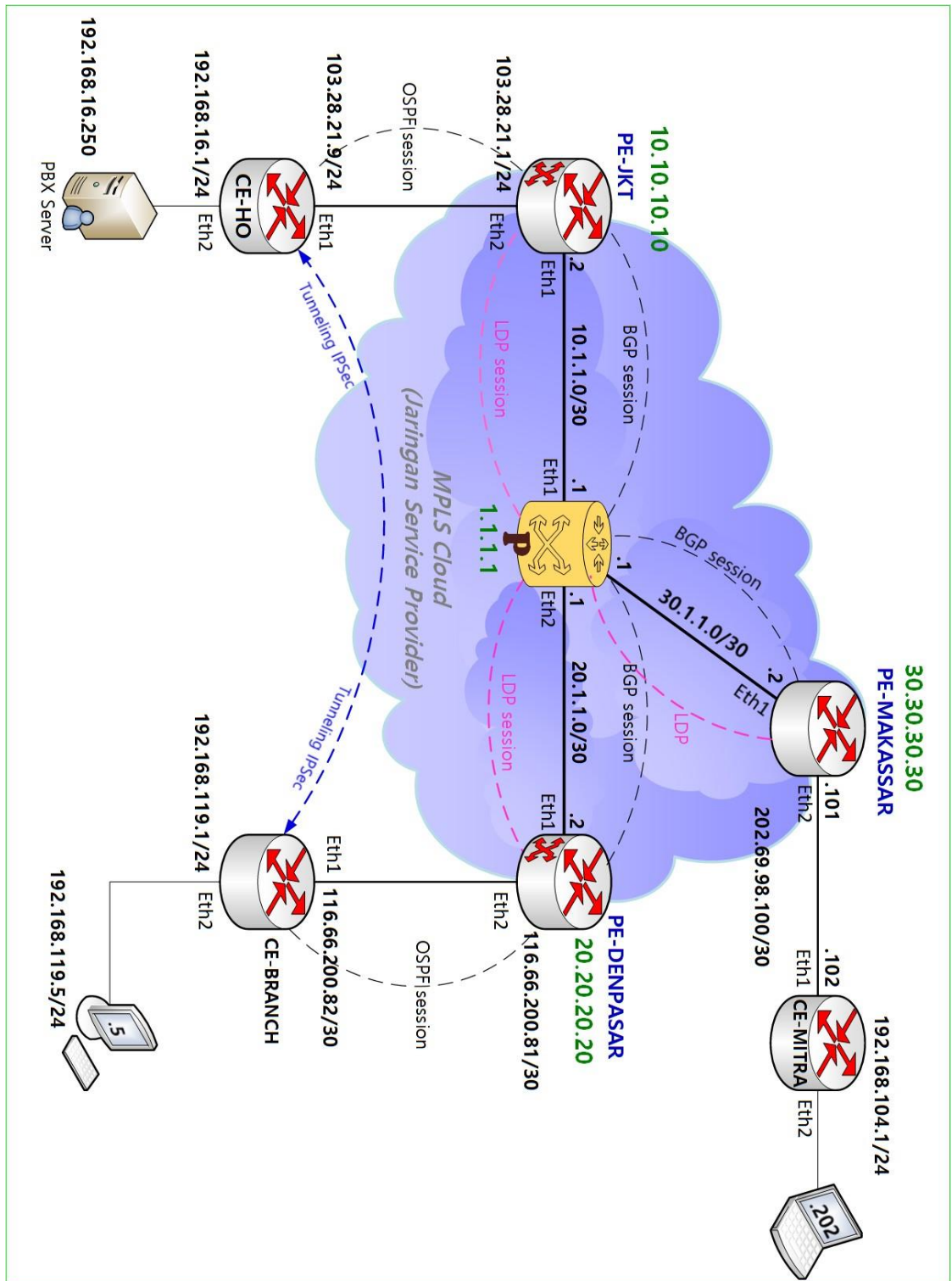


LAMPIRAN A

Topologi Simulasi Jaringan VPN MPLS



LAMPIRAN B

SCRIPT KONFIGURASI PERANGKAT JARINGAN PADA SIMULASI KONFIGURASI MPLS BACKBONE

- Konfigurasi di router PE-JKT :

```
/ip address add address=10.1.1.2/30 interface=ether1
/ip address add address=103.28.21.1/24 interface=ether2

/interface bridge add name=lobridge
/ip address add address=10.10.10.10/32 interface=lobridge

/ip route add dst-address=1.1.1.1/32 gateway=10.1.1.1
/ip route add dst-address=20.20.20.20/32 gateway=10.1.1.1
/ip route add dst-address=30.30.30.30/32 gateway=10.1.1.1
```

