컴퓨터네트워크 TASK1

학과: 소프트웨어학과

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1. 개요

이 과제에서는 서로 다른 네트워크를 사용하는 사람이 클라이언트와 서버 역할을 번갈아 수행하고 Wireshark를 이용해서 UDP와 TCP 패킷 분석이 목적이다.

2. 이론적 배경

포트포워딩: 컴퓨터 네트워크에서 라우터를 거쳐 하나의 IP주소와 포트번호의 결합으로 통신요청을 다른곳으로 넘겨주는 역할을 한다. 즉 공유기에 공인 IP가 설정되어 있고 각 기계(컴퓨터, 핸드폰, TV 등등)은 사설 IP를 사용하고 있는데 포트 번호를 보고 공유기가 사설 IP로 연결해주는 방식이다.

공인 IP: 인터넷 서비스 제공업체(ISP)로부터 할당받은, 외부에서 접근 가능한 IP 주소

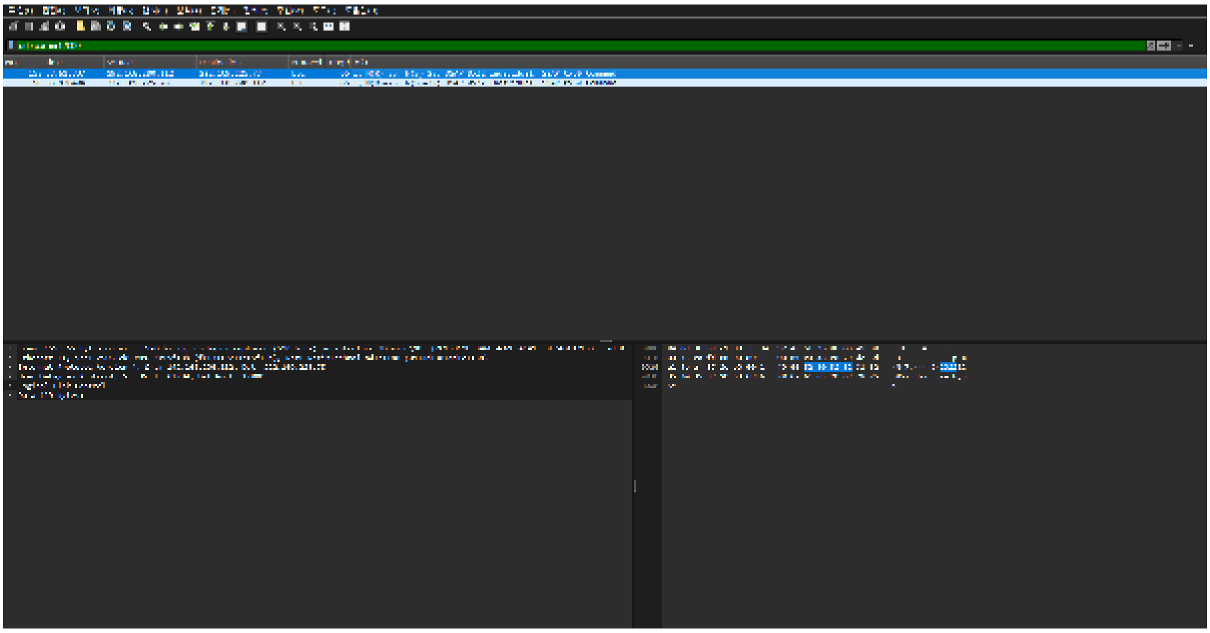
사설 IP: 내부 네트워크에서만 사용되는 IP 주소(예: 192.168.x.x, 10.x.x.x)

3. Client 역할 패킷 분석

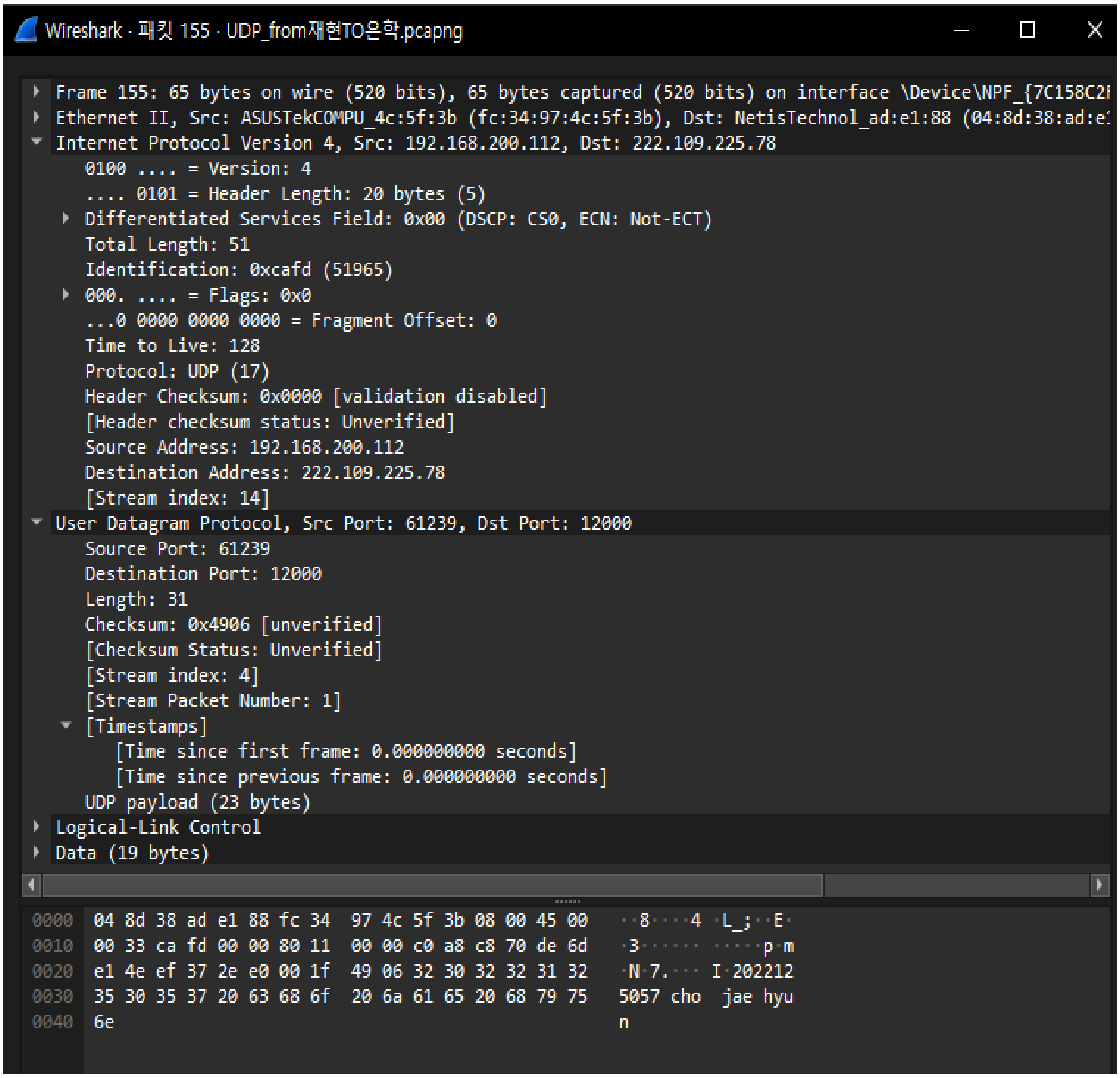
네트워크 인터페이스: Ethernet, 서버 포트: 12000

3-1. UDP

1. 조재현(client) <-> 이은학(server)



클라이언트 -> 서버 (UDP Request)



Wireshark · 패킷 155 · UDP_from재현TO은학.pcapng

```
Frame 155: 65 bytes on wire (520 bits), 65 bytes captured (520 bits) on interface \Device\NPF_{7C158C2
Ethernet II, Src: ASUSTekCOMPU_4c:5f:3b (fc:34:97:4c:5f:3b), Dst: NetisTechnol_ad:e1:88 (04:8d:38:ad:e
Internet Protocol Version 4, Src: 192.168.200.112, Dst: 222.109.225.78
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
  Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 51
    Identification: 0xcafd (51965)
  000. .... = Flags: 0x0
    ...0 0000 0000 0000 = Fragment Offset: 0
    Time to Live: 128
    Protocol: UDP (17)
    Header Checksum: 0x0000 [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 192.168.200.112
    Destination Address: 222.109.225.78
    [Stream index: 14]
User Datagram Protocol, Src Port: 61239, Dst Port: 12000
    Source Port: 61239
    Destination Port: 12000
    Length: 31
    Checksum: 0x4906 [unverified]
    [Checksum Status: Unverified]
    [Stream index: 4]
    [Stream Packet Number: 1]
  [Timestamps]
       [Time since first frame: 0.000000000 seconds]
       [Time since previous frame: 0.000000000 seconds]
    UDP payload (23 bytes)
Logical-Link Control
Data (19 bytes)

0000  04 8d 38 ad e1 88 fc 34  97 4c 5f 3b 08 00 45 00   ··8····4 ·L_;··E·
0010  00 33 ca fd 00 00 80 11  00 00 c0 a8 c8 70 de 6d   ·3······ ·····p·m
0020  e1 4e ef 37 2e e0 00 1f  49 06 32 30 32 32 31 32   ·N·7.··· I·202212
0030  35 30 35 37 20 63 68 6f  20 6a 61 65 20 68 79 75   5057 cho  jae hyu
0040  6e                                                 n
```

출발지 IP: 192.168.200.112

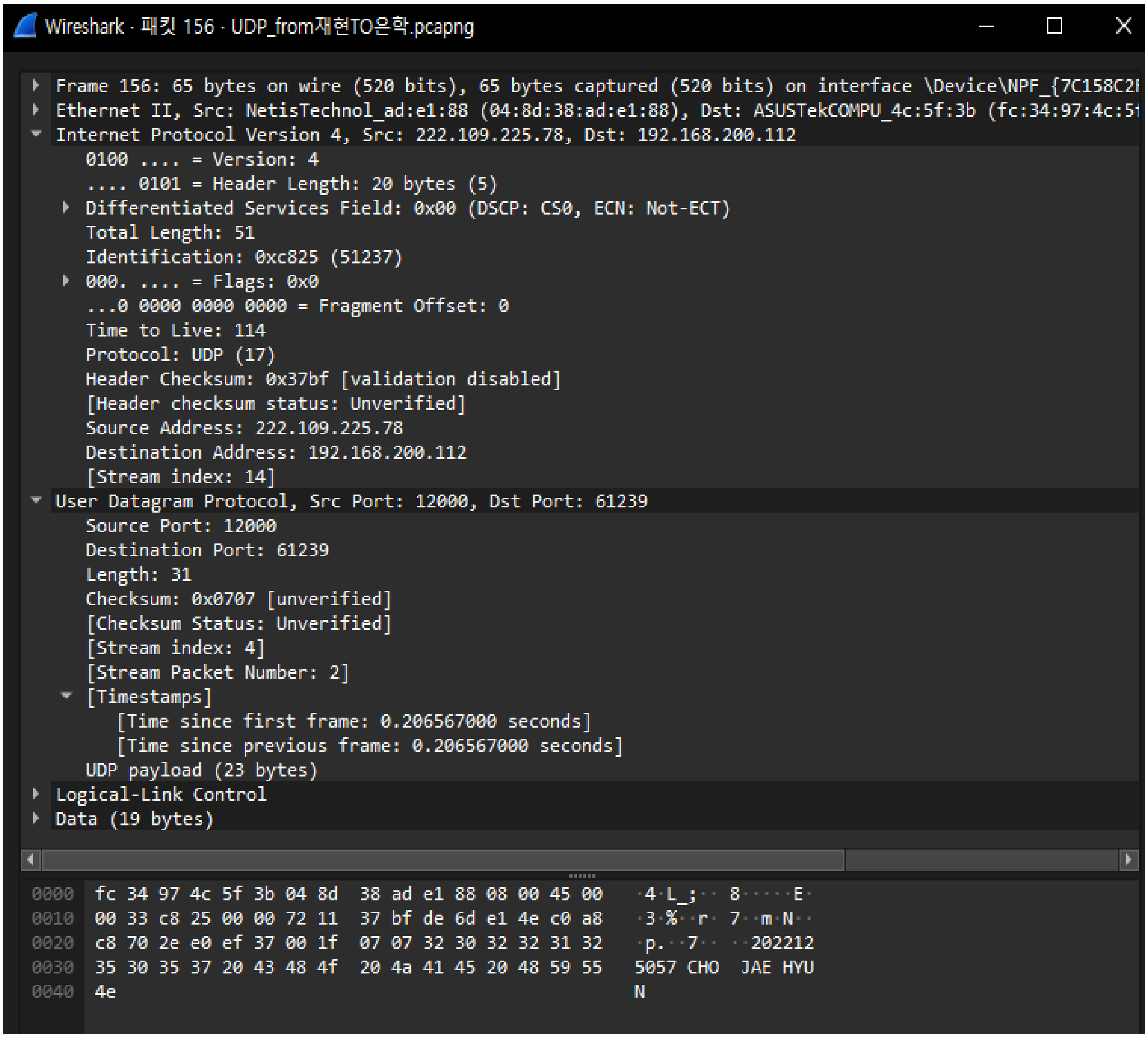
목적지 IP: 222.109.225.78

출발지 포트: 61239

목적지 포트: 12000

전송된 데이터 내용: 2022125057 cho jae hyun

서버 -> 클라이언트 (UDP Response)



Wireshark · 패킷 156 · UDP_from재현TO은학.pcapng

```
Frame 156: 65 bytes on wire (520 bits), 65 bytes captured (520 bits) on interface \Device\NPF_{7C158C2
Ethernet II, Src: NetisTechnol_ad:e1:88 (04:8d:38:ad:e1:88), Dst: ASUSTekCOMPU_4c:5f:3b (fc:34:97:4c:5
Internet Protocol Version 4, Src: 222.109.225.78, Dst: 192.168.200.112
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 51
    Identification: 0xc825 (51237)
    000. .... = Flags: 0x0
    ...0 0000 0000 0000 = Fragment Offset: 0
    Time to Live: 114
    Protocol: UDP (17)
    Header Checksum: 0x37bf [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 222.109.225.78
    Destination Address: 192.168.200.112
    [Stream index: 14]
User Datagram Protocol, Src Port: 12000, Dst Port: 61239
    Source Port: 12000
    Destination Port: 61239
    Length: 31
    Checksum: 0x0707 [unverified]
    [Checksum Status: Unverified]
    [Stream index: 4]
    [Stream Packet Number: 2]
    [Timestamps]
        [Time since first frame: 0.206567000 seconds]
        [Time since previous frame: 0.206567000 seconds]
    UDP payload (23 bytes)
Logical-Link Control
Data (19 bytes)
```

```
0000  fc 34 97 4c 5f 3b 04 8d  38 ad e1 88 08 00 45 00   ·4·L_;·· 8·····E·
0010  00 33 c8 25 00 00 72 11  37 bf de 6d e1 4e c0 a8   ·3·%··r· 7··m·N··
0020  c8 70 2e e0 ef 37 00 1f  07 07 32 30 32 32 31 32   ·p.··7·· ··202212
0030  35 30 35 37 20 43 48 4f  20 4a 41 45 20 48 59 55   5057 CHO  JAE HYU
0040  4e                                                 N
```

