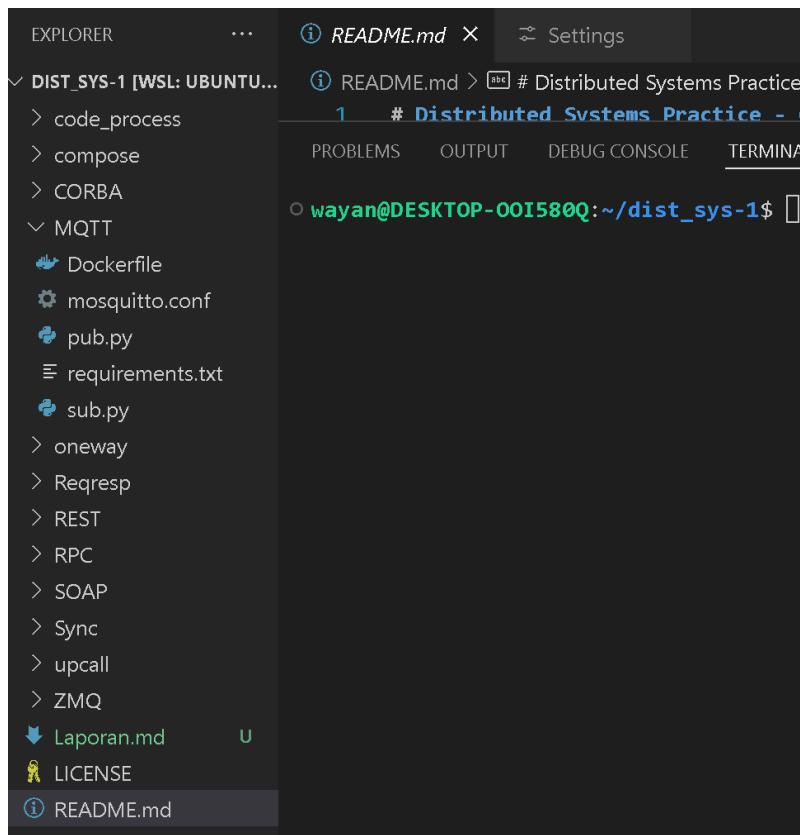


LK 01: Lingkungan Praktik Mandiri + Ujicoba Messaging Protocols

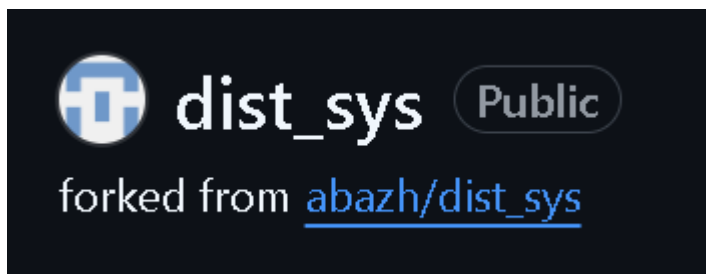
I Wayan Ivan Zenatmaja - 2546000075

1. Buat Lingkungan Praktik Mandiri berbasis VSCode+GitHub Copilot, WSL2 + Ubuntu, Docker Container



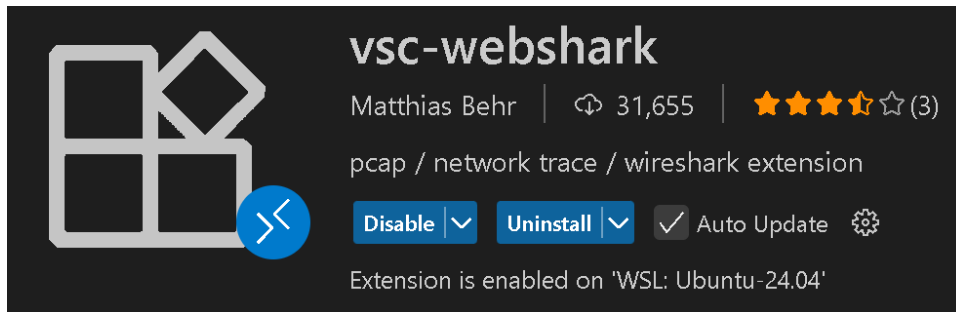
Gambar 1. Tampilan sudah berada di Lingkungan Praktik Mandiri.