- Konfigurasi di router P (Core) :

```
/ip address add address=10.1.1.1/30 interface=ether1
/ip address add address=20.1.1.1/30 interface=ether2
/ip address add address=30.1.1.1/30 interface=ether3

/interface bridge add name=lobridge
/ip address add address=1.1.1.1/32 interface=lobridge

/ip route add dst-address=10.10.10.10/32 gateway=10.1.1.2
/ip route add dst-address=20.20.20.20/32 gateway=20.1.1.2
/ip route add dst-address=30.30.30.30/32 gateway=30.1.1.3
```

- Konfigurasi di router PE-DENPASAR :

```
/ip address add address=20.1.1.2/30 interface=ether1
/ip address add address=116.66.200.81/30 interface=ether2

/interface bridge add name=lobridge
/ip address add address=20.20.20.20/32 interface=lobridge

/ip route add dst-address=1.1.1.1/32 gateway=20.1.1.1
/ip route add dst-address=10.10.10.10/32 gateway=20.1.1.1
/ip route add dst-address=30.30.30.30/32 gateway=20.1.1.1
```

- Konfigurasi di router PE-MAKASSAR :

```
/ip address add address=30.1.1.2/30 interface=ether1
/ip address add address=202.69.98.101/30 interface=ether2

/interface bridge add name=lobridge
/ip address add address=30.30.30.30/32 interface=lobridge

/ip route add dst-address=1.1.1.1/32 gateway=30.1.1.1
/ip route add dst-address=10.10.10.10/32 gateway=30.1.1.1
```

```
/ip route add dst-address=20.20.20.20/32 gateway=30.1.1.1
```

LAMPIRAN C

KONFIGURASI BGP DI ROUTER PE

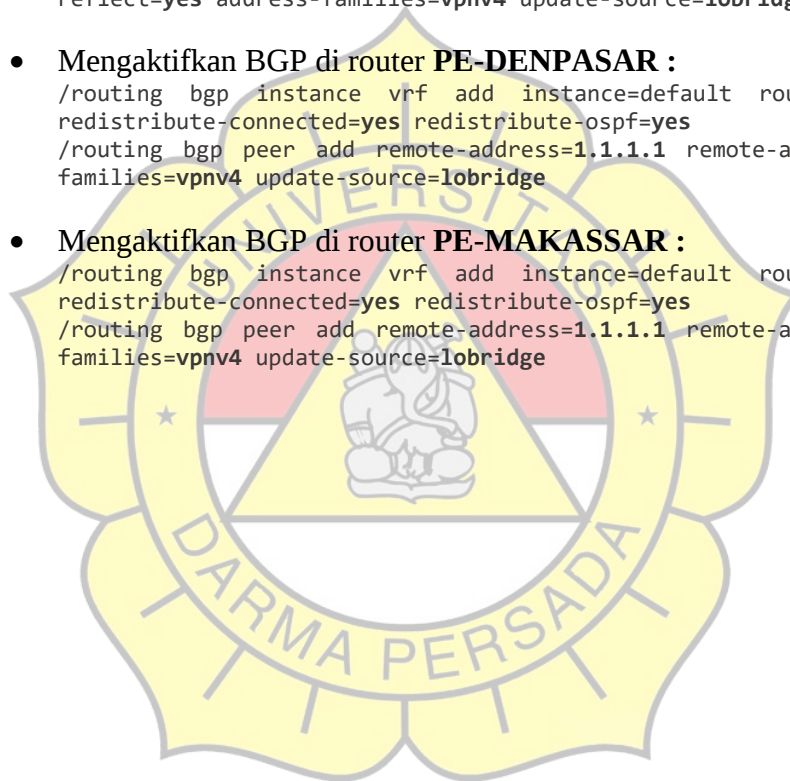
- Mengaktifkan BGP di router **PE-JKT** :

```
/routing bgp instance vrf add instance=default routing-mark=vrf-01  
redistribute-connected=yes redistribute-ospf=yes  
/routing bgp peer add remote-address=1.1.1.1 remote-as=65530 address-  
families=vpn4 update-source=lobridge
```
- Mengaktifkan BGP di router **P (Core)** :

```
/routing bgp peer add remote-address=10.10.10.10 remote-as=65530 route-  
reflect=yes address-families=vpn4 update-source=lobridge  
/routing bgp peer add remote-address=20.20.20.20 remote-as=65530 route-  
reflect=yes address-families=vpn4 update-source=lobridge  
/routing bgp peer add remote-address=30.30.30.30 remote-as=65530 route-  
reflect=yes address-families=vpn4 update-source=lobridge
```
- Mengaktifkan BGP di router **PE-DENPASAR** :

```
/routing bgp instance vrf add instance=default routing-mark=vrf-01  
redistribute-connected=yes redistribute-ospf=yes  
/routing bgp peer add remote-address=1.1.1.1 remote-as=65530 address-  
families=vpn4 update-source=lobridge
```
- Mengaktifkan BGP di router **PE-MAKASSAR** :

```
/routing bgp instance vrf add instance=default routing-mark=vrf-01  
redistribute-connected=yes redistribute-ospf=yes  
/routing bgp peer add remote-address=1.1.1.1 remote-as=65530 address-  
families=vpn4 update-source=lobridge
```