출발지 IP: 222.109.225.78

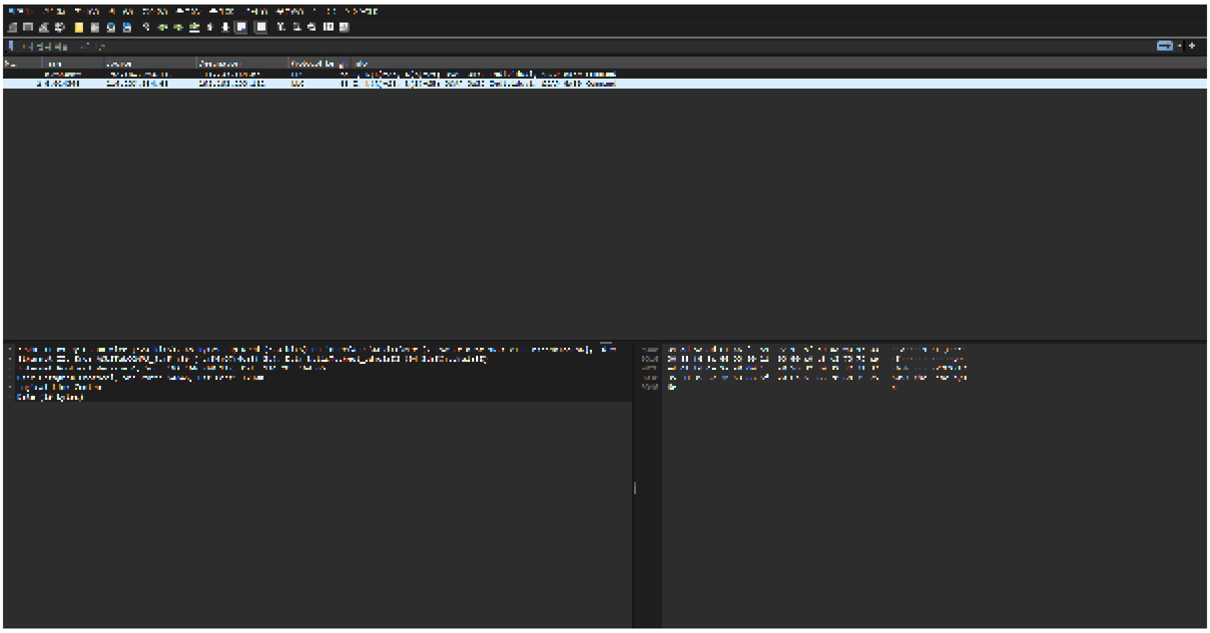
목적지 IP: 192.168.200.112

출발지 포트: 12000

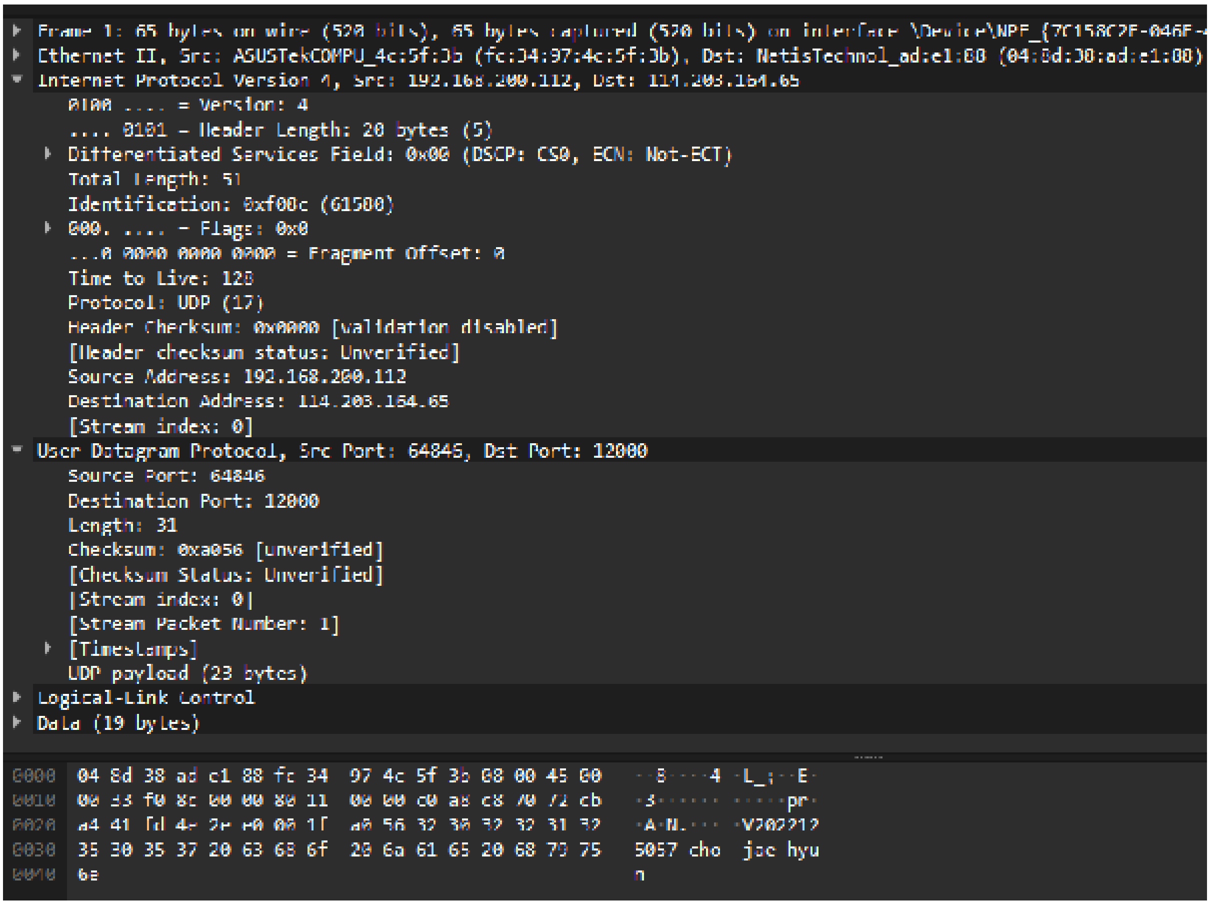
목적지 포트: 61239

응답 데이터: 2022125057 CHO JAE HYUN

2. 조재현(client) <-> 이석진(server)



클라이언트 -> 서버 (UDP Request)



```
▸ Frame 1: 65 bytes on wire (520 bits), 65 bytes captured (520 bits) on interface \Device\NPF_{7C158C2F-046F-
▸ Ethernet II, Src: ASUSTekCOMPU_4c:5f:3b (fc:34:97:4c:5f:3b), Dst: NetisTechnol_ad:c1:88 (04:8d:38:ad:c1:88)
▾ Internet Protocol Version 4, Src: 192.168.200.112, Dst: 114.203.164.65
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
  ▸ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 51
    Identification: 0xf00c (61500)
  ▸ 000. .... = Flags: 0x0
    ...0 0000 0000 0000 = Fragment Offset: 0
    Time to Live: 128
    Protocol: UDP (17)
    Header Checksum: 0x0000 [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 192.168.200.112
    Destination Address: 114.203.164.65
    [Stream index: 0]
▾ User Datagram Protocol, Src Port: 64846, Dst Port: 12000
    Source Port: 64846
    Destination Port: 12000
    Length: 31
    Checksum: 0xa056 [unverified]
    [Checksum Status: Unverified]
    [Stream index: 0]
    [Stream Packet Number: 1]
  ▸ [Timestamps]
    UDP payload (23 bytes)
▸ Logical-Link Control
▸ Data (19 bytes)

0000  04 8d 38 ad c1 88 fc 34  97 4c 5f 3b 08 00 45 00   ··8····4 ·L_;··E·
0010  00 33 f0 0c 00 00 80 11  00 00 c0 a8 c8 70 72 cb   ·3······ ·····pr·
0020  a4 41 fd 4e 2e e0 00 1f  a0 56 32 30 32 32 31 32   ·A·N.··· ·V202212
0030  35 30 35 37 20 63 68 6f  20 6a 61 65 20 68 79 75   5057 cho  jae hyu
0040  6e                                                 n
```

출발지 IP: 192.168.200.112

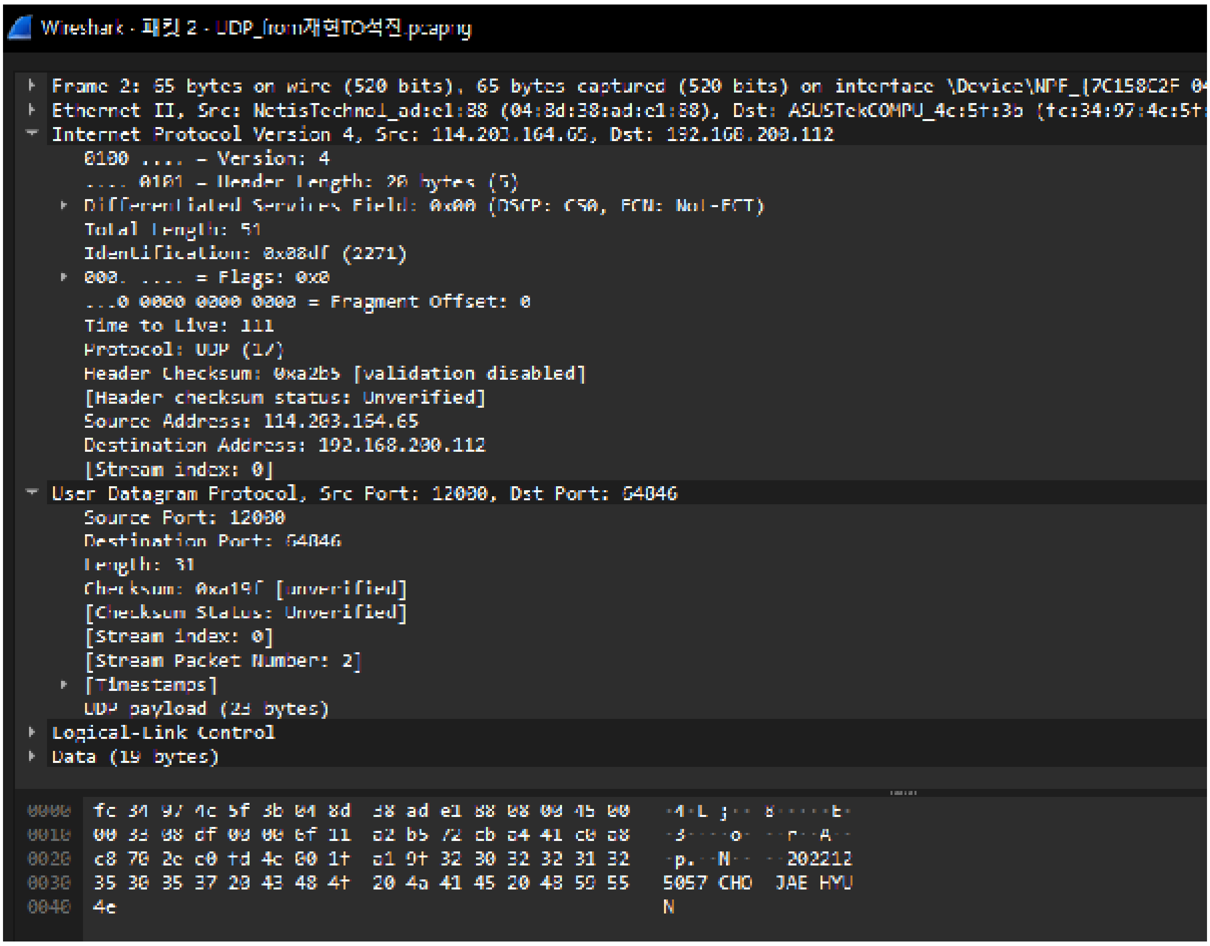
목적지 IP: 114.203.164.65

출발지 포트: 64846

목적지 포트: 12000

전송된 데이터 내용: 2022125057 cho jae hyun

서버-> 클라이언트 (UDP Response)


Wireshark · 패킷 2 · UDP_from재현TO석진.pcapng

```
▸ Frame 2: 65 bytes on wire (520 bits), 65 bytes captured (520 bits) on interface \Device\NPF_{7C158C2F 0
▸ Ethernet II, Src: NetisTechnol_ad:e1:88 (04:8d:38:ad:e1:88), Dst: ASUSTekCOMPU_4c:5f:3b (fc:34:97:4c:5f:
▾ Internet Protocol Version 4, Src: 114.203.164.65, Dst: 192.168.200.112
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
  ▸ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 51
    Identification: 0x08df (2271)
  ▸ 000. .... = Flags: 0x0
    ...0 0000 0000 0000 = Fragment Offset: 0
    Time to Live: 111
    Protocol: UDP (17)
    Header Checksum: 0xa2b5 [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 114.203.164.65
    Destination Address: 192.168.200.112
    [Stream index: 0]
▾ User Datagram Protocol, Src Port: 12000, Dst Port: 64846
    Source Port: 12000
    Destination Port: 64846
    Length: 31
    Checksum: 0xa19f [unverified]
    [Checksum Status: Unverified]
    [Stream index: 0]
    [Stream Packet Number: 2]
  ▸ [Timestamps]
    UDP payload (23 bytes)
▸ Logical-Link Control
▸ Data (19 bytes)

0000  fc 34 97 4c 5f 3b 04 8d  38 ad e1 88 08 00 45 00   ·4·L_;·· 8·····E·
0010  00 33 08 df 00 00 6f 11  a2 b5 72 cb a4 41 c0 a8   ·3····o· ··r··A··
0020  c8 70 2e e0 fd 4e 00 1f  a1 9f 32 30 32 32 31 32   ·p.··N·· ··202212
0030  35 30 35 37 20 43 48 4f  20 4a 41 45 20 48 59 55   5057 CHO  JAE HYU
0040  4e                                                 N
```

출발지 IP: 114.203.164.65

목적지 IP: 192.168.200.112

출발지 포트: 12000

목적지 포트: 64846

응답 데이터: 2022125057 CHO JAE HYUN

3-2. TCP

TCP는 UDP와 다르게 3-way handshake 과정을 포함됨.

Wireshark에서 캡처한 TCP 패킷을 분석한 결과, 클라이언트와 서버 간의 TCP 연결이 정상적으로 설정됨을 확인할 수 있었다.