2. Fork Repository Program: [GitHub - abazh/dist_sys: Distributed System Hands-On](#) ke dalam akun Github @ivanz3natmaja



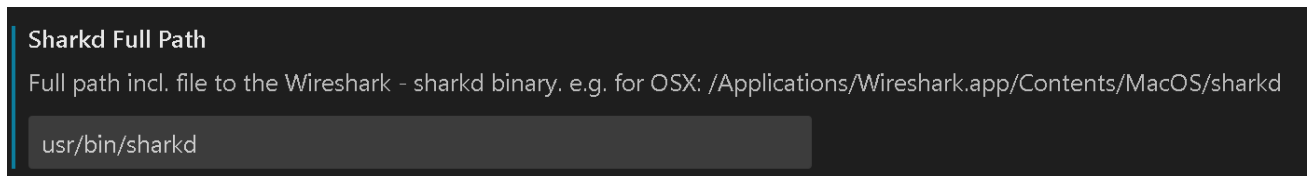
Gambar 2. Tampilan github sudah dilakukan fork

3. Menginstal extension yang dibutuhkan untuk menganalisis protokol pada repositori



Gambar 3. Menginstal extension vsc-webshark

4. Pastikan mengarahkan lokasinya pada usr/bin/sharkd



Gambar 4. Tampilan pengaturan pada vsc-webshark (Bagian sharkd full path)

5. Lakukan ujicoba per protocol dan modifikasi yang diperlukan

`sudo apt install wireshark -y`

Protokol MQTT

- Melakukan docker compose pada mqtt.yml

```
docker compose -f compose/mqtt.yml up -d
```

```
● wayan@DESKTOP-00I580Q:~/dist_sys-1$ docker compose -f compose/mqtt.yml up -d
WARN[0000] /home/wayan/dist_sys-1/compose/mqtt.yml: the attribute `version` is ob
o avoid potential confusion
[+] Running 4/4
✓ mqtt-broker Pulled
✓ 9824c27679d3 Pull complete
✓ 8be3a6e695b8 Pull complete
✓ e661fc39aa0a Pull complete
```

Gambar 5. Tampilan mempraktekkan docker compose

- Pada file pub.py dilakukan modifikasi seolah-olah ini menggunakan platform YT ceritanya

```
21 # Inisialisasi topik dan pesan (modified)
22 topic = "sister/channel/gaming"
23 kanal = "@Ivanzenatmaja"
```

Gambar 6. Modifikasi baris 21-23

```
47 # Mempublikasikan kanal YT ke topik (modified)
48 message = f"Ada kanal Youtube baru nih: {kanal}"
```

Gambar 7. Modifikasi baris 47-48

- Pada file sub.py dilakukan modifikasi

```
# topik (modified)
topic = "sister/channel/kesehatan"
```

Gambar 8. Modifikasi baris 15-16

- Melakukan split terminal dan melaksanakan masing-masing perintah pada masing-masing terminal

```
docker compose -f compose/mqtt.yml exec mqtt-sub python sub.py
```

```
docker compose -f compose/mqtt.yml exec mqtt-pub python pub.py
```

- Kemudian coba dilakukan, ternyata pelanggan tidak dapat menerima pesan, karena kanalnya berbeda antara sub dan pub

```
wayan@DESKTOP-00I580Q:~/dist_sys-1$ docker compose -f compose/mqtt.yml exec mqtt-sub python sub.py
WARN[0000] /home/wayan/dist_sys-1/compose/mqtt.yml: the attribute `version` is obsolete, it will be ignored, please remove it to avoid potential confusion
Menghubungkan ke mqtt-broker...
Menunggu pesan... (Tekan Ctrl+C untuk keluar)
Berhasil terhubung ke broker MQTT mqtt-broker
Berlangganan topik: sister/channel/kesehatan
[]

wayan@DESKTOP-00I580Q:~/dist_sys-1$ docker compose -f compose/mqtt.yml exec mqtt-pub python pub.py
WARN[0000] /home/wayan/dist_sys-1/compose/mqtt.yml: the attribute `version` is obsolete, it will be ignored, please remove it to avoid potential confusion
Menghubungkan ke mqtt-broker...
Published: Ada kanal Youtube baru nih: @Ivanzena tmaja
Published: Ada kanal Youtube baru nih: @Ivanzena tmaja
Published: Ada kanal Youtube baru nih: @Ivanzena tmaja
Published: Ada kanal Youtube baru nih: @Ivanzena tmaja
Published: Ada kanal Youtube baru nih: @Ivanzena tmaja
Published: Ada kanal Youtube baru nih: @Ivanzena tmaja
Published: Ada kanal Youtube baru nih: @Ivanzena tmaja
```

Gambar 9. Tampilan sub.py yang tidak menerima pesan, meski berhasil terhubung ke broker

- Coba disamakan topicnya sister/channel/gaming di sub.py.

```
# topik (modified)
topic = "sister/channel/gaming"
```

