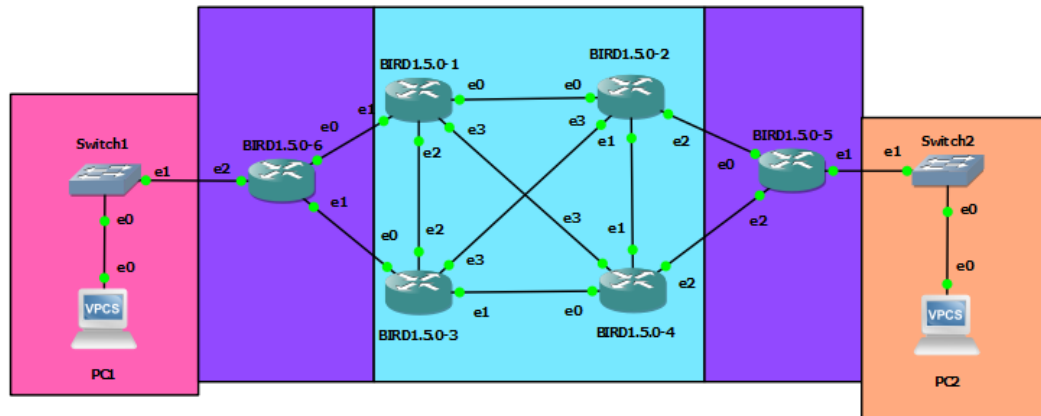


LAMPIRAN



Lampiran 1. Topologi Jaringan

```

pc1_1.pcapng [pc2 eth3 to co2 eth3]
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
icmp5App.dst==172.16.1.2 && @.src==172.16.2.2
No. Time Source Destination Protocol Iden
16 2023-05-31 12:16:27,221618 172.16.2.2 172.16.1.2 UDP 0xaf8b (445939)
21 2023-05-31 12:16:27,228664 172.16.2.2 172.16.1.2 UDP 0xaf8c (445940)
22 2023-05-31 12:16:27,238788 172.16.2.2 172.16.1.2 UDP 0xaf8d (445941)
23 2023-05-31 12:16:27,249837 172.16.2.2 172.16.1.2 UDP 0xaf8e (445942)
24 2023-05-31 12:16:27,260884 172.16.2.2 172.16.1.2 UDP 0xaf8f (445943)
25 2023-05-31 12:16:27,271871 172.16.2.2 172.16.1.2 UDP 0xaf90 (445944)
26 2023-05-31 12:16:27,282871 172.16.2.2 172.16.1.2 UDP 0xaf91 (445945)
27 2023-05-31 12:16:27,293853 172.16.2.2 172.16.1.2 UDP 0xaf92 (445946)
28 2023-05-31 12:16:27,304886 172.16.2.2 172.16.1.2 UDP 0xaf93 (445947)
29 2023-05-31 12:16:27,315950 172.16.2.2 172.16.1.2 UDP 0xaf94 (445948)
30 2023-05-31 12:16:27,326988 172.16.2.2 172.16.1.2 UDP 0xaf95 (445949)
31 2023-05-31 12:16:27,337951 172.16.2.2 172.16.1.2 UDP 0xaf96 (445950)
32 2023-05-31 12:16:27,348994 172.16.2.2 172.16.1.2 UDP 0xaf97 (445951)
33 2023-05-31 12:16:27,360919 172.16.2.2 172.16.1.2 UDP 0xaf98 (445952)
34 2023-05-31 12:16:27,371990 172.16.2.2 172.16.1.2 UDP 0xaf99 (445953)
35 2023-05-31 12:16:27,383506 172.16.2.2 172.16.1.2 UDP 0xaf9a (445954)
36 2023-05-31 12:16:27,394819 172.16.2.2 172.16.1.2 UDP 0xaf9b (445955)
37 2023-05-31 12:16:27,406082 172.16.2.2 172.16.1.2 UDP 0xaf9c (445956)
38 2023-05-31 12:16:27,415506 172.16.2.2 172.16.1.2 UDP 0xaf9d (445957)
39 2023-05-31 12:16:27,426607 172.16.2.2 172.16.1.2 UDP 0xaf9e (445958)
40 2023-05-31 12:16:27,438090 172.16.2.2 172.16.1.2 UDP 0xaf9f (445959)
41 2023-05-31 12:16:27,449050 172.16.2.2 172.16.1.2 UDP 0xafa0 (445960)
42 2023-05-31 12:16:27,459531 172.16.2.2 172.16.1.2 UDP 0xafa1 (445961)
43 2023-05-31 12:16:27,470572 172.16.2.2 172.16.1.2 UDP 0xafa2 (445962)
44 2023-05-31 12:16:27,481571 172.16.2.2 172.16.1.2 UDP 0xafa3 (445963)
45 2023-05-31 12:16:27,493545 172.16.2.2 172.16.1.2 UDP 0xafa4 (445964)
46 2023-05-31 12:16:27,504579 172.16.2.2 172.16.1.2 UDP 0xafa5 (445965)
47 2023-05-31 12:16:27,515582 172.16.2.2 172.16.1.2 UDP 0xafa6 (445966)
48 2023-05-31 12:16:27,526658 172.16.2.2 172.16.1.2 UDP 0xafa7 (445967)
49 2023-05-31 12:16:27,538325 172.16.2.2 172.16.1.2 UDP 0xafa8 (445968)
50 2023-05-31 12:16:27,548379 172.16.2.2 172.16.1.2 UDP 0xafa9 (445969)
51 2023-05-31 12:16:27,559729 172.16.2.2 172.16.1.2 UDP 0xafaa (445970)
52 2023-05-31 12:16:27,570636 172.16.2.2 172.16.1.2 UDP 0xafab (445971)
53 2023-05-31 12:16:27,581050 172.16.2.2 172.16.1.2 UDP 0xafac (445972)
> Frame 16: 46 bytes on wire (368 bits), 46 bytes captured (368) on interface 0
> Ethernet II, Src: 0c:a4:00:63:00:00 (0c:a4:00:63:00:00), Dst: 01:00:5e:00:00:00
0000 0c 26 dc fd 00 00 0c a4 00 63 00 00 08 00 45 00 &.....c....E:
0010 00 20 af 80 40 00 00 11 30 1d ec 18 02 62 ac 10 .....@.....
0020 01 02 8a ba 14 51 00 0c 94 d1 15 cd 5b 07 .....Q.....[