- SYN→ 클라이언트가 서버에 연결 요청

- SYN-ACK→ 서버가 응답

- ACK→ 클라이언트가 확인 응답

TCP 4-way Handshake (연결 종료)

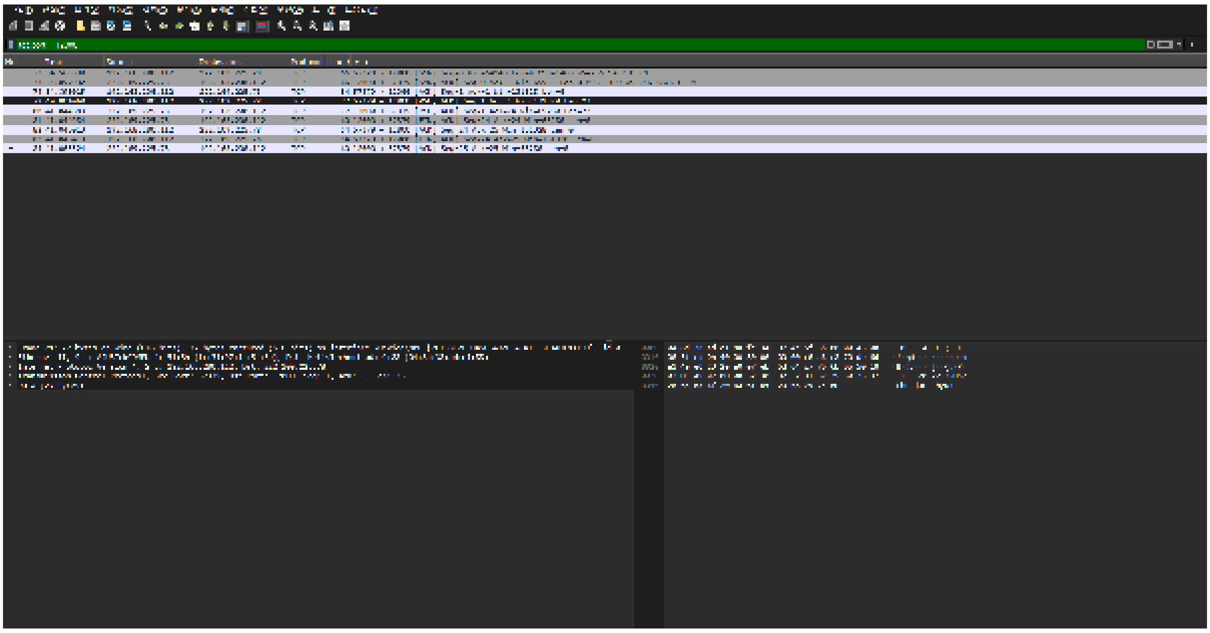
- FIN→ 클라이언트 또는 서버가 연결 종료 요청

- ACK→ 상대방이 확인 응답

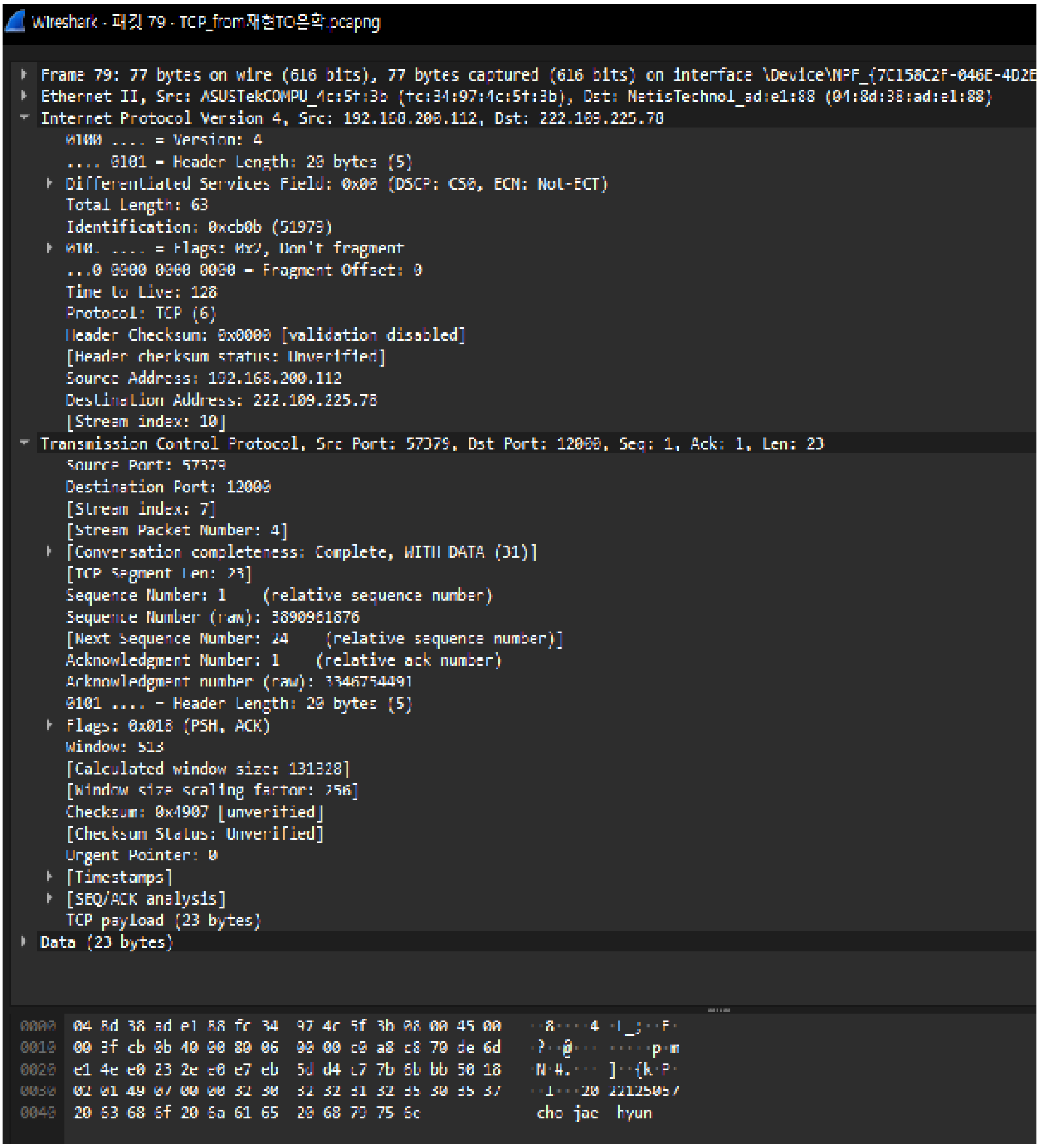
- FIN→ 반대쪽에서 연결 종료 요청

- ACK→ 최종 확인 후 연결 종료

1. 조재현(client) <-> 이은학(server)



클라이언트 -> 서버 (TCP Request)



```
Wireshark · 패킷 79 · TCP_from재현TO은학.pcapng

▸ Frame 79: 77 bytes on wire (616 bits), 77 bytes captured (616 bits) on interface \Device\NPF_{7C158C2F-046E-4D2E
▸ Ethernet II, Src: ASUSTekCOMPU_4c:5f:3b (fc:34:97:4c:5f:3b), Dst: NetisTechnol_ad:e1:88 (04:8d:38:ad:e1:88)
▾ Internet Protocol Version 4, Src: 192.168.200.112, Dst: 222.109.225.78
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
  ▸ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 63
    Identification: 0xcb0b (51979)
  ▸ 010. .... = Flags: 0x2, Don't fragment
    ...0 0000 0000 0000 = Fragment Offset: 0
    Time to Live: 128
    Protocol: TCP (6)
    Header Checksum: 0x0000 [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 192.168.200.112
    Destination Address: 222.109.225.78
    [Stream index: 10]
▾ Transmission Control Protocol, Src Port: 57379, Dst Port: 12000, Seq: 1, Ack: 1, Len: 23
    Source Port: 57379
    Destination Port: 12000
    [Stream index: 7]
    [Stream Packet Number: 4]
  ▸ [Conversation completeness: Complete, WITH DATA (31)]
    [TCP Segment Len: 23]
    Sequence Number: 1    (relative sequence number)
    Sequence Number (raw): 3890961876
    [Next Sequence Number: 24    (relative sequence number)]
    Acknowledgment Number: 1    (relative ack number)
    Acknowledgment number (raw): 3346754491
    0101 .... = Header Length: 20 bytes (5)
  ▸ Flags: 0x018 (PSH, ACK)
    Window: 513
    [Calculated window size: 131328]
    [Window size scaling factor: 256]
    Checksum: 0x4907 [unverified]
    [Checksum Status: Unverified]
    Urgent Pointer: 0
  ▸ [Timestamps]
  ▸ [SEQ/ACK analysis]
    TCP payload (23 bytes)
▸ Data (23 bytes)

0000  04 8d 38 ad e1 88 fc 34  97 4c 5f 3b 08 00 45 00   ··8····4 ·L_;··E·
0010  00 3f cb 0b 40 00 80 06  00 00 c0 a8 c8 70 de 6d   ·?··@··· ·····p·m
0020  e1 4e e0 23 2e e0 e7 eb  5d d4 c7 7b 6b bb 50 18   ·N·#.··· ]··{k·P·
0030  02 01 49 07 00 00 32 30  32 32 31 32 35 30 35 37   ··I···20 22125057
0040  20 63 68 6f 20 6a 61 65  20 68 79 75 6e             cho jae  hyun
```

출발지 IP: 192.168.200.112

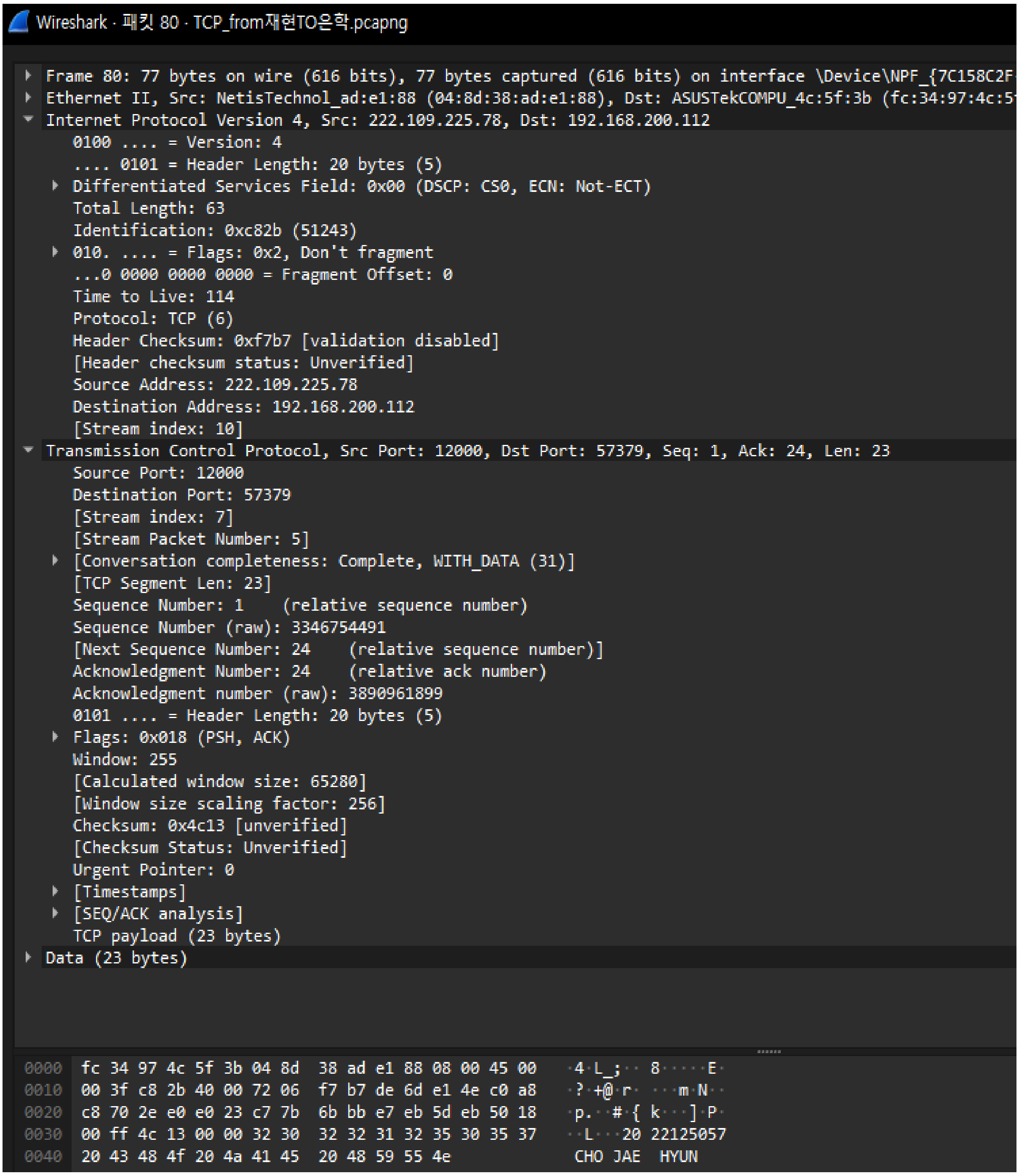
목적지 IP: 222.109.225.78

출발지 포트: 57379

목적지 포트: 12000

전송된 데이터 내용: 2022125057 cho jae hyun

서버 -> 클라이언트 (TCP Response)



```
▸ Frame 80: 77 bytes on wire (616 bits), 77 bytes captured (616 bits) on interface \Device\NPF_{7C158C2F
▸ Ethernet II, Src: NetisTechnol_ad:e1:88 (04:8d:38:ad:e1:88), Dst: ASUSTekCOMPU_4c:5f:3b (fc:34:97:4c:5
▾ Internet Protocol Version 4, Src: 222.109.225.78, Dst: 192.168.200.112
     0100 .... = Version: 4
     .... 0101 = Header Length: 20 bytes (5)
   ▸ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
     Total Length: 63
     Identification: 0xc82b (51243)
   ▸ 010. .... = Flags: 0x2, Don't fragment
     ...0 0000 0000 0000 = Fragment Offset: 0
     Time to Live: 114
     Protocol: TCP (6)
     Header Checksum: 0xf7b7 [validation disabled]
     [Header checksum status: Unverified]
     Source Address: 222.109.225.78
     Destination Address: 192.168.200.112
     [Stream index: 10]
▾ Transmission Control Protocol, Src Port: 12000, Dst Port: 57379, Seq: 1, Ack: 24, Len: 23
     Source Port: 12000
     Destination Port: 57379
     [Stream index: 7]
     [Stream Packet Number: 5]
   ▸ [Conversation completeness: Complete, WITH_DATA (31)]
     [TCP Segment Len: 23]
     Sequence Number: 1    (relative sequence number)
     Sequence Number (raw): 3346754491
     [Next Sequence Number: 24    (relative sequence number)]
     Acknowledgment Number: 24    (relative ack number)
     Acknowledgment number (raw): 3890961899
     0101 .... = Header Length: 20 bytes (5)
   ▸ Flags: 0x018 (PSH, ACK)
     Window: 255
     [Calculated window size: 65280]
     [Window size scaling factor: 256]
     Checksum: 0x4c13 [unverified]
     [Checksum Status: Unverified]
     Urgent Pointer: 0
   ▸ [Timestamps]
   ▸ [SEQ/ACK analysis]
     TCP payload (23 bytes)
▸ Data (23 bytes)

0000  fc 34 97 4c 5f 3b 04 8d  38 ad e1 88 08 00 45 00   ·4·L_;·· 8·····E·
0010  00 3f c8 2b 40 00 72 06  f7 b7 de 6d e1 4e c0 a8   ·?·+@·r· ···m·N··
0020  c8 70 2e e0 e0 23 c7 7b  6b bb e7 eb 5d eb 50 18   ·p.··#·{ k···]·P·
0030  00 ff 4c 13 00 00 32 30  32 32 31 32 35 30 35 37   ··L···20 22125057
0040  20 43 48 4f 20 4a 41 45  20 48 59 55 4e             CHO JAE  HYUN
```