Gambar 10. Pengubahan topic pada sub.py (Menyamakan dengan pub.py)

```
wayan@DESKTOP-00I580Q:~/dist_sys-1$ docker compose -f compose/mqtt.yml exec mqtt-sub python sub.py
WARN[0000] /home/wayan/dist_sys-1/compose/mqtt.yml: the attribute `version` is obsolete, it will be ignored, please remove it to avoid potential confusion
Menghubungkan ke mqtt-broker...
Menunggu pesan... (Tekan Ctrl+C untuk keluar)
Berhasil terhubung ke broker MQTT mqtt-broker
Berlangganan topik: sister/channel/gaming
Received message: Ada kanal Youtube baru nih: @Ivanzenatmaja (Topic: sister/channel/gaming)
Received message: Ada kanal Youtube baru nih: @Ivanzenatmaja (Topic: sister/channel/gaming)
Received message: Ada kanal Youtube baru nih: @Ivanzenatmaja (Topic: sister/channel/gaming)
Received message: Ada kanal Youtube baru nih: @Ivanzenatmaja (Topic: sister/channel/gaming)
Received message: Ada kanal Youtube baru nih: @Ivanzenatmaja (Topic: sister/channel/gaming)

○ wayan@DESKTOP-00I580Q:~/dist_sys-1$ docker compose -f compose/mqtt.yml exec mqtt-pub python pub.py
WARN[0000] /home/wayan/dist_sys-1/compose/mqtt.yml: the attribute `version` is obsolete, it will be ignored, please remove it to avoid potential confusion
Menghubungkan ke mqtt-broker...
Published: Ada kanal Youtube baru nih: @Ivanzenatmaja
Published: Ada kanal Youtube baru nih: @Ivanzenatmaja
Published: Ada kanal Youtube baru nih: @Ivanzenatmaja
Published: Ada kanal Youtube baru nih: @Ivanzenatmaja
Published: Ada kanal Youtube baru nih: @Ivanzenatmaja
Published: Ada kanal Youtube baru nih: @Ivanzenatmaja
Published: Ada kanal Youtube baru nih: @Ivanzenatmaja
Published: Ada kanal Youtube baru nih: @Ivanzenatmaja
Published: Ada kanal Youtube baru nih: @Ivanzenatmaja
Published: Ada kanal Youtube baru nih: @Ivanzenatmaja
```

Gambar 11. sub.py berhasil terhubung

- Untuk melakukan pengecekan ip untuk mengetahui proses mqtt yang terjadi

```
wayan@DESKTOP-00I580Q:~/dist_sys-1$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 q
```

Gambar 12. Tampilan melakukan perintah ip a

```
24: veth2c8d9eb@if2: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue master br-f74973d38390 state UP group default
    link/ether 66:33:5f:21:df:92 brd ff:ff:ff:ff:ff:ff link-netnsid 14
    inet6 fe80::6433:5fff:fe21:df92/64 scope link
        valid_lft forever preferred_lft forever
```

Gambar 13. Tampilan didapatkan br-....

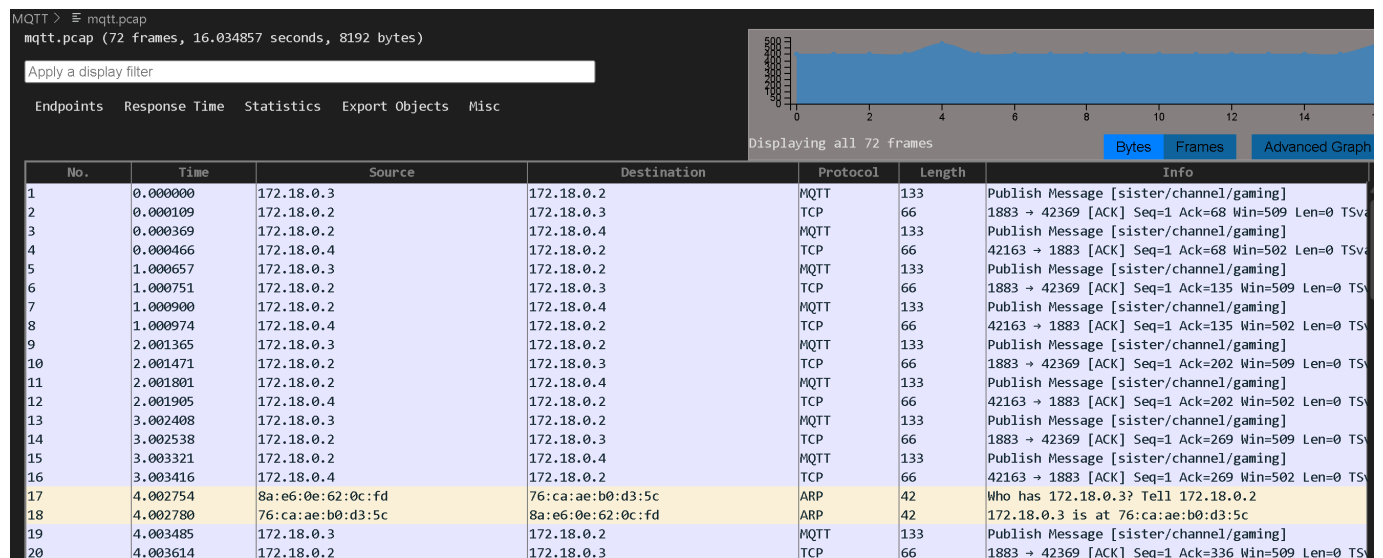
```
wayan@DESKTOP-00I580Q:~/dist_sys-1$ sudo apt install tcpdump
```