```

The image displays two screenshots of a Wireshark network traffic capture. The top screenshot shows a UDP stream with the following details:

No.	Time	Source	Destination	Protocol	Length	Info
24	31.325048	172.16.2.2	172.16.1.2	UDP	46	60386 → 5201 Len=4
29	31.331567	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
30	31.341456	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
31	31.352466	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
32	31.363481	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
33	31.374531	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
34	31.385598	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
35	31.397571	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
36	31.408522	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
37	31.419567	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
38	31.430572	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
39	31.441535	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
40	31.452620	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
41	31.463618	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
42	31.474537	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
43	31.485721	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
44	31.496626	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
45	31.507617	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
46	31.518595	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
47	31.529623	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
48	31.540591	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
49	31.551612	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
50	31.562646	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
51	31.573669	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
52	31.584306	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
53	31.595780	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
54	31.606780	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
55	31.617652	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
56	31.629664	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
57	31.639670	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
58	31.650663	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
59	31.661735	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
60	31.672696	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448
61	31.684731	172.16.2.2	172.16.1.2	UDP	1490	60386 → 5201 Len=1448

The bottom screenshot shows a TCP stream with the following details:

No.	Time	Source	Destination	Protocol	Length	Info
4	11.312911	172.16.2.2	172.16.1.2	TCP	74	60388 → 5201 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM TSval=541628974 TSecr=0 WS=16
6	11.316312	172.16.2.2	172.16.1.2	TCP	66	46388 → 5201 [ACK] Seq=1 Ack=1 Win=64240 Len=0 TSval=541628978 TSecr=289131617
7	11.316738	172.16.2.2	172.16.1.2	TCP	103	46388 → 5201 [PSH, ACK] Seq=1 Ack=1 Win=64240 Len=37 TSval=541628975 TSecr=289131617
10	11.319753	172.16.2.2	172.16.1.2	TCP	66	46388 → 5201 [ACK] Seq=38 Ack=2 Win=64240 Len=0 TSval=541628981 TSecr=289131621
11	11.319922	172.16.2.2	172.16.1.2	TCP	70	46388 → 5201 [PSH, ACK] Seq=38 Ack=2 Win=64240 Len=4 TSval=541628981 TSecr=289131621
12	11.320225	172.16.2.2	172.16.1.2	TCP	181	46388 → 5201 [PSH, ACK] Seq=42 Ack=2 Win=64240 Len=115 TSval=541628982 TSecr=289131621
15	11.326388	172.16.2.2	172.16.1.2	TCP	74	46398 → 5201 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 SACK_PERM TSval=541628998 TSecr=0 WS=16
17	11.327826	172.16.2.2	172.16.1.2	TCP	66	46398 → 5201 [ACK] Seq=1 Ack=1 Win=64240 Len=0 TSval=541628999 TSecr=289131629