출발지 IP: 222.109.225.78

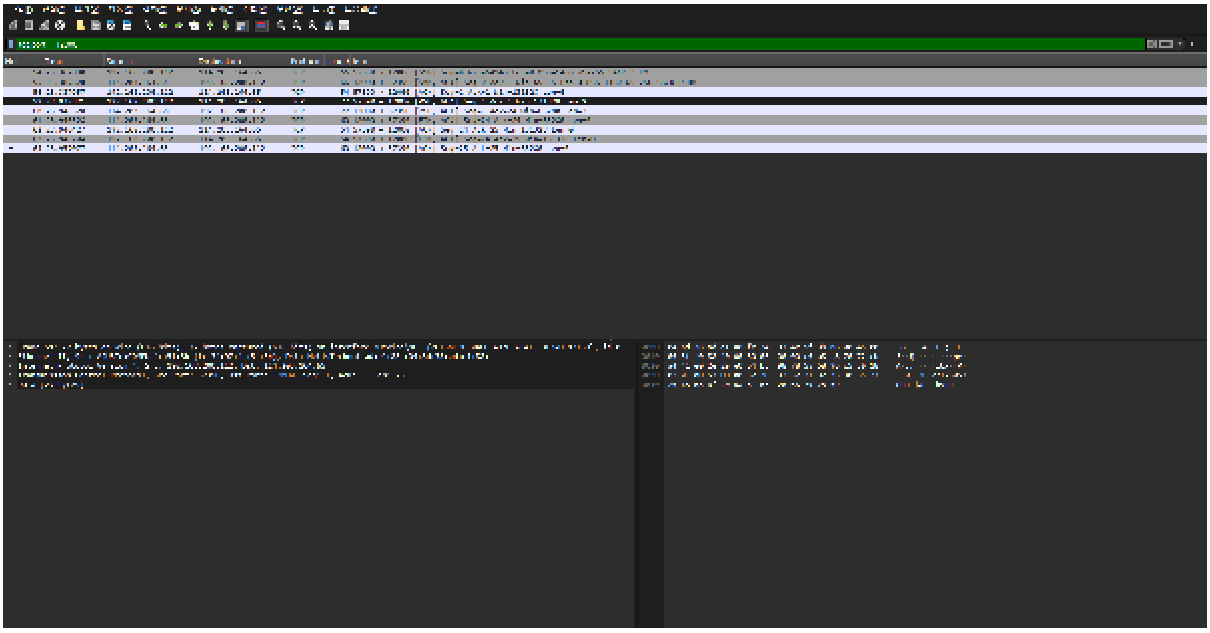
목적지 IP: 192.168.200.112

출발지 포트: 12000

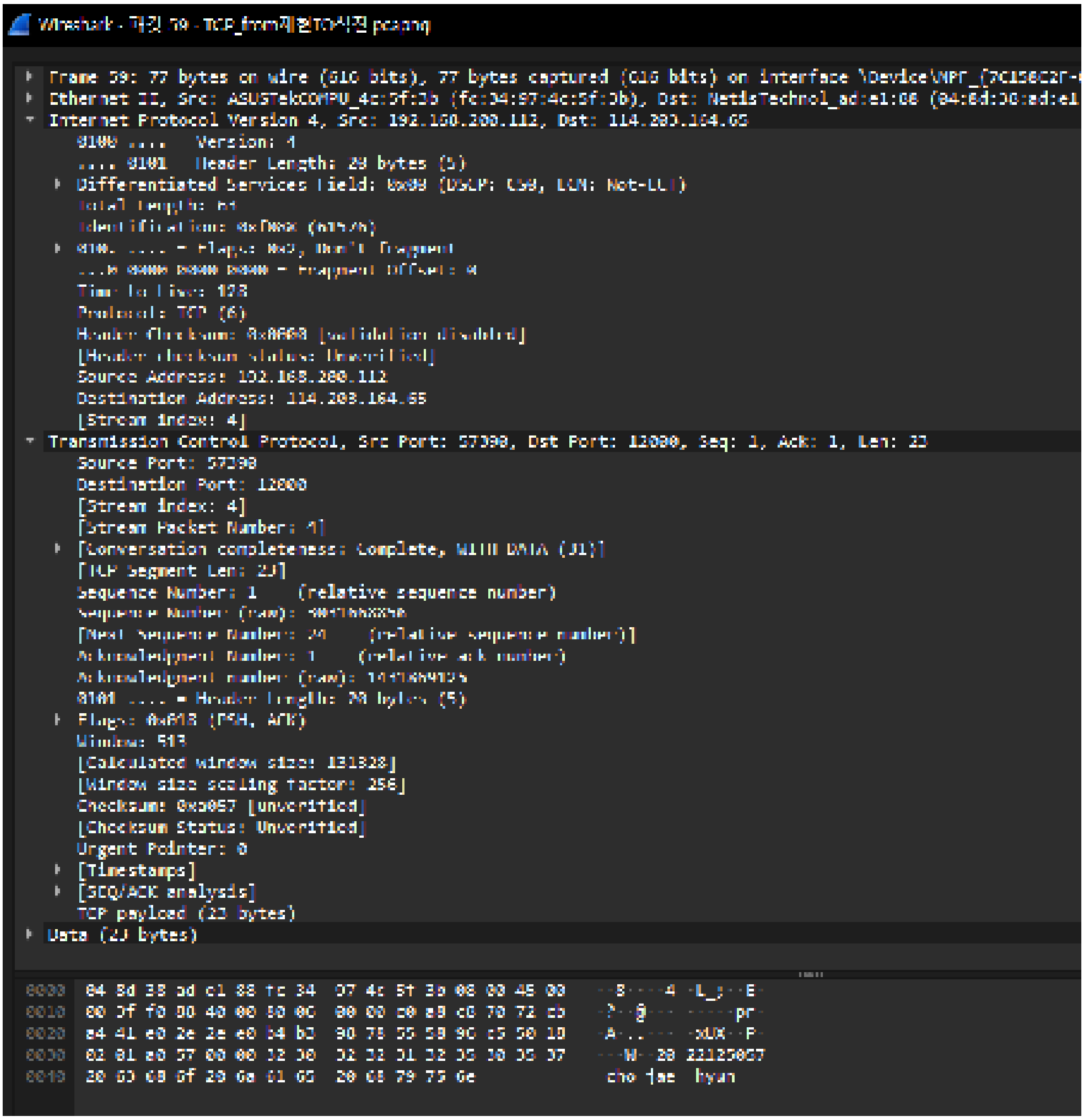
목적지 포트: 57379

응답 데이터: 2022125057 CHO JAE HYUN

2. 조재현(client) <-> 이석진(server)



클라이언트 -> 서버 (TCP Request)



Wireshark · 패킷 59 · TCP_from재현TCP사진.pcapng

```
▸ Frame 59: 77 bytes on wire (616 bits), 77 bytes captured (616 bits) on interface \Device\NPF_{7C158C2F-
▸ Ethernet II, Src: ASUSTekCOMPU_4c:5f:3b (fc:34:97:4c:5f:3b), Dst: NetisTechnol_ad:e1:88 (04:8d:38:ad:e1
▾ Internet Protocol Version 4, Src: 192.168.200.112, Dst: 114.203.164.65
     0100 .... = Version: 4
     .... 0101 = Header Length: 20 bytes (5)
   ▸ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
     Total Length: 63
     Identification: 0xf080 (61568)
   ▸ 010. .... = Flags: 0x2, Don't fragment
     ...0 0000 0000 0000 = Fragment Offset: 0
     Time to Live: 128
     Protocol: TCP (6)
     Header Checksum: 0x0000 [validation disabled]
     [Header checksum status: Unverified]
     Source Address: 192.168.200.112
     Destination Address: 114.203.164.65
     [Stream index: 4]
▾ Transmission Control Protocol, Src Port: 57390, Dst Port: 12000, Seq: 1, Ack: 1, Len: 23
     Source Port: 57390
     Destination Port: 12000
     [Stream index: 4]
     [Stream Packet Number: 4]
   ▸ [Conversation completeness: Complete, WITH_DATA (31)]
     [TCP Segment Len: 23]
     Sequence Number: 1    (relative sequence number)
     Sequence Number (raw): 3031666808
     [Next Sequence Number: 24    (relative sequence number)]
     Acknowledgment Number: 1    (relative ack number)
     Acknowledgment number (raw): 1431870661
     0101 .... = Header Length: 20 bytes (5)
   ▸ Flags: 0x018 (PSH, ACK)
     Window: 513
     [Calculated window size: 131328]
     [Window size scaling factor: 256]
     Checksum: 0xa057 [unverified]
     [Checksum Status: Unverified]
     Urgent Pointer: 0
   ▸ [Timestamps]
   ▸ [SEQ/ACK analysis]
     TCP payload (23 bytes)
▸ Data (23 bytes)

0000  04 8d 38 ad e1 88 fc 34  97 4c 5f 3b 08 00 45 00   ··8····4 ·L_;··E·
0010  00 3f f0 80 40 00 80 06  00 00 c0 a8 c8 70 72 cb   ·?··@··· ·····pr·
0020  a4 41 e0 2e 2e e0 b4 b3  90 78 55 58 9c c5 50 18   ·A·..··· ·xUX··P·
0030  02 01 a0 57 00 00 32 30  32 32 31 32 35 30 35 37   ···W··20 22125057
0040  20 63 68 6f 20 6a 61 65  20 68 79 75 6e             cho jae  hyun
```

출발지 IP: 192.168.200.112

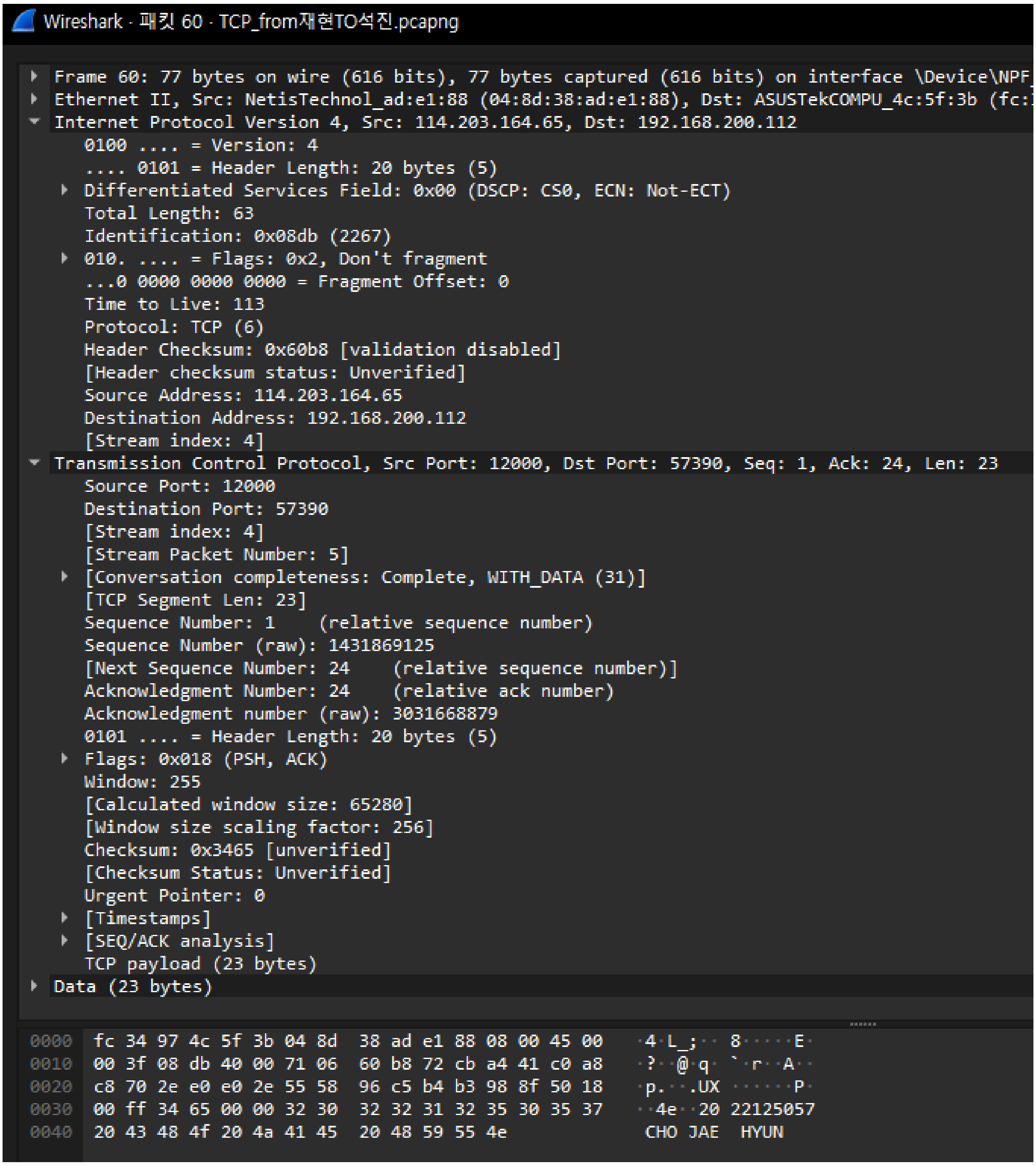
목적지 IP: 114.203.164.65

출발지 포트: 57390

목적지 포트: 12000

전송된 데이터 내용: 2022125057 cho jae hyun

서버 -> 클라이언트 (TCP Response)



Wireshark · 패킷 60 · TCP_from재현TO석진.pcapng

```
▸ Frame 60: 77 bytes on wire (616 bits), 77 bytes captured (616 bits) on interface \Device\NPF_
▸ Ethernet II, Src: NetisTechnol_ad:e1:88 (04:8d:38:ad:e1:88), Dst: ASUSTekCOMPU_4c:5f:3b (fc:
▾ Internet Protocol Version 4, Src: 114.203.164.65, Dst: 192.168.200.112
     0100 .... = Version: 4
     .... 0101 = Header Length: 20 bytes (5)
   ▸ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
     Total Length: 63
     Identification: 0x08db (2267)
   ▸ 010. .... = Flags: 0x2, Don't fragment
     ...0 0000 0000 0000 = Fragment Offset: 0
     Time to Live: 113
     Protocol: TCP (6)
     Header Checksum: 0x60b8 [validation disabled]
     [Header checksum status: Unverified]
     Source Address: 114.203.164.65
     Destination Address: 192.168.200.112
     [Stream index: 4]
▾ Transmission Control Protocol, Src Port: 12000, Dst Port: 57390, Seq: 1, Ack: 24, Len: 23
     Source Port: 12000
     Destination Port: 57390
     [Stream index: 4]
     [Stream Packet Number: 5]
   ▸ [Conversation completeness: Complete, WITH_DATA (31)]
     [TCP Segment Len: 23]
     Sequence Number: 1    (relative sequence number)
     Sequence Number (raw): 1431869125
     [Next Sequence Number: 24    (relative sequence number)]
     Acknowledgment Number: 24    (relative ack number)
     Acknowledgment number (raw): 3031668879
     0101 .... = Header Length: 20 bytes (5)
   ▸ Flags: 0x018 (PSH, ACK)
     Window: 255
     [Calculated window size: 65280]
     [Window size scaling factor: 256]
     Checksum: 0x3465 [unverified]
     [Checksum Status: Unverified]
     Urgent Pointer: 0
   ▸ [Timestamps]
   ▸ [SEQ/ACK analysis]
     TCP payload (23 bytes)
▸ Data (23 bytes)

0000  fc 34 97 4c 5f 3b 04 8d  38 ad e1 88 08 00 45 00   ·4·L_;·· 8·····E·
0010  00 3f 08 db 40 00 71 06  60 b8 72 cb a4 41 c0 a8   ·?··@·q· `·r··A··
0020  c8 70 2e e0 e0 2e 55 58  96 c5 b4 b3 98 8f 50 18   ·p.··.UX ······P·
0030  00 ff 34 65 00 00 32 30  32 32 31 32 35 30 35 37   ··4e··20 22125057
0040  20 43 48 4f 20 4a 41 45  20 48 59 55 4e             CHO JAE  HYUN
```