Gambar 14. Tampilan melakukan perintah sudo apt install tcpdump

- Melakukan analisis mqtt.pcap

```
wayan@DESKTOP-00I580Q:~/dist_sys-1$ sudo tcpdump -nvi br-f74973d38390 -w mqtt.pcap
```

Gambar 15. Tampilan melakukan perintah sudo tcp dump



Gambar 16. Tampilan mqtt.pcap

- **Aliran utama:** komunikasi antar host 172.18.0.2, 172.18.0.3, dan 172.18.0.4.
- **Aktivitas MQTT:** semua paket yang terlihat adalah **Publish Message** ke topik:

```
sister/channel/gaming
```

Protokol TCP

- Melakukan docker compose pada reqresp.yml

```
docker compose -f compose/reqresp.yml up -d
```

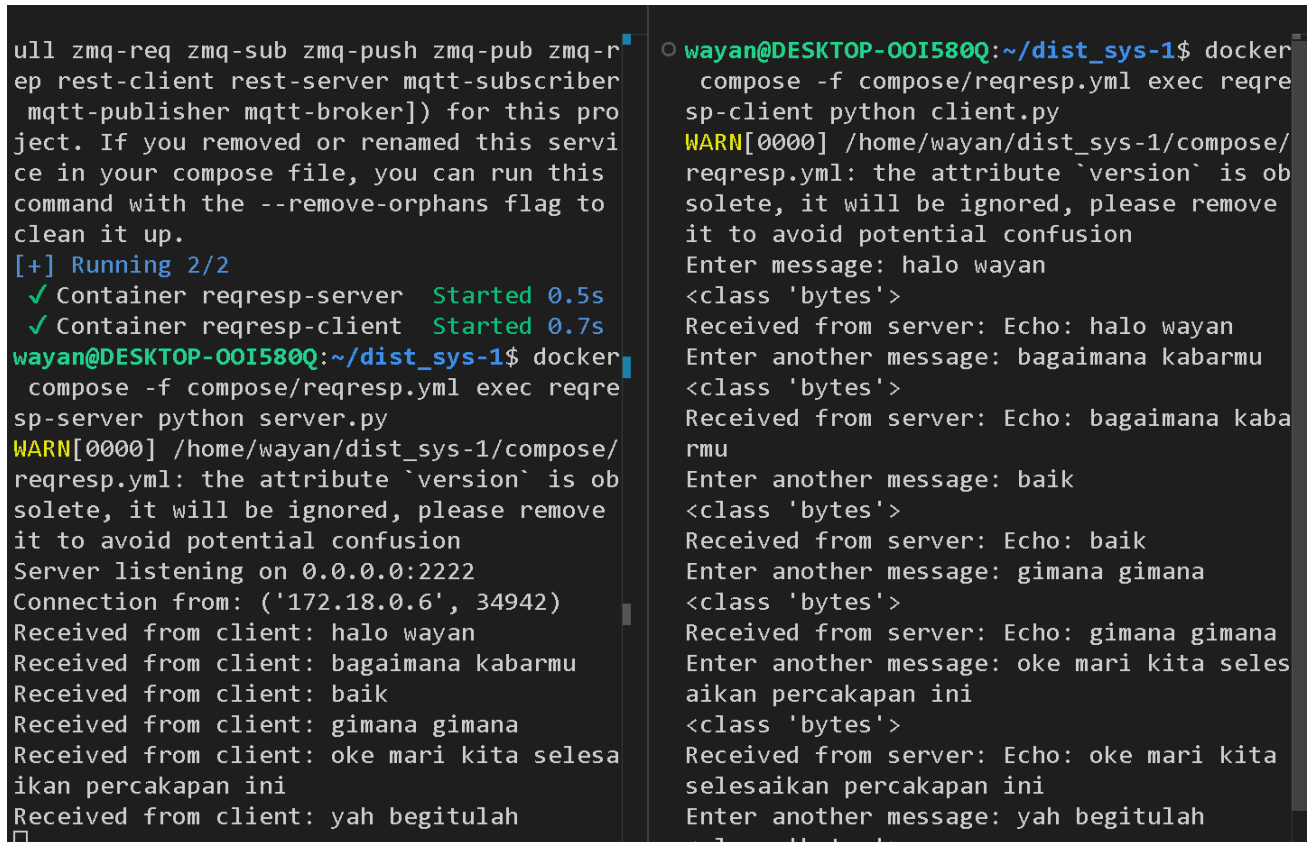
```
wayan@DESKTOP-00I580Q:~/dist_sys-1$ docker compose -f compose/reqresp.yml up -d
WARN[0000] /home/wayan/dist_sys-1/compose/reqresp.yml: the attribute `version` is
t to avoid potential confusion
#1 [internal] load local bake definitions
#1 reading from stdin 987B done
#1 DONE 0.0s
```

