.eth.type
```

```
>>> pkt.layers
[<ETH Layer>, <IP Layer>, <TCP Layer>]
>>> dir(pkt.eth)
['DATA_LAYER', '__class__', '__delattr__', '__dict__', '__dir__', '__doc__', '__
e__', '__getstate__', '__gt__', '__hash__', '__init__', '__init_subclass__', '__
e__', '__reduce_ex__', '__repr__', '__setattr__', '__setstate__', '__sizeof__',
 '_field_prefix', '_get_all_field_lines', '_get_all_fields_with_alternates', '_g
_sanitize_field_name', 'addr', 'addr_resolved', 'dst', 'dst_resolved', 'field_na
d_value', 'ig', 'layer_name', 'lg', 'pretty_print', 'raw_mode', 'src', 'src_reso
>>> pkt.eth.src
'1c:5f:2b:59:e1:24'
>>> pkt.eth.dst
'00:0c:29:d5:b7:2d'
>>> pkt.eth.type
'0x00000800'
```

For our next step, we need the fields of the IP packet. We used the dir function on the IP layer and then we use src and dst fields here on this layer. We see that we have the IP Address as this is the IP layer. As the Ethernet layer works on the MAC Addresses, they store the MAC Addresses of the Source and the Destination which changes when we come to the IP Layer.

```
dir(pkt.ip)
pkt.ip.src
pkt.ip.dst
pkt.ip.pretty_print()
```

```
>>> dir(pkt.ip)
['DATA_LAYER', '__class__', '__delattr__', '__dict__', '__dir__', '__doc__', '__eq_
e__', '__getstate__', '__gt__', '__hash__', '__init__', '__init_subclass__', '__le_
e__', '__reduce_ex__', '__repr__', '__setattr__', '__setstate__', '__sizeof__', '__
 '_field_prefix', '_get_all_field_lines', '_get_all_fields_with_alternates', '_get_
_sanitize_field_name', 'addr', 'checksum', 'checksum_status', 'dsfield', 'dsfield_d
lags', 'flags_df', 'flags_mf', 'flags_rb', 'frag_offset', 'get', 'get_field', 'get_
 'id', 'layer_name', 'len', 'pretty_print', 'proto', 'raw_mode', 'src', 'src_host',
>>> pkt.ip.src
'13.35.190.40'
>>> pkt.ip.dst
'192.168.0.137'
>>> pkt.ip.pretty_print()
Layer IP:
        0100 .... = Version: 4
        .... 0101 = Header Length: 20 bytes (5)
        Differentiated Services Field: 0x10 (DSCP: Unknown, ECN: Not-ECT)
        0001 00.. = Differentiated Services Codepoint: Unknown (4)
        .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
        Total Length: 52
        Identification: 0x2e26 (11814)
        Flags: 0x4000, Don't fragment
        0... .... .... .... = Reserved bit: Not set
        .1.. .... .... .... = Don't fragment: Set
        ..0. .... .... .... = More fragments: Not set
        ...0 0000 0000 0000 = Fragment offset: 0
        Time to live: 248
        Protocol: TCP (6)
        Header checksum: 0xc810 [validation disabled]
        Header checksum status: Unverified
        Source: 13.35.190.40
        Destination: 192.168.0.137
```

Similarly, we can use the dir function and the field's value on any layer of the capture. This makes the investigation of the capture quite easier.

Promisc Capture

In previous articles we learned about the promisc mode that means that a network interface card will pass all frames received up to the operating system for processing, versus the traditional mode of operation wherein only frames destined for the NIC's MAC address or a broadcast address will be passed up to the OS. Generally, promiscuous mode is used to "sniff" all traffic on the wire. But we got stuck when we configured the network interface card to work on promisc mode. So, while capturing traffic on TShark we can switch between the normal capture and the promisc capture using the –p parameter as shown in the image given below.