출발지 IP: 114.203.164.65

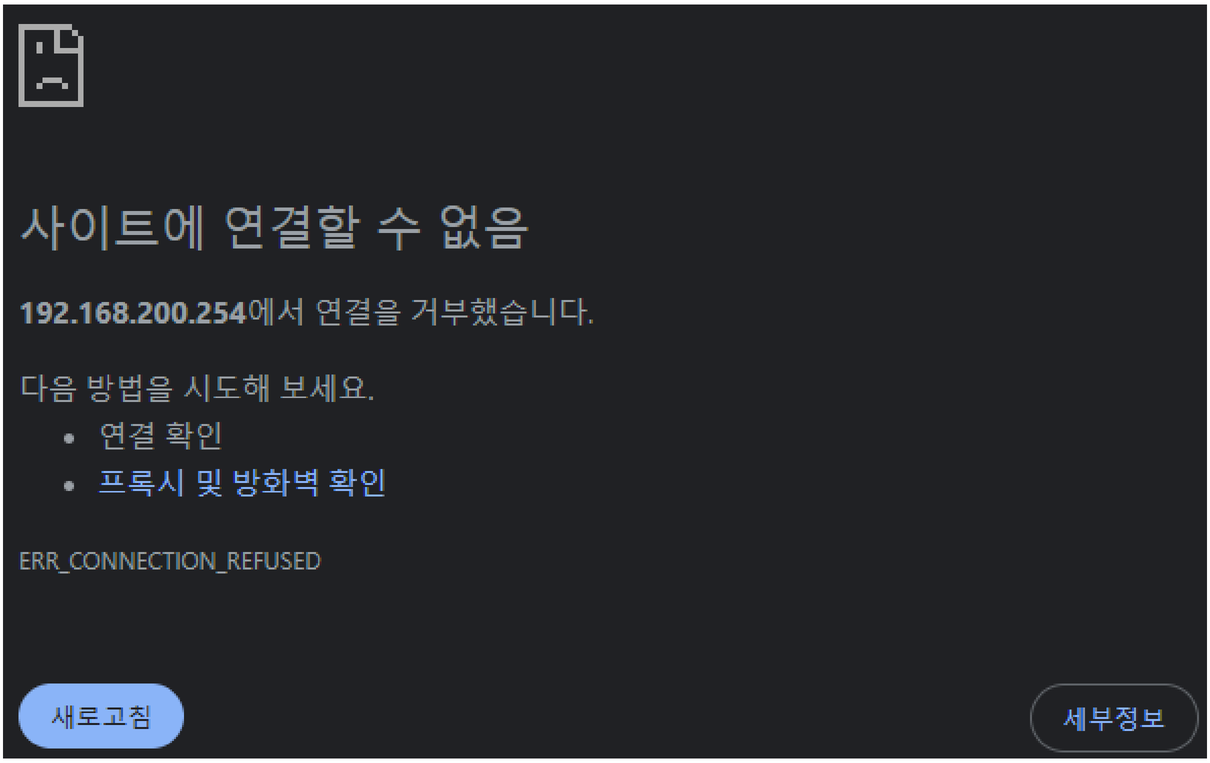
목적지 IP: 192.168.200.112

출발지 포트: 12000

목적지 포트: 57390

응답 데이터: 2022125057 CHO JAE HYUN

4. Server 역할 패킷 분석



사이트에 연결할 수 없음

192.168.200.254에서 연결을 거부했습니다.

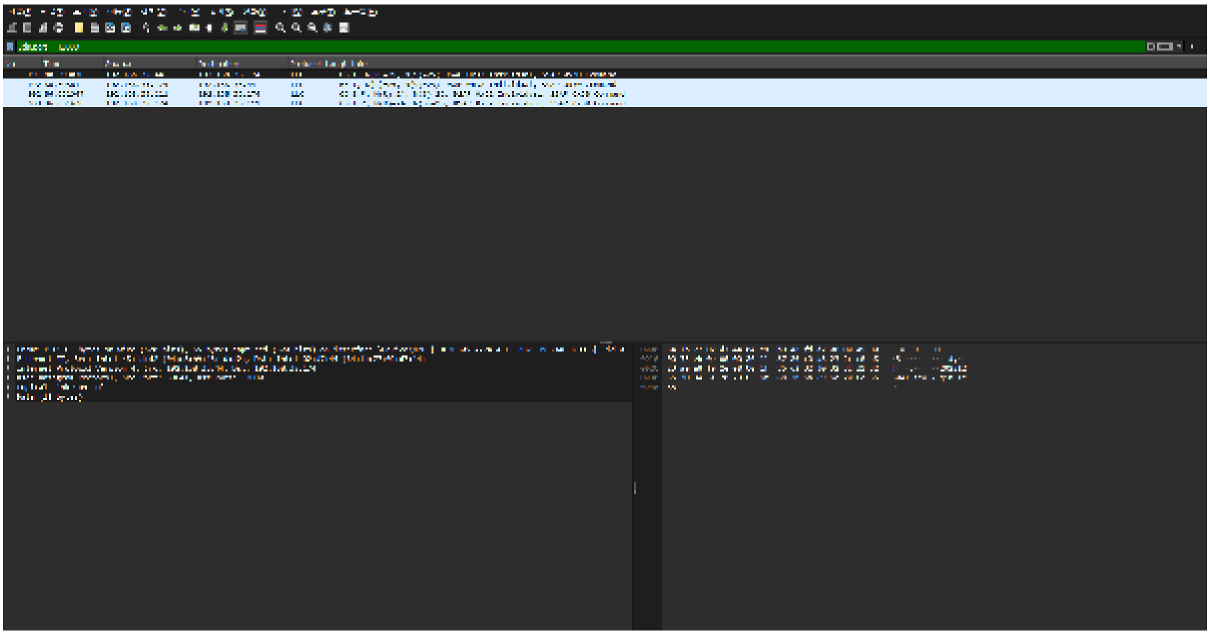
다음 방법을 시도해 보세요.

- 연결 확인
- 프록시 및 방화벽 확인

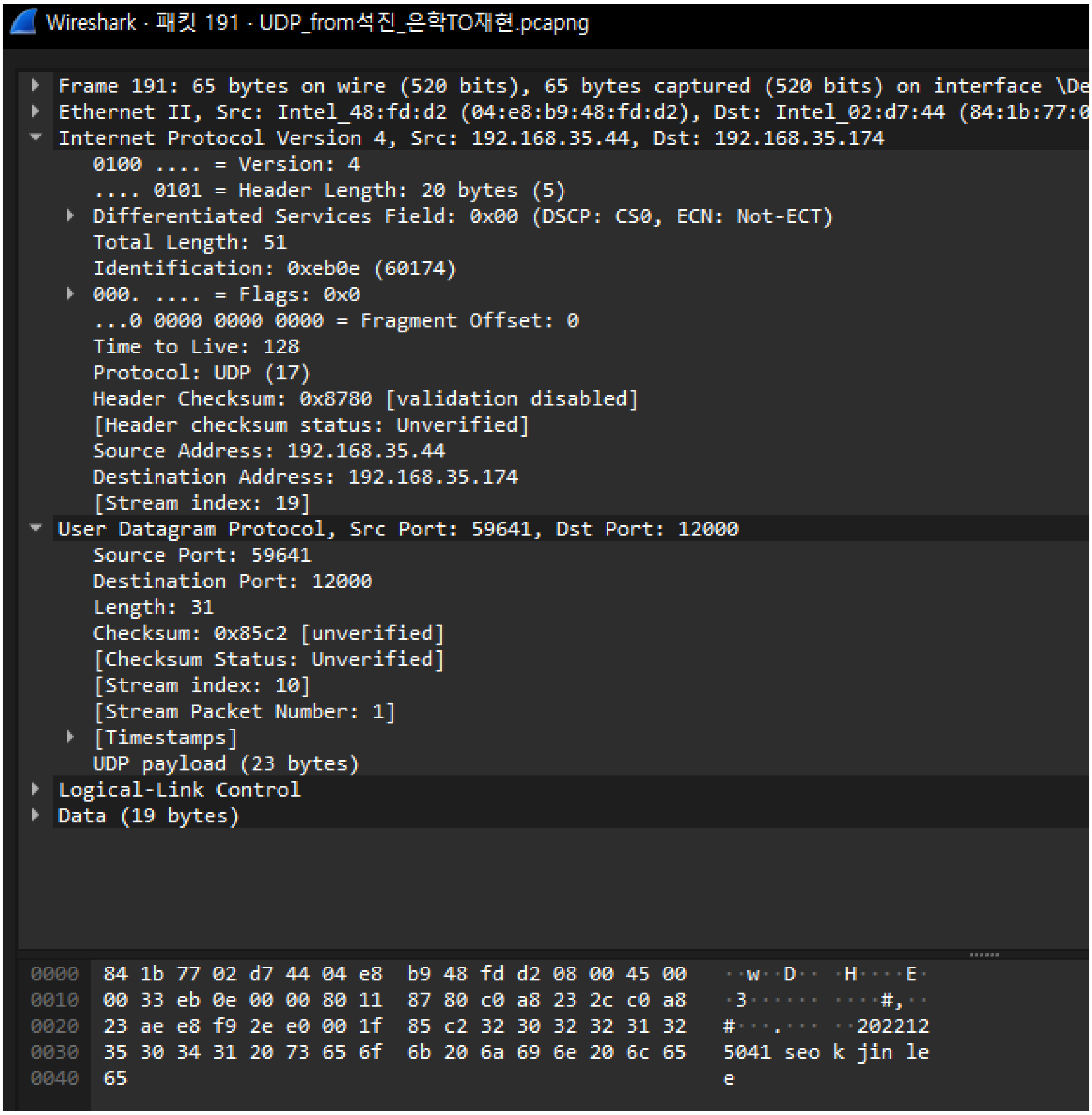
ERR_CONNECTION_REFUSED

내 집에서는 네트워크 관리 웹사이트가 차단되어 있어 포트포워딩을 진행할 수 없었다. 이에 팀원 모두가 이석진의 집에 모여 내가 서버 역할을 맡고 팀원들이 클라이언트 역할을 수행하였다.

1. UDP, 클라이언트(이은학, 이석진) <-> 서버(조재현)



클라이언트(이석진) -> 서버(조재현) (UDP Resquest)



Wireshark · 패킷 191 · UDP_from석진_은학TO재현.pcapng

```
▸ Frame 191: 65 bytes on wire (520 bits), 65 bytes captured (520 bits) on interface \De
▸ Ethernet II, Src: Intel_48:fd:d2 (04:e8:b9:48:fd:d2), Dst: Intel_02:d7:44 (84:1b:77:0
▾ Internet Protocol Version 4, Src: 192.168.35.44, Dst: 192.168.35.174
     0100 .... = Version: 4
     .... 0101 = Header Length: 20 bytes (5)
   ▸ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
     Total Length: 51
     Identification: 0xeb0e (60174)
   ▸ 000. .... = Flags: 0x0
     ...0 0000 0000 0000 = Fragment Offset: 0
     Time to Live: 128
     Protocol: UDP (17)
     Header Checksum: 0x8780 [validation disabled]
     [Header checksum status: Unverified]
     Source Address: 192.168.35.44
     Destination Address: 192.168.35.174
     [Stream index: 19]
▾ User Datagram Protocol, Src Port: 59641, Dst Port: 12000
     Source Port: 59641
     Destination Port: 12000
     Length: 31
     Checksum: 0x85c2 [unverified]
     [Checksum Status: Unverified]
     [Stream index: 10]
     [Stream Packet Number: 1]
   ▸ [Timestamps]
     UDP payload (23 bytes)
▸ Logical-Link Control
▸ Data (19 bytes)

0000  84 1b 77 02 d7 44 04 e8  b9 48 fd d2 08 00 45 00   ··w··D·· ·H····E·
0010  00 33 eb 0e 00 00 80 11  87 80 c0 a8 23 2c c0 a8   ·3······ ····#,··
0020  23 ae e8 f9 2e e0 00 1f  85 c2 32 30 32 32 31 32   #···.··· ··202212
0030  35 30 34 31 20 73 65 6f  6b 20 6a 69 6e 20 6c 65   5041 seo k jin le
0040  65                                                 e
```

출발지 IP: 192.168.35.44

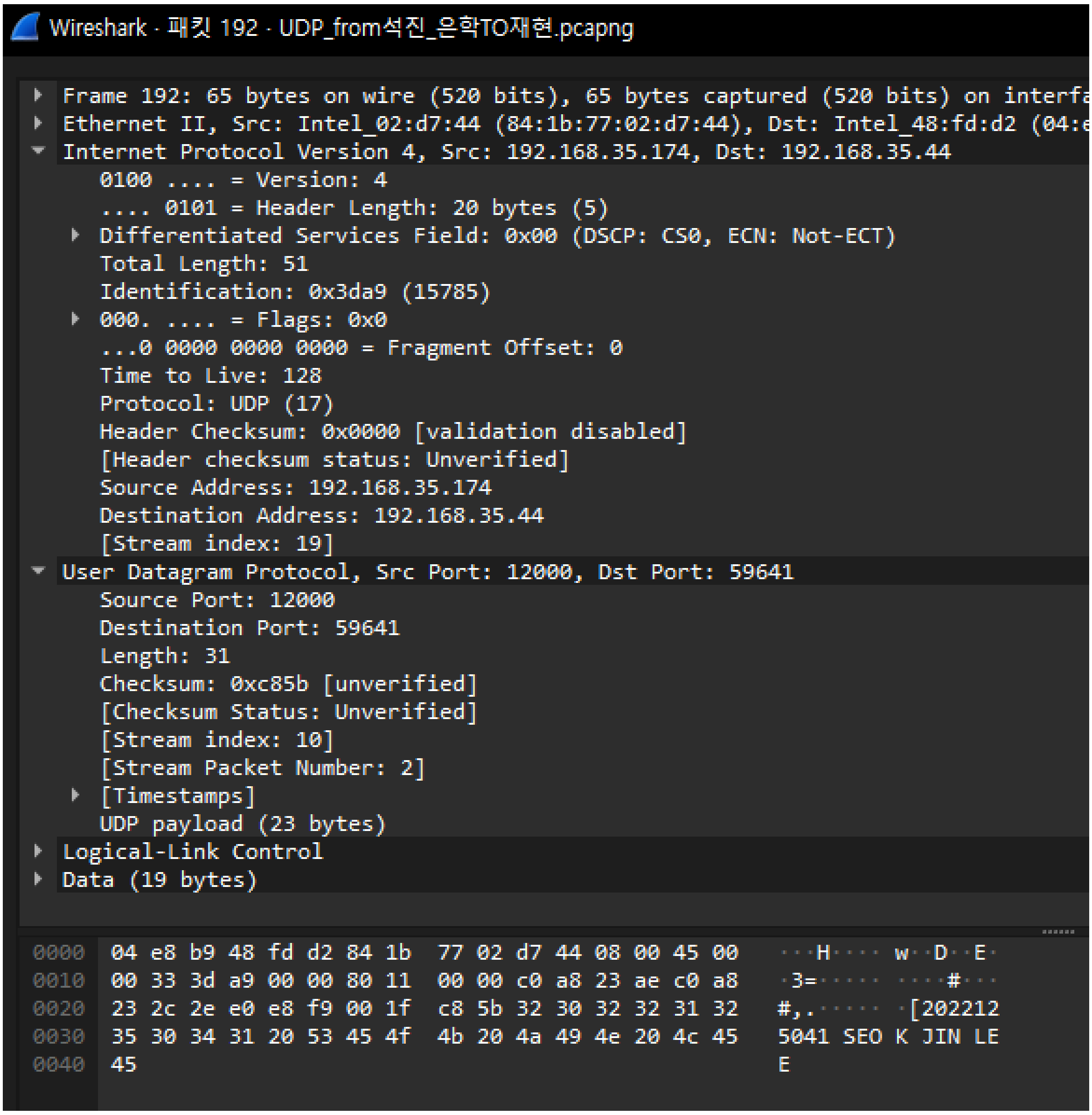
목적지 IP: 192.168.35.174

출발지 포트: 59641

목적지 포트: 12000

전송된 데이터 내용: 2022125041 seok jin lee

서버(조재현) -> 클라이언트(이석진)(UDP Response)