Gambar 17. Tampilan mempraktekkan docker compose

- Melakukan split terminal dan melaksanakan masing-masing perintah pada masing-masing terminal

```
docker compose -f compose/reqresp.yml exec reqresp-server python server.py
```

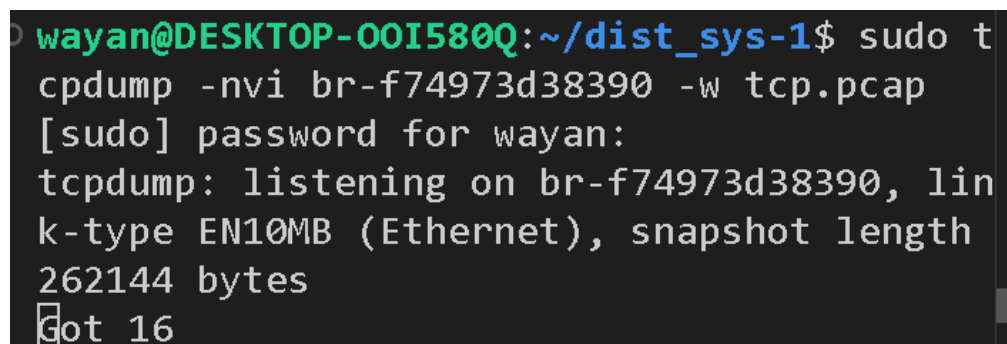
```
docker compose -f compose/reqresp.yml exec reqresp-client python client.py
```



```
ull zmq-req zmq-sub zmq-push zmq-pub zmq-r
ep rest-client rest-server mqtt-subscriber
mqtt-publisher mqtt-broker]) for this pro
ject. If you removed or renamed this servi
ce in your compose file, you can run this
command with the --remove-orphans flag to
clean it up.
[+] Running 2/2
✓ Container reqresp-server Started 0.5s
✓ Container reqresp-client Started 0.7s
wayan@DESKTOP-00I580Q:~/dist_sys-1$ docker
compose -f compose/reqresp.yml exec reqre
sp-server python server.py
WARN[0000] /home/wayan/dist_sys-1/compose/
reqresp.yml: the attribute `version` is ob
solete, it will be ignored, please remove
it to avoid potential confusion
Server listening on 0.0.0.0:2222
Connection from: ('172.18.0.6', 34942)
Received from client: halo wayan
Received from client: bagaimana kabarmu
Received from client: baik
Received from client: gimana gimana
Received from client: oke mari kita selesa
ikan percakapan ini
Received from client: yah begitulah
wayan@DESKTOP-00I580Q:~/dist_sys-1$ docker
compose -f compose/reqresp.yml exec reqre
sp-client python client.py
WARN[0000] /home/wayan/dist_sys-1/compose/
reqresp.yml: the attribute `version` is ob
solete, it will be ignored, please remove
it to avoid potential confusion
Enter message: halo wayan
<class 'bytes'>
Received from server: Echo: halo wayan
Enter another message: bagaimana kabarmu
<class 'bytes'>
Received from server: Echo: bagaimana kaba
rmu
Enter another message: baik
<class 'bytes'>
Received from server: Echo: baik
Enter another message: gimana gimana
<class 'bytes'>
Received from server: Echo: gimana gimana
Enter another message: oke mari kita seles
aikan percakapan ini
<class 'bytes'>
Received from server: Echo: oke mari kita
selesaikan percakapan ini
Enter another message: yah begitulah
<class 'bytes'>
```

Gambar 18. Tampilan dilakukan split terminal

- Melakukan tangkapan melalui tcp dump



```
wayan@DESKTOP-00I580Q:~/dist_sys-1$ sudo t
cpdump -nvi br-f74973d38390 -w tcp.pcap
[sudo] password for wayan:
tcpdump: listening on br-f74973d38390, lin
k-type EN10MB (Ethernet), snapshot length
262144 bytes
Got 16
```

Gambar 19. Tampilan tcp dump

- Melakukan analisis tcp.pcap

tcp.pcap (23 frames, 201.223111 seconds, 1838 bytes)