18	11.328008	172.16.2.2	172.16.1.2	TCP	103	46398 → 5201 [PSH, ACK] Seq=1 Ack=1 Win=64240 Len=37 TSval=541629000 TSecr=289131629
22	11.335183	172.16.2.2	172.16.1.2	TCP	66	46388 → 5201 [ACK] Seq=157 Ack=5 Win=64240 Len=0 TSval=541628997 TSecr=289131626
23	11.336282	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=38 Ack=1 Win=64240 Len=1448 TSval=541628998 TSecr=289131632
24	11.336293	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=1486 Ack=1 Win=64240 Len=1448 TSval=541628998 TSecr=289131632
25	11.336305	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=2934 Ack=1 Win=64240 Len=1448 TSval=541628998 TSecr=289131632
26	11.336389	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=4382 Ack=1 Win=64240 Len=1448 TSval=541628998 TSecr=289131632
27	11.336315	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [PSH, ACK] Seq=5030 Ack=1 Win=64240 Len=1448 TSval=541628998 TSecr=289131632
31	11.342414	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=7278 Ack=1 Win=64240 Len=1448 TSval=541629004 TSecr=289131632
34	11.342425	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=8726 Ack=1 Win=64240 Len=1448 TSval=541629004 TSecr=289131632
35	11.342434	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=10174 Ack=1 Win=64240 Len=1448 TSval=541629004 TSecr=289131632
36	11.342438	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=11622 Ack=1 Win=64240 Len=1448 TSval=541629004 TSecr=289131632
37	11.342442	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [PSH, ACK] Seq=13070 Ack=1 Win=64240 Len=1448 TSval=541629004 TSecr=289131632
42	11.348598	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=14519 Ack=1 Win=64240 Len=1448 TSval=541629010 TSecr=289131640
43	11.348668	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [PSH, ACK] Seq=15966 Ack=1 Win=64240 Len=1448 TSval=541629010 TSecr=289131640
45	11.348996	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=17414 Ack=1 Win=64240 Len=1448 TSval=541629011 TSecr=289131642
46	11.349006	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=18862 Ack=1 Win=64240 Len=1448 TSval=541629011 TSecr=289131642
47	11.349010	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=20310 Ack=1 Win=64240 Len=1448 TSval=541629011 TSecr=289131642
48	11.349019	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [PSH, ACK] Seq=21758 Ack=1 Win=64240 Len=1448 TSval=541629011 TSecr=289131642
49	11.349172	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=23206 Ack=1 Win=64240 Len=1448 TSval=541629011 TSecr=289131644
50	11.349186	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=24654 Ack=1 Win=64240 Len=1448 TSval=541629011 TSecr=289131644
51	11.349190	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=26102 Ack=1 Win=64240 Len=1448 TSval=541629011 TSecr=289131644
52	11.349194	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [PSH, ACK] Seq=27550 Ack=1 Win=64240 Len=1448 TSval=541629011 TSecr=289131644
53	11.349294	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=28998 Ack=1 Win=64240 Len=1448 TSval=541629011 TSecr=289131647
54	11.349382	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=30446 Ack=1 Win=64240 Len=1448 TSval=541629011 TSecr=289131647
55	11.349386	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [ACK] Seq=31894 Ack=1 Win=64240 Len=1448 TSval=541629011 TSecr=289131647
56	11.349314	172.16.2.2	172.16.1.2	TCP	1514	46398 → 5201 [PSH, ACK] Seq=33342 Ack=1 Win=64240 Len=1448 TSval=541629011 TSecr=289131647

Lampiran 2 Capture pada wireshark

Pengambilan data dilakukan dengan menggunakan iperf dengan pc1 sebagai *client* dan pc2 sebagai *server*. Kemudian *capture*-an dilakukan dengan menggunakan dan melakukan *filter* untuk membatasi data yang diambil.