Wireshark · 패킷 192 · UDP_from석진_은학TO재현.pcapng

```
▸ Frame 192: 65 bytes on wire (520 bits), 65 bytes captured (520 bits) on interfa
▸ Ethernet II, Src: Intel_02:d7:44 (84:1b:77:02:d7:44), Dst: Intel_48:fd:d2 (04:e
▾ Internet Protocol Version 4, Src: 192.168.35.174, Dst: 192.168.35.44
     0100 .... = Version: 4
     .... 0101 = Header Length: 20 bytes (5)
   ▸ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
     Total Length: 51
     Identification: 0x3da9 (15785)
   ▸ 000. .... = Flags: 0x0
     ...0 0000 0000 0000 = Fragment Offset: 0
     Time to Live: 128
     Protocol: UDP (17)
     Header Checksum: 0x0000 [validation disabled]
     [Header checksum status: Unverified]
     Source Address: 192.168.35.174
     Destination Address: 192.168.35.44
     [Stream index: 19]
▾ User Datagram Protocol, Src Port: 12000, Dst Port: 59641
     Source Port: 12000
     Destination Port: 59641
     Length: 31
     Checksum: 0xc85b [unverified]
     [Checksum Status: Unverified]
     [Stream index: 10]
     [Stream Packet Number: 2]
   ▸ [Timestamps]
     UDP payload (23 bytes)
▸ Logical-Link Control
▸ Data (19 bytes)

0000  04 e8 b9 48 fd d2 84 1b  77 02 d7 44 08 00 45 00   ···H····w··D··E·
0010  00 33 3d a9 00 00 80 11  00 00 c0 a8 23 ae c0 a8   ·3=·········#···
0020  23 2c 2e e0 e8 f9 00 1f  c8 5b 32 30 32 32 31 32   #,.·······[202212
0030  35 30 34 31 20 53 45 4f  4b 20 4a 49 4e 20 4c 45   5041 SEOK JIN LE
0040  45                                                 E
```

출발지 IP: 192.168.35.174

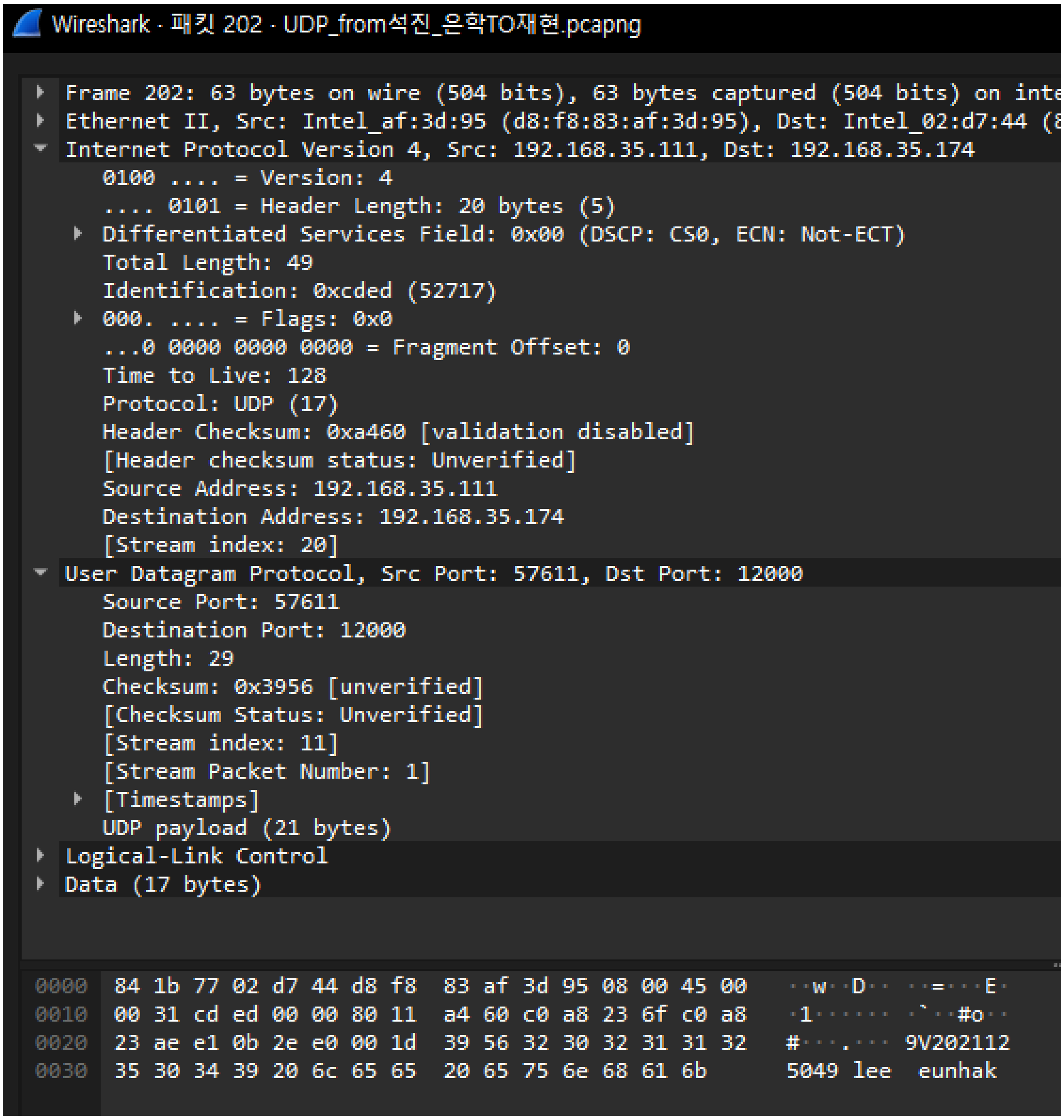
목적지 IP: 192.168.35.44

출발지 포트: 12000

목적지 포트: 59641

응답 데이터: 2022125041 SEOK JIN LEE

클라이언트(이은학) -> 서버(조재현) (UDP Request)



Wireshark · 패킷 202 · UDP_from석진_은학TO재현.pcapng

```
▸ Frame 202: 63 bytes on wire (504 bits), 63 bytes captured (504 bits) on inte
▸ Ethernet II, Src: Intel_af:3d:95 (d8:f8:83:af:3d:95), Dst: Intel_02:d7:44 (8
▾ Internet Protocol Version 4, Src: 192.168.35.111, Dst: 192.168.35.174
     0100 .... = Version: 4
     .... 0101 = Header Length: 20 bytes (5)
   ▸ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
     Total Length: 49
     Identification: 0xcded (52717)
   ▸ 000. .... = Flags: 0x0
     ...0 0000 0000 0000 = Fragment Offset: 0
     Time to Live: 128
     Protocol: UDP (17)
     Header Checksum: 0xa460 [validation disabled]
     [Header checksum status: Unverified]
     Source Address: 192.168.35.111
     Destination Address: 192.168.35.174
     [Stream index: 20]
▾ User Datagram Protocol, Src Port: 57611, Dst Port: 12000
     Source Port: 57611
     Destination Port: 12000
     Length: 29
     Checksum: 0x3956 [unverified]
     [Checksum Status: Unverified]
     [Stream index: 11]
     [Stream Packet Number: 1]
   ▸ [Timestamps]
     UDP payload (21 bytes)
▸ Logical-Link Control
▸ Data (17 bytes)

0000  84 1b 77 02 d7 44 d8 f8  83 af 3d 95 08 00 45 00   ··w··D··  ··=···E·
0010  00 31 cd ed 00 00 80 11  a4 60 c0 a8 23 6f c0 a8   ·1······  ·`··#o··
0020  23 ae e1 0b 2e e0 00 1d  39 56 32 30 32 31 31 32   #···.···  9V202112
0030  35 30 34 39 20 6c 65 65  20 65 75 6e 68 61 6b      5049 lee  eunhak
```

출발지 IP: 192.168.35.111

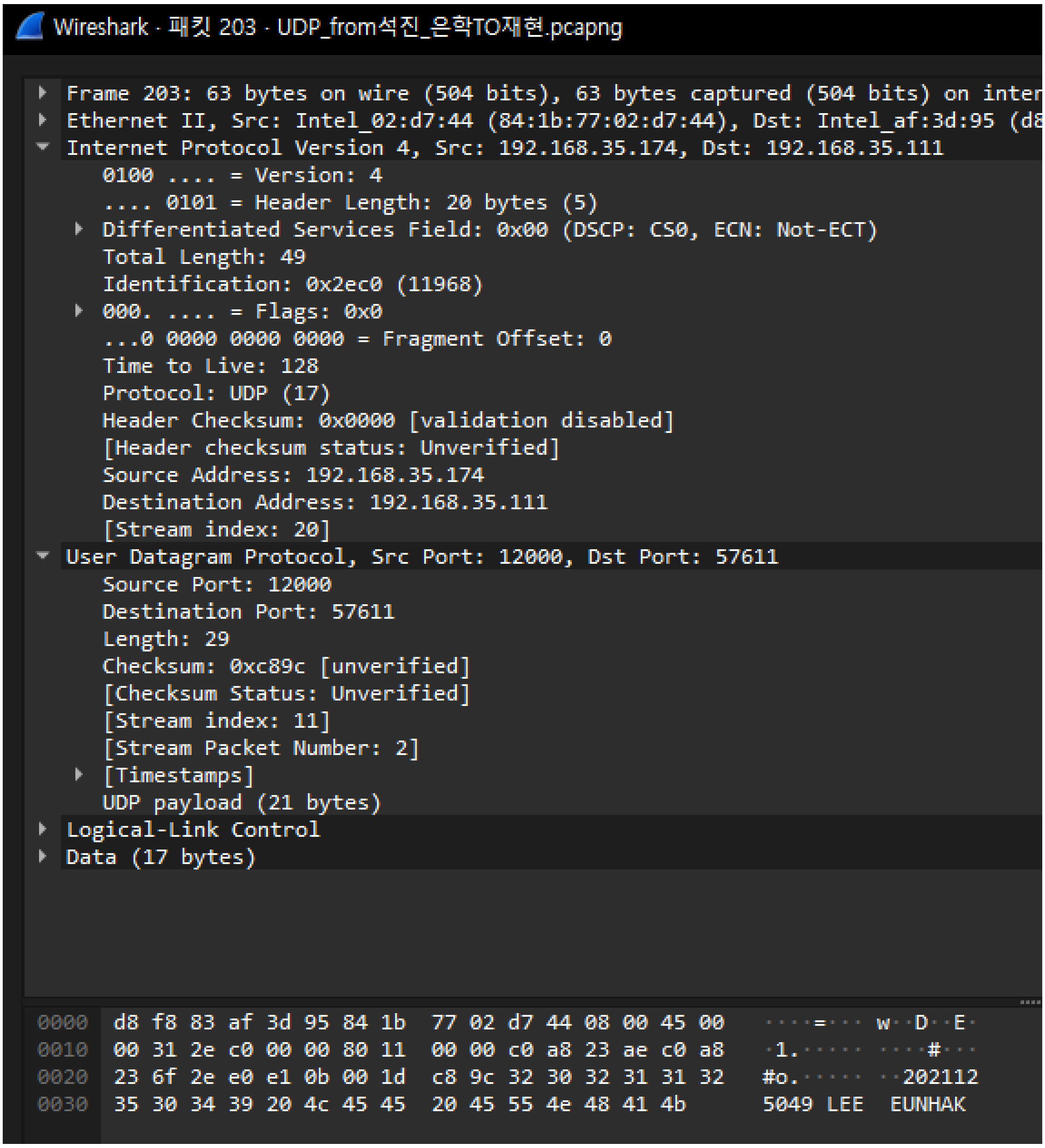
목적지 IP: 192.168.35.174

출발지 포트: 57611

목적지 포트: 12000

전송된 데이터 내용: 2021125049 lee eunhak

서버(조재현) -> 클라이언트(이은학)(UDP Response)



Wireshark · 패킷 203 · UDP_from석진_은학TO재현.pcapng

```
Frame 203: 63 bytes on wire (504 bits), 63 bytes captured (504 bits) on inter
Ethernet II, Src: Intel_02:d7:44 (84:1b:77:02:d7:44), Dst: Intel_af:3d:95 (d8
Internet Protocol Version 4, Src: 192.168.35.174, Dst: 192.168.35.111
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 49
    Identification: 0x2ec0 (11968)
    000. .... = Flags: 0x0
    ...0 0000 0000 0000 = Fragment Offset: 0
    Time to Live: 128
    Protocol: UDP (17)
    Header Checksum: 0x0000 [validation disabled]
    [Header checksum status: Unverified]
    Source Address: 192.168.35.174
    Destination Address: 192.168.35.111
    [Stream index: 20]
User Datagram Protocol, Src Port: 12000, Dst Port: 57611
    Source Port: 12000
    Destination Port: 57611
    Length: 29
    Checksum: 0xc89c [unverified]
    [Checksum Status: Unverified]
    [Stream index: 11]
    [Stream Packet Number: 2]
    [Timestamps]
    UDP payload (21 bytes)
Logical-Link Control
Data (17 bytes)

0000  d8 f8 83 af 3d 95 84 1b  77 02 d7 44 08 00 45 00   ····=···  w··D··E·
0010  00 31 2e c0 00 00 80 11  00 00 c0 a8 23 ae c0 a8   ·1.·····  ····#···
0020  23 6f 2e e0 e1 0b 00 1d  c8 9c 32 30 32 31 31 32   #o.·····  ··202112
0030  35 30 34 39 20 4c 45 45  20 45 55 4e 48 41 4b      5049 LEE  EUNHAK
```