```
ifconfig eth0 promisc

ifconfig eth0

tshark -i eth0 -c 10

tshark -i eth0 -c 10 -p
```

```
root@kali:~# ifconfig eth0 promisc
root@kali:~# ifconfig eth0
eth0: flags=4419<UP,BROADCAST,RUNNING,PROMISC,MULTICAST>  mtu 1500
        inet 192.168.0.137  netmask 255.255.255.0  broadcast 192.168.0.255
        inet6 fe80::20c:29ff:fed5:b72d  prefixlen 64  scopeid 0x20<link>
        ether 00:0c:29:d5:b7:2d  txqueuelen 1000  (Ethernet)
        RX packets 67816  bytes 85545596 (81.5 MiB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 30726  bytes 2463013 (2.3 MiB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

root@kali:~# tshark -i eth0 -c 10
Running as user "root" and group "root". This could be dangerous.
Capturing on 'eth0'
    1 0.000000000 192.168.0.137 → 35.169.2.62  TLSv1.2 164 Application Data
    2 0.000142943 192.168.0.137 → 107.23.176.98 TLSv1.2 164 Application Data
    3 0.236904732  35.169.2.62 → 192.168.0.137 TLSv1.2 187 Application Data
    4 0.236921665 192.168.0.137 → 35.169.2.62  TCP 66 40520 → 443 [ACK] Seq=99 Ack=122 W
    5 0.242952531 107.23.176.98 → 192.168.0.137 TLSv1.2 187 Application Data
    6 0.242967301 192.168.0.137 → 107.23.176.98 TCP 66 41152 → 443 [ACK] Seq=99 Ack=122
    7 1.343354460  192.168.0.6 → 224.0.0.251  IGMPv2 60 Membership Report group 224.0.0.
    8 2.842606464  192.168.0.6 → 224.0.0.252  IGMPv2 60 Membership Report group 224.0.0.
    9 6.807673972 192.168.0.137 → 34.213.241.62 TCP 66 51094 → 443 [ACK] Seq=1 Ack=1 Win
   10 7.100843807 34.213.241.62 → 192.168.0.137 TCP 66 [TCP ACKed unseen segment] 443 →
10 packets captured
root@kali:~# tshark -i eth0 -c 10 -p
Running as user "root" and group "root". This could be dangerous.
Capturing on 'eth0'
    1 0.000000000 34.213.241.62 → 192.168.0.137 TLSv1.2 97 Encrypted Alert
    2 0.000019158 192.168.0.137 → 34.213.241.62 TCP 66 51094 → 443 [ACK] Seq=1 Ack=32 Wi
    3 0.000222027 192.168.0.137 → 34.213.241.62 TLSv1.2 97 Encrypted Alert
    4 0.000288786 192.168.0.137 → 34.213.241.62 TCP 66 51094 → 443 [FIN, ACK] Seq=32 Ack
    5 0.289883135 34.213.241.62 → 192.168.0.137 TCP 66 [TCP Previous segment not capture
    6 0.289903932 34.213.241.62 → 192.168.0.137 TCP 66 [TCP Out-Of-Order] 443 → 51094 [F
    7 0.289914338 192.168.0.137 → 34.213.241.62 TCP 66 51094 → 443 [ACK] Seq=33 Ack=33 W
    8 4.120921966 192.168.0.137 → 35.169.2.62  TLSv1.2 165 Application Data
    9 4.121065015 192.168.0.137 → 107.23.176.98 TLSv1.2 164 Application Data
   10 4.394954971  35.169.2.62 → 192.168.0.137 TLSv1.2 188 Application Data
10 packets captured
```

Conclusion

This report focuses on the basic commands and functionality of TShark. To help you get familiar with its features, we also cover advanced aspects of TShark, such as its statistical and reporting functionalities.

Hence, one can make use of these commands as a cybersecurity professional to assess vulnerabilities on systems and keep these systems away from threat.

References

- https://www.hackingarticles.in/beginners-guide-to-tshark-part-1/
- https://www.hackingarticles.in/beginners-guide-to-tshark-part-2/
- https://www.hackingarticles.in/beginners-guide-to-tshark-part-3/
- https://kiminewt.github.io/pyshark/