No.	Time	Source	Destination	Protocol	Length	Info	Iden
1	47,40732	172.16.2.2172	172.16.1.2	UDP	46	43374 >	50x8e02 (36354)
2	47,41443	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e03 (36355)
3	47,42449	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e04 (36356)
4	47,43547	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e05 (36357)
5	47,44655	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e06 (36358)
6	47,45754	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e07 (36359)
7	47,46853	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e08 (36360)
8	47,47959	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e09 (36361)
9	47,49158	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e0a (36362)
10	47,50257	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e0b (36363)
11	47,51352	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e0c (36364)
12	47,52456	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e0d (36365)
13	47,53556	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e0e (36366)
14	47,54665	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e0f (36367)
15	47,55758	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e10 (36368)
16	47,56835	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e11 (36369)
17	47,57919	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e12 (36370)
18	47,59063	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e13 (36371)
19	47,60163	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e14 (36372)
20	47,61265	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e15 (36373)
21	47,62366	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e16 (36374)
22	47,63466	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e17 (36375)
23	47,64569	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e18 (36376)
24	47,65664	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e19 (36377)
25	47,66779	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e1a (36378)
26	47,67869	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e1b (36379)
27	47,68964	172.16.2.2172	172.16.1.2	UDP	1490	43374 >	50x8e1c (36380)

Lampiran 3 Export csv pada excel

Setelah dilakukan *capture* dilakukan *export* pada cvs untuk mempermudah proses perhitungan.

No.	Time 2	Time 1	Delay	Iden 2	Iden
1	47,40790	47,407316	0,000474	0x8e02 (36354)	0x8e02 (36354)
2	47,414823	47,414296	0,000527	0x8e03 (36355)	0x8e03 (36355)
3	47,424982	47,424485	0,000497	0x8e04 (36356)	0x8e04 (36356)
4	47,436031	47,435474	0,000557	0x8e05 (36357)	0x8e05 (36357)
5	47,447305	47,446554	0,000751	0x8e06 (36358)	0x8e06 (36358)
6	47,458298	47,457536	0,000762	0x8e07 (36359)	0x8e07 (36359)
7	47,469253	47,468525	0,000728	0x8e08 (36360)	0x8e08 (36360)
8	47,480264	47,479592	0,000672	0x8e09 (36361)	0x8e09 (36361)
9	47,491274	47,491578	0,000296	0x8e0a (36362)	0x8e0a (36362)
10	47,502287	47,502568	0,000281	0x8e0b (36363)	0x8e0b (36363)
11	47,513297	47,513522	0,000225	0x8e0c (36364)	0x8e0c (36364)
12	47,524307	47,524562	0,000255	0x8e0d (36365)	0x8e0d (36365)
13	47,535314	47,535562	0,000248	0x8e0e (36366)	0x8e0e (36366)
14	47,546324	47,546646	0,000322	0x8e0f (36367)	0x8e0f (36367)
15	47,557334	47,557584	0,000250	0x8e10 (36368)	0x8e10 (36368)
16	47,568344	47,568594	0,000250	0x8e11 (36369)	0x8e11 (36369)
17	47,579354	47,579604	0,000250	0x8e12 (36370)	0x8e12 (36370)
18	47,590364	47,590614	0,000250	0x8e13 (36371)	0x8e13 (36371)
19	47,601374	47,601624	0,000250	0x8e14 (36372)	0x8e14 (36372)
20	47,612384	47,612634	0,000250	0x8e15 (36373)	0x8e15 (36373)
21	47,623394	47,623644	0,000250	0x8e16 (36374)	0x8e16 (36374)
22	47,634404	47,634654	0,000250	0x8e17 (36375)	0x8e17 (36375)
23	47,645414	47,645664	0,000250	0x8e18 (36376)	0x8e18 (36376)
24	47,656424	47,656674	0,000250	0x8e19 (36377)	0x8e19 (36377)
25	47,667434	47,667684	0,000250	0x8e1a (36378)	0x8e1a (36378)
26	47,678444	47,678694	0,000250	0x8e1b (36379)	0x8e1b (36379)
27	47,689454	47,689704	0,000250	0x8e1c (36380)	0x8e1c (36380)

Lampiran 4 Perhitungan delay

Kemudian dilakukan perhitungan untuk menghitung delay antara pc1 dan pc2.

Berikut merupakan link dari data yang digunakan pada penelitian tugas akhir ini :

<https://bit.ly/DataDataTugasAkhir>