Apply a display filter

Endpoints Response Time Statistics Export Objects Misc

Displaying all 23 frames

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	172.18.0.6	172.18.0.5	TCP	75	34942 → 2222 [PSH, ACK] Seq=1 Ack=1 Win=502 Len=9
2	0.000626	172.18.0.5	172.18.0.6	TCP	81	2222 → 34942 [PSH, ACK] Seq=1 Ack=10 Win=509 Len=5
3	0.000668	172.18.0.6	172.18.0.5	TCP	66	34942 → 2222 [ACK] Seq=10 Ack=16 Win=502 Len=0 TS
4	6.545954	0e:d2:3a:5c:6b:80	26:b3:97:0a:fc:ff	ARP	42	Who has 172.18.0.6? Tell 172.18.0.5
5	6.545962	26:b3:97:0a:fc:ff	0e:d2:3a:5c:6b:80	ARP	42	Who has 172.18.0.5? Tell 172.18.0.6
6	6.545970	26:b3:97:0a:fc:ff	0e:d2:3a:5c:6b:80	ARP	42	172.18.0.6 is at 26:b3:97:0a:fc:ff
7	6.545979	0e:d2:3a:5c:6b:80	26:b3:97:0a:fc:ff	ARP	42	172.18.0.5 is at 0e:d2:3a:5c:6b:80
8	7.538316	172.18.0.6	172.18.0.5	TCP	83	34942 → 2222 [PSH, ACK] Seq=10 Ack=16 Win=502 Len=9
9	7.538571	172.18.0.5	172.18.0.6	TCP	89	2222 → 34942 [PSH, ACK] Seq=16 Ack=27 Win=509 Len=5
10	7.538614	172.18.0.6	172.18.0.5	TCP	66	34942 → 2222 [ACK] Seq=27 Ack=39 Win=502 Len=0 TS
11	10.435287	172.18.0.6	172.18.0.5	TCP	74	34942 → 2222 [PSH, ACK] Seq=27 Ack=39 Win=502 Len=9
12	10.435471	172.18.0.5	172.18.0.6	TCP	80	2222 → 34942 [PSH, ACK] Seq=39 Ack=35 Win=509 Len=5
13	10.435519	172.18.0.6	172.18.0.5	TCP	66	34942 → 2222 [ACK] Seq=35 Ack=53 Win=502 Len=0 TS
14	14.632514	172.18.0.6	172.18.0.5	TCP	80	34942 → 2222 [PSH, ACK] Seq=35 Ack=53 Win=502 Len=9
15	14.632690	172.18.0.5	172.18.0.6	TCP	86	2222 → 34942 [PSH, ACK] Seq=53 Ack=49 Win=509 Len=5
16	14.632730	172.18.0.6	172.18.0.5	TCP	66	34942 → 2222 [ACK] Seq=49 Ack=73 Win=502 Len=0 TS
17	196.104548	172.18.0.6	172.18.0.5	TCP	66	34942 → 2222 [FIN, ACK] Seq=49 Ack=73 Win=502 Len=0 TS
18	196.105024	172.18.0.5	172.18.0.6	TCP	66	2222 → 34942 [FIN, ACK] Seq=73 Ack=50 Win=509 Len=0 TS
19	196.105223	172.18.0.6	172.18.0.5	TCP	66	34942 → 2222 [ACK] Seq=50 Ack=74 Win=502 Len=0 TS
20	201.223099	26:b3:97:0a:fc:ff	0e:d2:3a:5c:6b:80	ARP	42	Who has 172.18.0.5? Tell 172.18.0.6

Gambar 20. Tampilan membuka tcp.pcap

- **Aktivitas TCP:** pertukaran pesan antara host 172.18.0.6 dan 172.18.0.5 melalui port 2222 yang kemudian ditutup secara normal dengan FIN-ACK
- **Aliran utama:** komunikasi antar host 172.18.0.6 dan 172.18.0.5.
- Kode tidak dilakukan modifikasi apapun

Protokol SOAP

- Melakukan modifikasi kode pada protokol SOAP dengan metode perkalian selisih kuadrat

```
16 # Memanggil metode perkalian selisih kuadrat dari layanan SOAP server (modified)
17 result = client.service.add(20, 30)
```

Gambar 21. modifikasi pada client.py

```
13 # Membuat layanan SOAP dengan metode perkalian selisih kuadrat (modified)
14 class CalculatorService(ServiceBase):
15     @rpc(Integer, Integer, _returns=Integer)
16     def add(ctx, a, b):
17         return ((a + b) * (a - b))
```

Gambar 22. modifikasi pada server.py

- Melakukan docker compose

```
docker compose -f compose/soap.yml up -d
```

```

wayan@DESKTOP-00I580Q:~/dist_sys-1$ docker
compose -f compose/soap.yml up -d
WARN[0000] /home/wayan/dist_sys-1/compose/
soap.yml: the attribute `version` is obso
ete, it will be ignored, please remove it