LAMPIRAN D

KONFIGURASI ROUTER CE (CUSTOMER EDGE)

1) Setting *IP Address* pada semua *interface* router

Konfigurasi router CE Head Office :

```
/ip address add address=103.8.21.1/24 interface=ether1  
/ip address add address=192.168.16.1/24 interface=ether2
```

Konfigurasi router CE Branch Office :

```
/ip address add address=116.66.200.82/30 interface=ether1  
/ip address add address=192.168.119.1/24 interface=ether2
```

Konfigurasi router CE Mitra :

```
/ip address add address=202.69.98.102/30 interface=ether1  
/ip address add address=192.168.104.1/24 interface=ether2
```

2) Mengaktifkan *routing* OSPF

Berikut konfigurasinya di masing-masing router CE

Di router CE Head Office :

```
/routing ospf network add network=103.28.21.0/24 area=backbone  
/routing ospf network add network=192.168.16.0/24 area=backbone
```

Di router CE Branch Office :

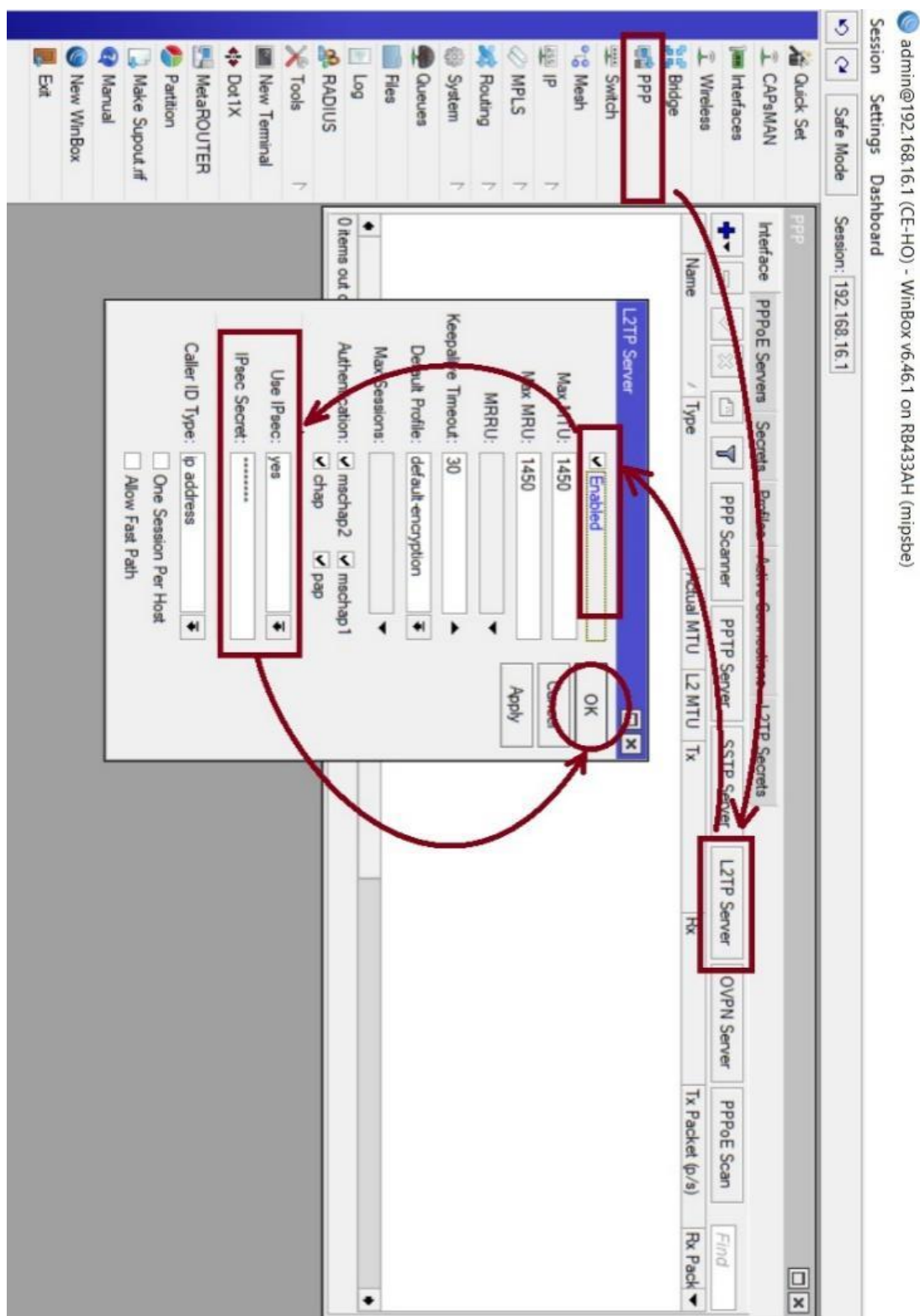
```
/routing ospf network add network=116.66.200.80/30 area=backbone  
/routing ospf network add network=192.168.119.0/24 area=backbone
```