출발지 IP: 192.168.35.174

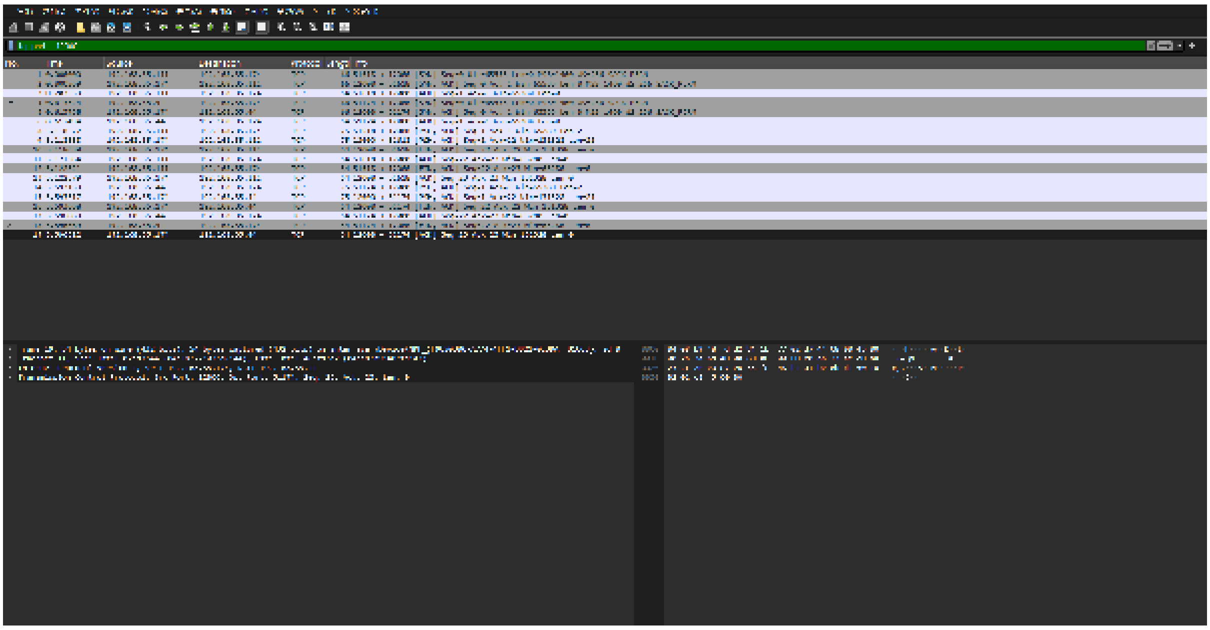
목적지 IP: 192.168.35.111

출발지 포트: 12000

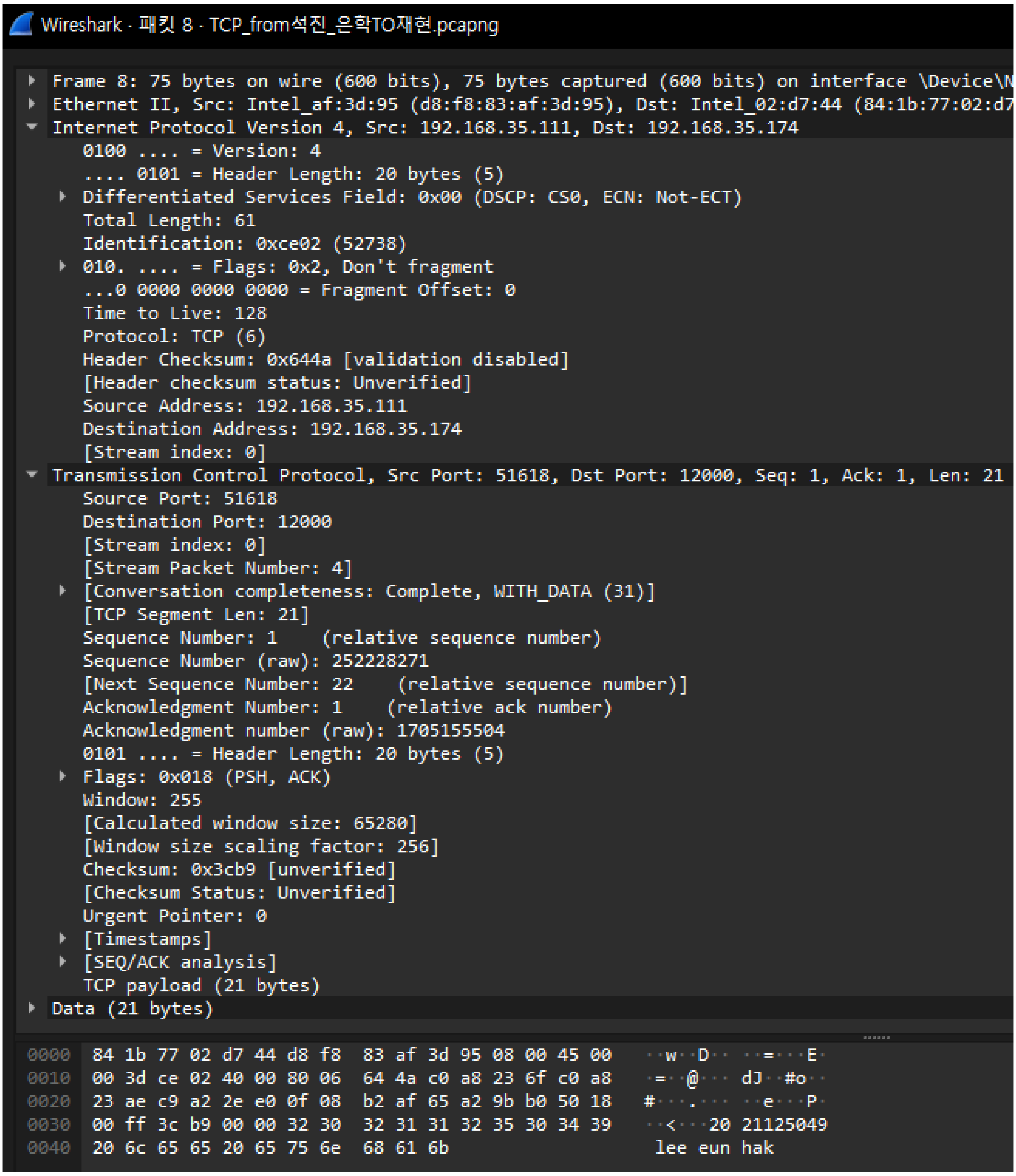
목적지 포트: 57611

응답 데이터: 2021125049 LEE EUNHAK

2. TCP, 클라이언트(이은학, 이석진) <-> 서버(조재현)



클라이언트(이은학) -> 서버(조재현) (TCP Resquest)



Wireshark · 패킷 8 · TCP_from석진_은학TO재현.pcapng

```
▸ Frame 8: 75 bytes on wire (600 bits), 75 bytes captured (600 bits) on interface \Device\N
▸ Ethernet II, Src: Intel_af:3d:95 (d8:f8:83:af:3d:95), Dst: Intel_02:d7:44 (84:1b:77:02:d7
▾ Internet Protocol Version 4, Src: 192.168.35.111, Dst: 192.168.35.174
     0100 .... = Version: 4
     .... 0101 = Header Length: 20 bytes (5)
   ▸ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
     Total Length: 61
     Identification: 0xce02 (52738)
   ▸ 010. .... = Flags: 0x2, Don't fragment
     ...0 0000 0000 0000 = Fragment Offset: 0
     Time to Live: 128
     Protocol: TCP (6)
     Header Checksum: 0x644a [validation disabled]
     [Header checksum status: Unverified]
     Source Address: 192.168.35.111
     Destination Address: 192.168.35.174
     [Stream index: 0]
▾ Transmission Control Protocol, Src Port: 51618, Dst Port: 12000, Seq: 1, Ack: 1, Len: 21
     Source Port: 51618
     Destination Port: 12000
     [Stream index: 0]
     [Stream Packet Number: 4]
   ▸ [Conversation completeness: Complete, WITH_DATA (31)]
     [TCP Segment Len: 21]
     Sequence Number: 1    (relative sequence number)
     Sequence Number (raw): 252228271
     [Next Sequence Number: 22    (relative sequence number)]
     Acknowledgment Number: 1    (relative ack number)
     Acknowledgment number (raw): 1705155504
     0101 .... = Header Length: 20 bytes (5)
   ▸ Flags: 0x018 (PSH, ACK)
     Window: 255
     [Calculated window size: 65280]
     [Window size scaling factor: 256]
     Checksum: 0x3cb9 [unverified]
     [Checksum Status: Unverified]
     Urgent Pointer: 0
   ▸ [Timestamps]
   ▸ [SEQ/ACK analysis]
     TCP payload (21 bytes)
▸ Data (21 bytes)

0000  84 1b 77 02 d7 44 d8 f8  83 af 3d 95 08 00 45 00   ··w··D·· ··=···E·
0010  00 3d ce 02 40 00 80 06  64 4a c0 a8 23 6f c0 a8   ·=··@··· dJ··#o··
0020  23 ae c9 a2 2e e0 0f 08  b2 af 65 a2 9b b0 50 18   #···.··· ··e···P·
0030  00 ff 3c b9 00 00 32 30  32 31 31 32 35 30 34 39   ··<···20 21125049
0040  20 6c 65 65 20 65 75 6e  68 61 6b                   lee eun hak
```

출발지 IP: 192.168.35.111

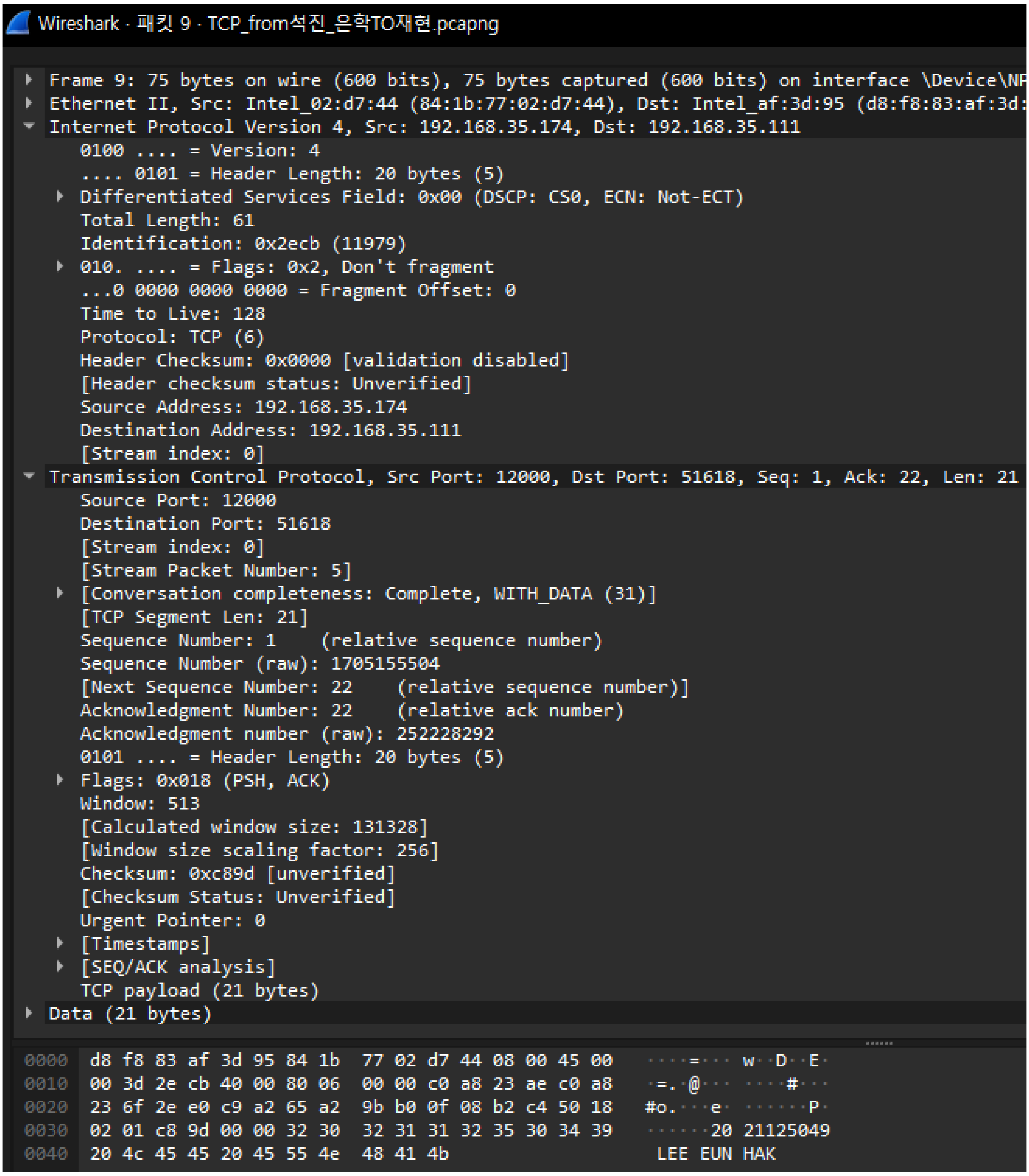
목적지 IP: 192.168.35.174

출발지 포트: 51618

목적지 포트: 12000

전송 데이터 내용: 2021125049 lee eun hak

서버(조재현) -> 클라이언트(이은학) (TCP Response)



Wireshark · 패킷 9 · TCP_from석진_은학TO재현.pcapng

```
▸ Frame 9: 75 bytes on wire (600 bits), 75 bytes captured (600 bits) on interface \Device\NF
▸ Ethernet II, Src: Intel_02:d7:44 (84:1b:77:02:d7:44), Dst: Intel_af:3d:95 (d8:f8:83:af:3d:
▾ Internet Protocol Version 4, Src: 192.168.35.174, Dst: 192.168.35.111
     0100 .... = Version: 4
     .... 0101 = Header Length: 20 bytes (5)
   ▸ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
     Total Length: 61
     Identification: 0x2ecb (11979)
   ▸ 010. .... = Flags: 0x2, Don't fragment
     ...0 0000 0000 0000 = Fragment Offset: 0
     Time to Live: 128
     Protocol: TCP (6)
     Header Checksum: 0x0000 [validation disabled]
     [Header checksum status: Unverified]
     Source Address: 192.168.35.174
     Destination Address: 192.168.35.111
     [Stream index: 0]
▾ Transmission Control Protocol, Src Port: 12000, Dst Port: 51618, Seq: 1, Ack: 22, Len: 21
     Source Port: 12000
     Destination Port: 51618
     [Stream index: 0]
     [Stream Packet Number: 5]
   ▸ [Conversation completeness: Complete, WITH_DATA (31)]
     [TCP Segment Len: 21]
     Sequence Number: 1    (relative sequence number)
     Sequence Number (raw): 1705155504
     [Next Sequence Number: 22    (relative sequence number)]
     Acknowledgment Number: 22    (relative ack number)
     Acknowledgment number (raw): 252228292
     0101 .... = Header Length: 20 bytes (5)
   ▸ Flags: 0x018 (PSH, ACK)
     Window: 513
     [Calculated window size: 131328]
     [Window size scaling factor: 256]
     Checksum: 0xc89d [unverified]
     [Checksum Status: Unverified]
     Urgent Pointer: 0
   ▸ [Timestamps]
   ▸ [SEQ/ACK analysis]
     TCP payload (21 bytes)
▸ Data (21 bytes)

0000  d8 f8 83 af 3d 95 84 1b  77 02 d7 44 08 00 45 00   ····=··· w··D··E·
0010  00 3d 2e cb 40 00 80 06  00 00 c0 a8 23 ae c0 a8   ·=.·@··· ····#···
0020  23 6f 2e e0 c9 a2 65 a2  9b b0 0f 08 b2 c4 50 18   #o.···e· ······P·
0030  02 01 c8 9d 00 00 32 30  32 31 31 32 35 30 34 39   ······20 21125049
0040  20 4c 45 45 20 45 55 4e  48 41 4b                   LEE EUN HAK
```