```

Gambar 23. Melakukan tahapan docker compose

- Melakukan split terminal serta menangkap proses melalui wireshark

Melaksanakan perintah:

```
docker compose -f compose/soap.yml exec soap-server python server.py
```

```
docker compose -f compose/soap.yml exec soap-client python client.py
```

```

wayan@DESKTOP-00I580Q:~/dist_sys-1$ docker
compose -f compose/soap.yml exec soap-ser
ver python server.py
WARN[0000] /home/wayan/dist_sys-1/compose/
soap.yml: the attribute `version` is obso
ete, it will be ignored, please remove it
to avoid potential confusion
SOAP server listening on http://0.0.0.0:80

wayan@DESKTOP-00I580Q:~/dist_sys-1$ docker
compose -f compose/soap.yml exec soap-cli
ent python client.py
WARN[0000] /home/wayan/dist_sys-1/compose/
soap.yml: the attribute `version` is obso
ete, it will be ignored, please remove it
to avoid potential confusion
Hasil penjumlahan dari server SOAP: -500

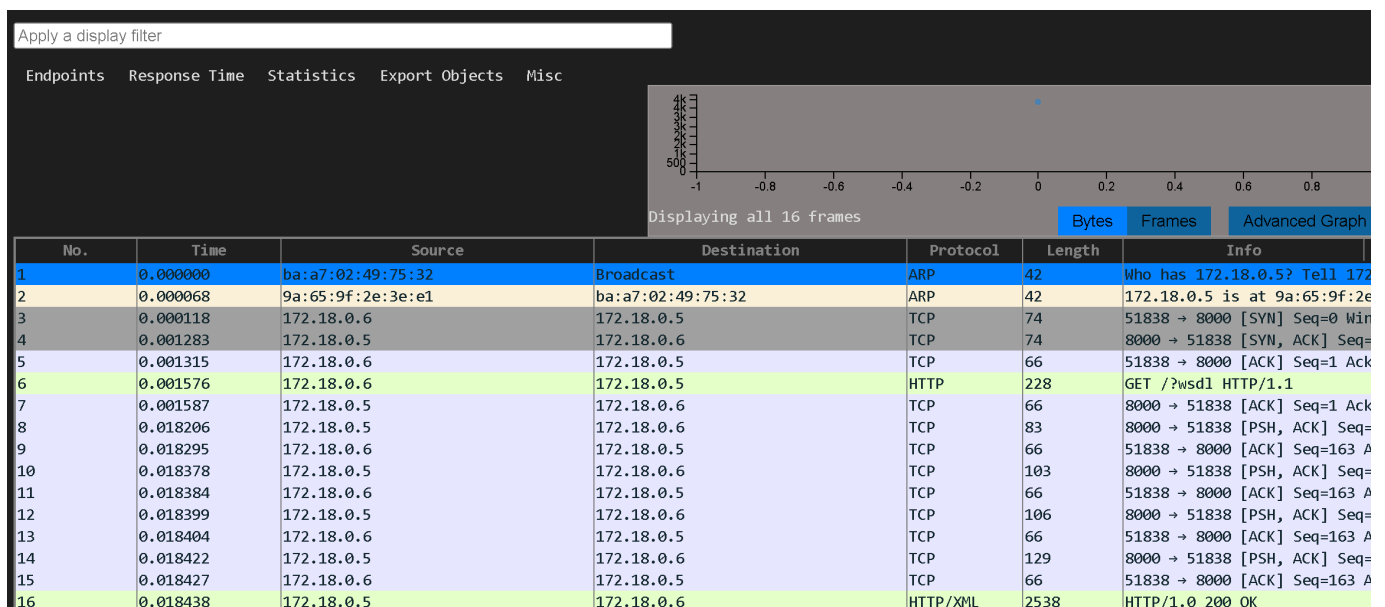
wayan@DESKTOP-00I580Q:~/dist_sys-1$ sudo t
cpdump -nvi br-f74973d38390 -w rest.pcap
[sudo] password for wayan:
tcpdump: listening on br-f74973d38390, lin
k-type EN10MB (Ethernet), snapshot length
262144 bytes
Got 40

```

didapatkan hasil -500.

Gambar 24. Tahapan split terminal

- Melakukan analisis pada soap.pcap (Setelah direname dari rest.pcap)

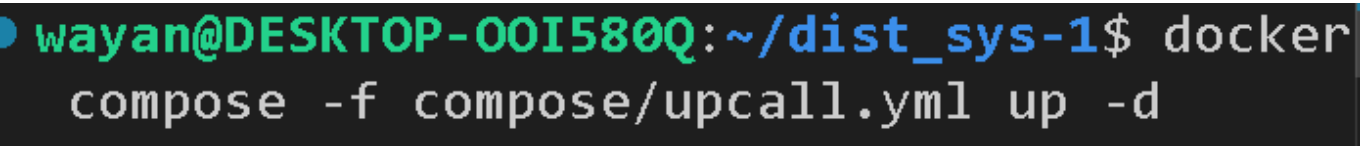


Gambar 25. Tampilan wireshark

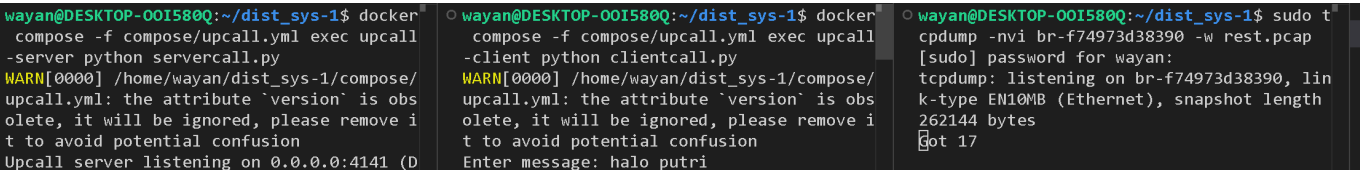
- **Aktivitas SOAP:** pertukaran pesan antara host 172.18.0.6 dan 172.18.0.5 melalui port 8000 yang kemudian ditutup secara normal.