Di router CE Mitra :

```
/routing ospf network add network=202.69.98.100/30 area=backbone  
/routing ospf network add network=192.168.104.0/24 area=backbone
```

LAMPIRAN E

Langkah membuat server L2TP di Router CE Head Office.



LAMPIRAN F

CAPTURE PEMBUKTIAN TUNNELING IPSEC ESP TELAH BERJALAN DI PERANGKAT ROUTER CE

The screenshot shows the RouterOS WinBox interface. The top menu bar includes Session, Settings, Dashboard, and a user profile. The left sidebar contains various configuration tools like Policies, Profiles, Groups, and more. The main window displays the 'Policies' configuration page for the 'IPsec' profile. The 'Policy' tab is active, showing a table with columns: Src Address, Dest Address, Action, Algorithm, Encr Key Size, and Current Bytes. The table contains four entries:

Src Address	Dest Address	Action	Algorithm	Encr Key Size	Current Bytes
27.147.6	102.69.98.102	ipsec	aes-128-gcm	256	9225162
27.147.6	102.69.98.102	ipsec	aes-128-gcm	256	1924
27.147.6	102.69.98.102	ipsec	aes-128-gcm	256	18877
27.147.6	102.69.98.102	ipsec	aes-128-gcm	256	17251

Below the table, there is a 'Find' button and a 'Filter' dropdown. The bottom terminal window shows the command prompt of the RouterOS. The user has entered the command 'ipsec policy' and the output shows the configuration of the IPsec policy, including the source and destination addresses, the action, the algorithm, the key size, and the current bytes. The output is as follows:

```

[admin@CE-HO] > ipsec policy
ipsec policy
  src-address=102.69.98.102 dest-address=102.69.98.102
  action=ipsec algorithm=aes-128-gcm encr-key-size=256
  current-bytes=17251
  src-address=102.69.98.102 dest-address=102.69.98.102
  action=ipsec algorithm=aes-128-gcm encr-key-size=256
  current-bytes=18877
  src-address=102.69.98.102 dest-address=102.69.98.102
  action=ipsec algorithm=aes-128-gcm encr-key-size=256
  current-bytes=1924
  src-address=102.69.98.102 dest-address=102.69.98.102
  action=ipsec algorithm=aes-128-gcm encr-key-size=256
  current-bytes=9225162
  
```

LAMPIRAN G

SETTING ALOKASI BANDWIDTH DI ROUTER MIKROTIK UNTUK PERCOBAAN VoIP

The screenshot displays the Mikrotik WinBox interface with the Queue Manager configuration window open. The configuration is for a queue named 'queue1' with a target of '192.168.1.256'. The 'Max Limit' and 'Target Upload' are both set to '256K', and the 'Target Download' is also set to '256K'. These values are circled in red. The 'NetPerfec' tool is also open, showing a bar graph of network performance metrics. The 'Current' value for the 'Average' metric is '35.25 Kbps', and the 'Max' value is '108.74 Kbps'. These values are also circled in red. The 'NetPerfec' tool is set to 'Display' and 'Auto scale'.