출발지 IP: 192.168.35.174

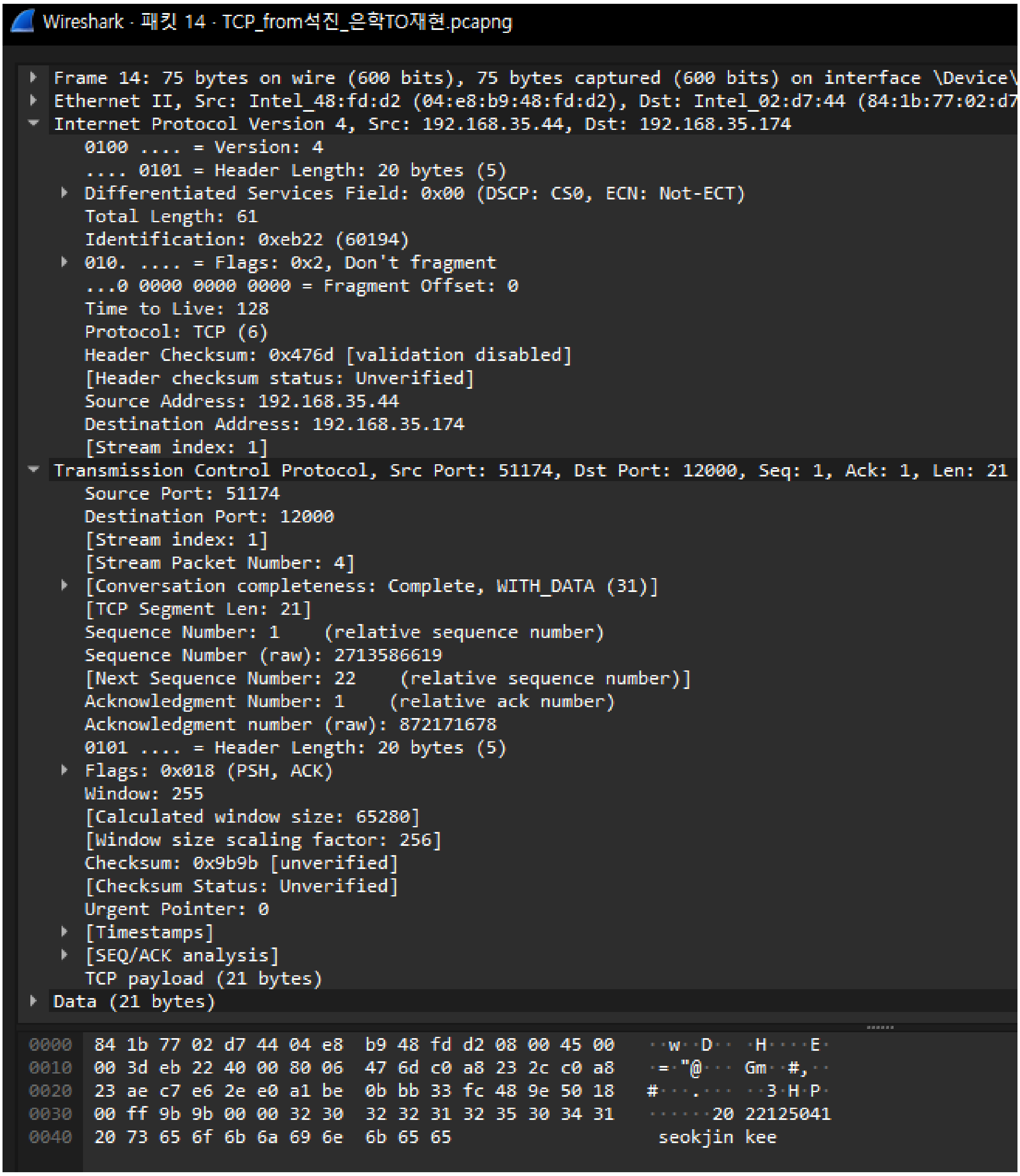
목적지 IP: 192.168.35.111

출발지 포트: 12000

목적지 포트: 51618

응답 데이터: 2021125049 LEE EUN HAK

클라이언트(이석진) -> 서버(조재현) (TCP Resquest)



Wireshark · 패킷 14 · TCP_from석진_은학TO재현.pcapng

```
▸ Frame 14: 75 bytes on wire (600 bits), 75 bytes captured (600 bits) on interface \Device\
▸ Ethernet II, Src: Intel_48:fd:d2 (04:e8:b9:48:fd:d2), Dst: Intel_02:d7:44 (84:1b:77:02:d7
▾ Internet Protocol Version 4, Src: 192.168.35.44, Dst: 192.168.35.174
     0100 .... = Version: 4
     .... 0101 = Header Length: 20 bytes (5)
   ▸ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
     Total Length: 61
     Identification: 0xeb22 (60194)
   ▸ 010. .... = Flags: 0x2, Don't fragment
     ...0 0000 0000 0000 = Fragment Offset: 0
     Time to Live: 128
     Protocol: TCP (6)
     Header Checksum: 0x476d [validation disabled]
     [Header checksum status: Unverified]
     Source Address: 192.168.35.44
     Destination Address: 192.168.35.174
     [Stream index: 1]
▾ Transmission Control Protocol, Src Port: 51174, Dst Port: 12000, Seq: 1, Ack: 1, Len: 21
     Source Port: 51174
     Destination Port: 12000
     [Stream index: 1]
     [Stream Packet Number: 4]
   ▸ [Conversation completeness: Complete, WITH_DATA (31)]
     [TCP Segment Len: 21]
     Sequence Number: 1    (relative sequence number)
     Sequence Number (raw): 2713586619
     [Next Sequence Number: 22    (relative sequence number)]
     Acknowledgment Number: 1    (relative ack number)
     Acknowledgment number (raw): 872171678
     0101 .... = Header Length: 20 bytes (5)
   ▸ Flags: 0x018 (PSH, ACK)
     Window: 255
     [Calculated window size: 65280]
     [Window size scaling factor: 256]
     Checksum: 0x9b9b [unverified]
     [Checksum Status: Unverified]
     Urgent Pointer: 0
   ▸ [Timestamps]
   ▸ [SEQ/ACK analysis]
     TCP payload (21 bytes)
▸ Data (21 bytes)

0000  84 1b 77 02 d7 44 04 e8  b9 48 fd d2 08 00 45 00   ··w··D·· ·H····E·
0010  00 3d eb 22 40 00 80 06  47 6d c0 a8 23 2c c0 a8   ·=·"@··· Gm··#,··
0020  23 ae c7 e6 2e e0 a1 be  0b bb 33 fc 48 9e 50 18   #···.··· ··3·H·P·
0030  00 ff 9b 9b 00 00 32 30  32 32 31 32 35 30 34 31   ······20 22125041
0040  20 73 65 6f 6b 6a 69 6e  6b 65 65                   seokjin kee
```

출발지 IP: 192.168.35.44

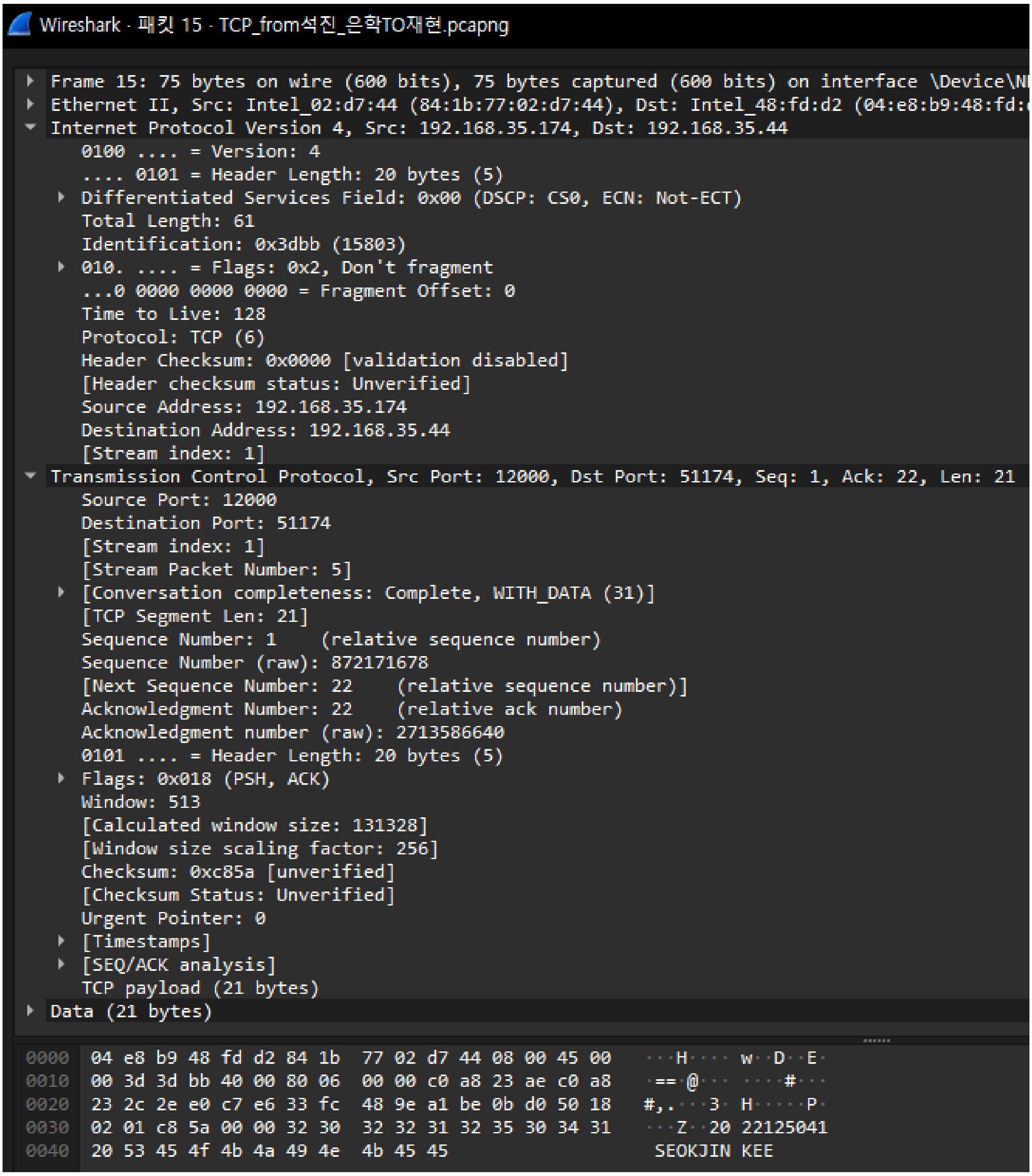
목적지 IP: 192.168.35.174

출발지 포트: 51174

목적지 포트: 12000

전송 데이터 내용: 2022125041 seokjin kee

서버(조재현) -> 클라이언트(이석진) (TCP Response)



Wireshark · 패킷 15 · TCP_from석진_은학TO재현.pcapng

```
▸ Frame 15: 75 bytes on wire (600 bits), 75 bytes captured (600 bits) on interface \Device\NI
▸ Ethernet II, Src: Intel_02:d7:44 (84:1b:77:02:d7:44), Dst: Intel_48:fd:d2 (04:e8:b9:48:fd:
▾ Internet Protocol Version 4, Src: 192.168.35.174, Dst: 192.168.35.44
     0100 .... = Version: 4
     .... 0101 = Header Length: 20 bytes (5)
   ▸ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
     Total Length: 61
     Identification: 0x3dbb (15803)
   ▸ 010. .... = Flags: 0x2, Don't fragment
     ...0 0000 0000 0000 = Fragment Offset: 0
     Time to Live: 128
     Protocol: TCP (6)
     Header Checksum: 0x0000 [validation disabled]
     [Header checksum status: Unverified]
     Source Address: 192.168.35.174
     Destination Address: 192.168.35.44
     [Stream index: 1]
▾ Transmission Control Protocol, Src Port: 12000, Dst Port: 51174, Seq: 1, Ack: 22, Len: 21
     Source Port: 12000
     Destination Port: 51174
     [Stream index: 1]
     [Stream Packet Number: 5]
   ▸ [Conversation completeness: Complete, WITH_DATA (31)]
     [TCP Segment Len: 21]
     Sequence Number: 1    (relative sequence number)
     Sequence Number (raw): 872171678
     [Next Sequence Number: 22    (relative sequence number)]
     Acknowledgment Number: 22    (relative ack number)
     Acknowledgment number (raw): 2713586640
     0101 .... = Header Length: 20 bytes (5)
   ▸ Flags: 0x018 (PSH, ACK)
     Window: 513
     [Calculated window size: 131328]
     [Window size scaling factor: 256]
     Checksum: 0xc85a [unverified]
     [Checksum Status: Unverified]
     Urgent Pointer: 0
   ▸ [Timestamps]
   ▸ [SEQ/ACK analysis]
     TCP payload (21 bytes)
▸ Data (21 bytes)

0000  04 e8 b9 48 fd d2 84 1b  77 02 d7 44 08 00 45 00   ···H···· w··D··E·
0010  00 3d 3d bb 40 00 80 06  00 00 c0 a8 23 ae c0 a8   ·==·@··· ····#···
0020  23 2c 2e e0 c7 e6 33 fc  48 9e a1 be 0b d0 50 18   #,.···3· H·····P·
0030  02 01 c8 5a 00 00 32 30  32 32 31 32 35 30 34 31   ···Z··20 22125041
0040  20 53 45 4f 4b 4a 49 4e  4b 45 45                   SEOKJIN KEE
```

출발지 IP: 192.168.35.44

목적지 IP: 192.168.35.111

출발지 포트: 12000

목적지 포트: 51174

응답 데이터: 2022125041 SEOKJIN KEE

5. 동일 PC에서 server/client 실행 시 캡처 안 되는 이유

Wireshark는 기본적으로 물리적 네트워크 인터페이스(Wi-Fi, Ethernet 등)를 통해 송수신되는 패킷을 캡처하는 도구이다. 그러나 동일한 PC에서 서버와 클라이언트를 실행할 경우, 데이터는 네트워크 인터페이스를 거치지 않고 OS 내부의 네트워크 스택을 통해 루프백 인터페이스에서 처리 된다. 그러므로 다른 사람과 통신 할 때 패킷을 캡쳐하는 Wi-Fi 혹은 Ethernet 인터페이스에서는 캡쳐가 되지 않는다.

6. 정리

UDP와 TCP 프로토콜을 이용한 클라이언트 <-> 서버 통신을 분석하고, Wireshark를 활용하여 패킷을 분석 할 수 있었다. UDP는 연결 지향이 아니고 비교적 빠른 전송이 가능하지만 신뢰성이 보장되지 않는 반면, TCP는 3-way handshake 과정을 통해 신뢰성을 보장하며 데이터가 순서대로 전달됨을 확인하였다.

또한, 포트 포워딩을 설정함으로써 서로 다른 네트워크에 위치한 클라이언트와 서버 간의 통신을 가능하게 만들었으며, 이를 통해 공인 IP와 사설 IP 간의 매핑 과정도 이해할 수 있었다. 동일한 PC에서 서버와 클라이언트를 실행할 경우, 네트워크 인터페이스를 거치지 않는 로컬 루프백 인터페이스를 통해 데이터가 전달되므로 Wireshark에서 패킷이 캡처되지 않는다는 점도 실제로 확인할 수 있었다.

7. 느낀 점

초기에는 IP, 포트, 포트 포워딩, 패킷과 같은 개념을 이론적으로만 알고 있어 실제 사용과의 연결이 어려웠다. 하지만 이번 실습을 통해 직접 설정하고 활용하면서 개념들이 점차 명확해졌고, 퍼즐처럼 맞춰지는 경험을 했다.

포트 포워딩의 경우, 참고 자료를 활용하여 비교적 쉽게 설정할 수 있었으나, 서로 다른 네트워크에서 서버에 접속할 때 어떤 IP 주소를 사용해야 하는지 혼란스러웠다. 하지만 공인 IP를 사용해야 한다는 점을 깨닫고 문제를 해결하면서 네트워크 주소 체계에 대한 이해가 더욱 깊어졌다.

수업 시간에 배운 "IP 주소는 집 주소, 포트 번호는 수취인과 비슷한 개념"이라는 비유가 실습을 통해 더욱 실감 나게 다가왔다. 이번 실험을 통해 네트워크 개념을 실제 환경에서 적용해 보고, 이론과 실습의 연관성을 깊이 이해할 수 있는 의미 있는 경험이었다.