- Aliran utama: komunikasi antar host 172.18.0.6 dan 172.18.0.5.

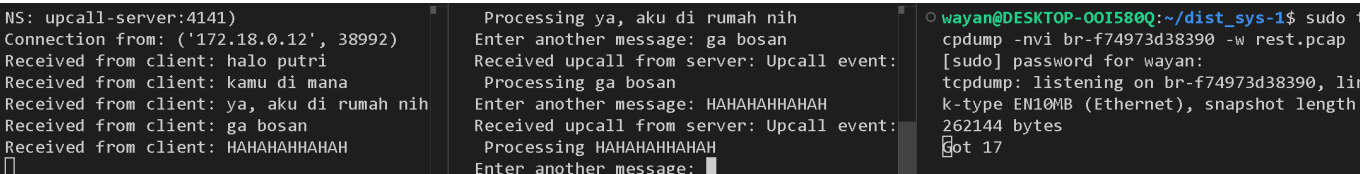
Protokol Upcall



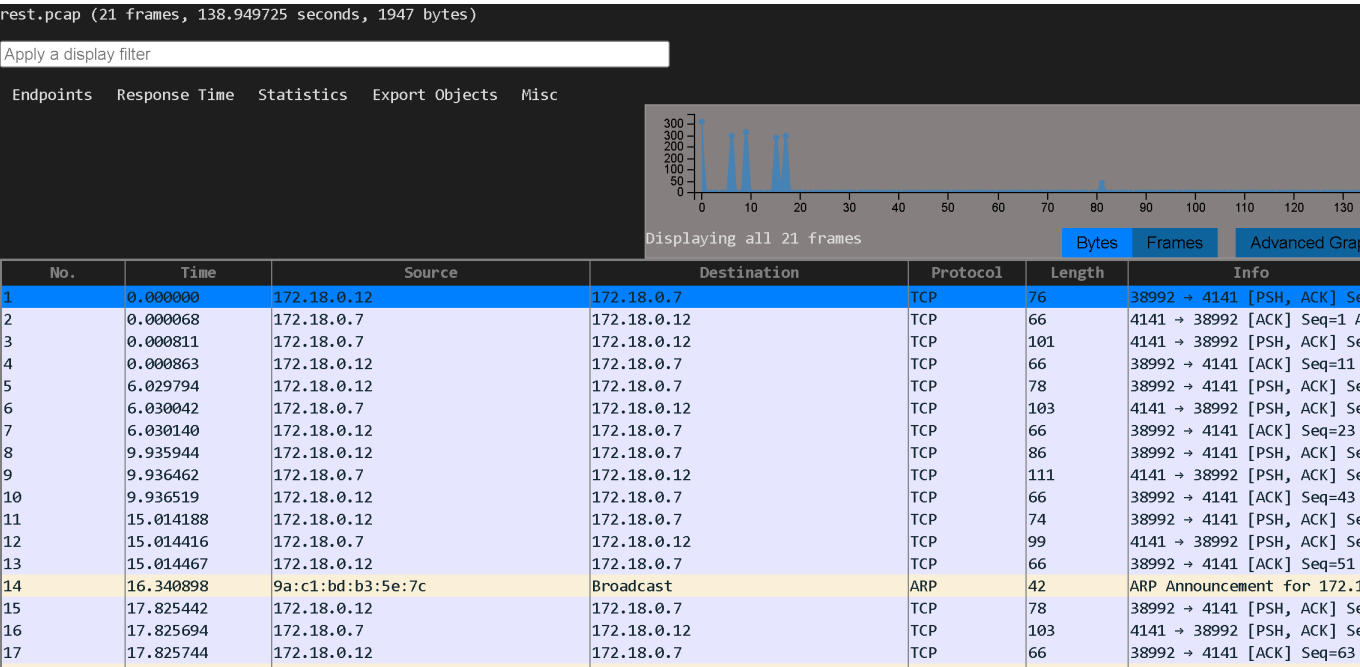
Gambar 26. Tampilan docker compose



Gambar 27. Tampilan Split Terminal



Gambar 28. Tampilan Split Terminal



Gambar 29. Tampilan upcall.pcap (Setelah direname dari upcall.pcap)

Tidak ada modifikasi kode sama sekali

Aktivitas Upcall : TCP (dengan beberapa payload `PSH, ACK`) + 1 ARP announcement

Aliran utama : Komunikasi **172.18.0.12** (client, port 38992) dengan **172.18.0.7** (server, port 4141)