Queue Manager Configuration:

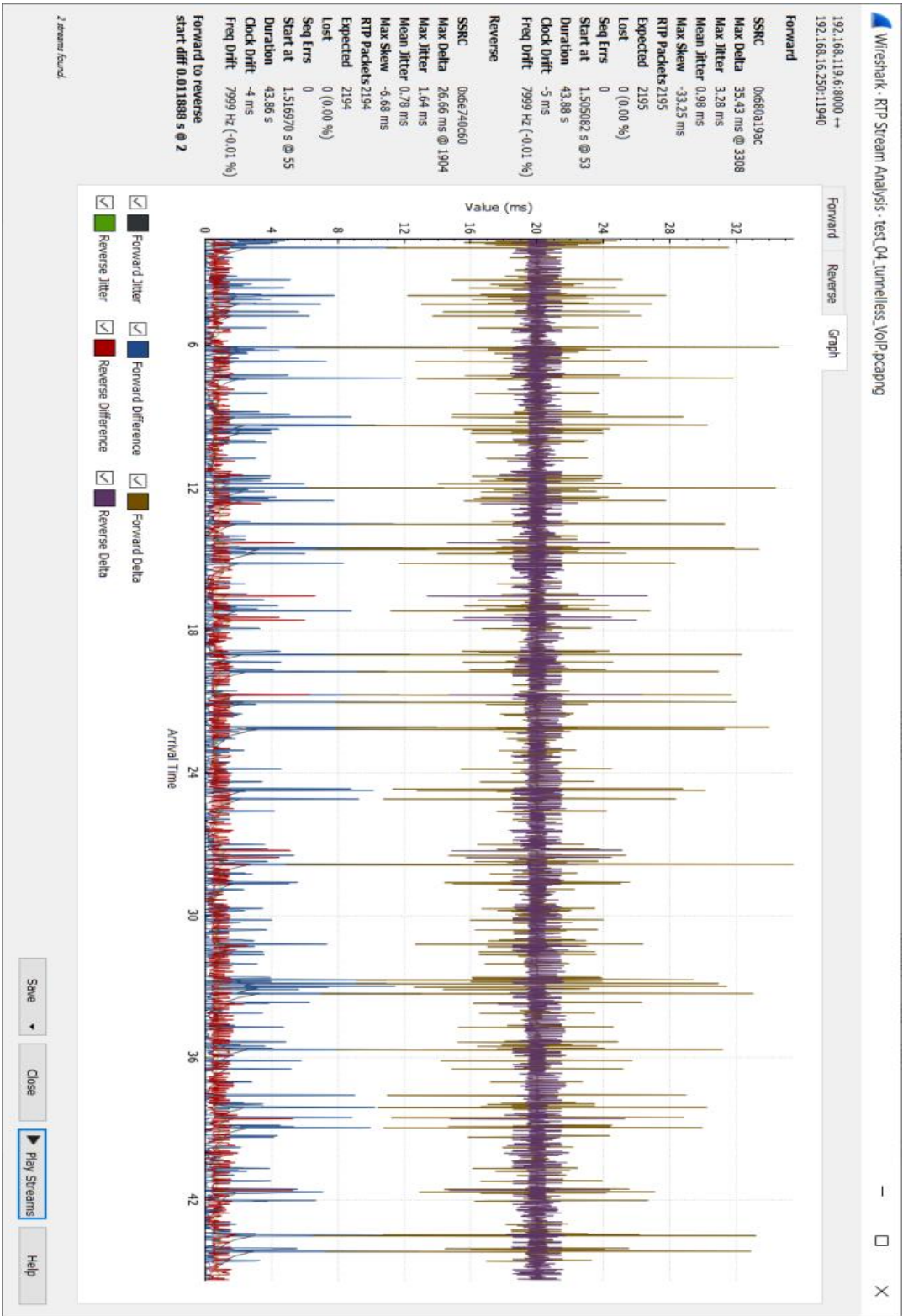
Name	Target	Upload Max Limit	Download Max Limit
queue1	192.168.1.256	256K	256K

NetPerfec Tool Results:

Metric	Current	Max
Average	35.25 Kbps	108.74 Kbps

LAMPIRAN H

GRAFIK ANALISIS RTP STREAM SEBELUM IMPLEMENTASI IPSEC



LAMPIRAN I

GRAFIK ANALISIS RTP STREAM SETELAH IMPLEMENTASI IPSEC

