1) 구현 환경

- Windows 10 Pro

- Python 3.12.0

2) 코드 설명

수정 전

```
# todo: scapy의 all verbose를 show하도록 설정하고,
# todo: scapy의 srp를 사용해 ARP response를 get
ans = None

for snd, rcv in ans:
    # todo: arp response (ans)로부터 ip address와 mac address를 get
    ip_addr = None
    mac_addr = None
    self.ARP_table.append((ip_addr, mac_addr))
```

수정 후

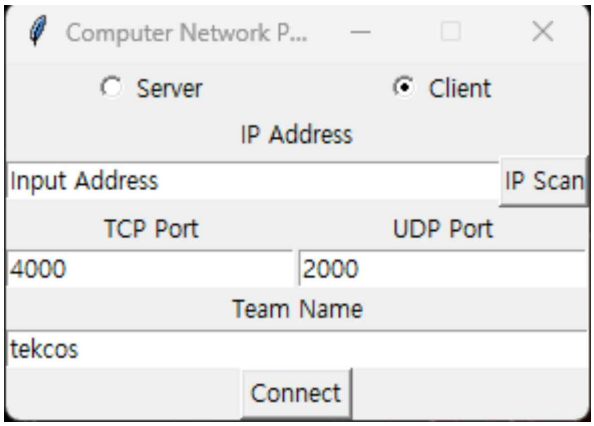
```
# todo: scapy의 all verbose를 show하도록 설정하고,
# todo: scapy의 srp를 사용해 ARP response를 get
conf.verb = 1
ans = (srp(Ether(dst="ff:ff:ff:ff:ff:ff") / ARP(pdst=ips), iface=interface, timeout=2, inter=0.1))[0]

for snd, rcv in ans:
    # todo: arp response (ans)로부터 ip address와 mac address를 get
    ip_addr = rcv[ARP].psrc
    mac_addr = rcv[Ether].hwsrc
    self.ARP_table.append((ip_addr, mac_addr))
```

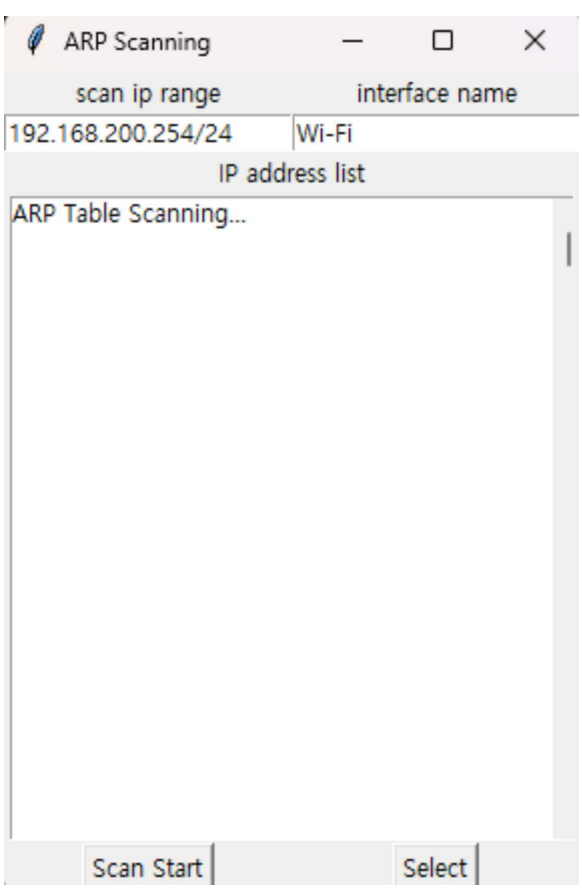
- netifaces, psutil, scapy.ARP, scapy.Ether 모듈을 사용하여 주변 기기 IP 주소 확인

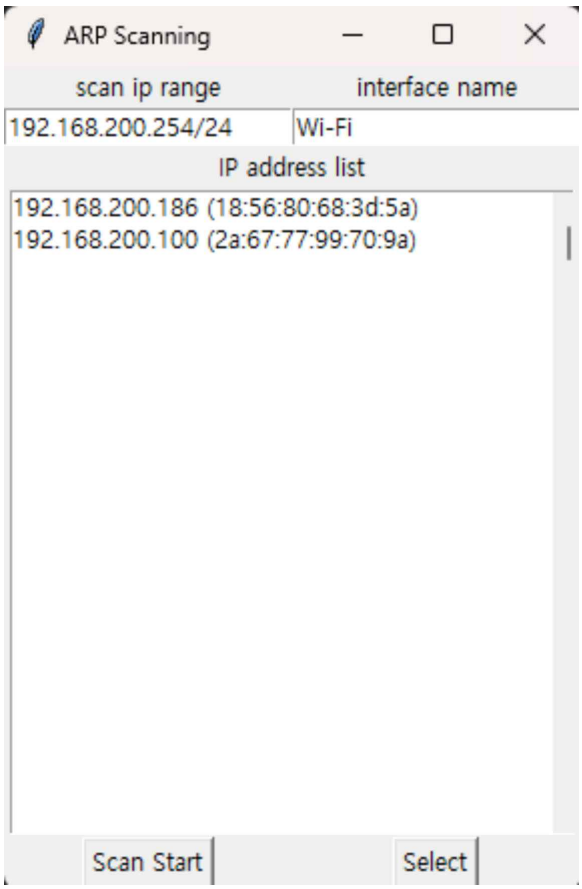
3) 정상 동작 스크린샷 (ARP table scanning 기능)

- IP Scan 전

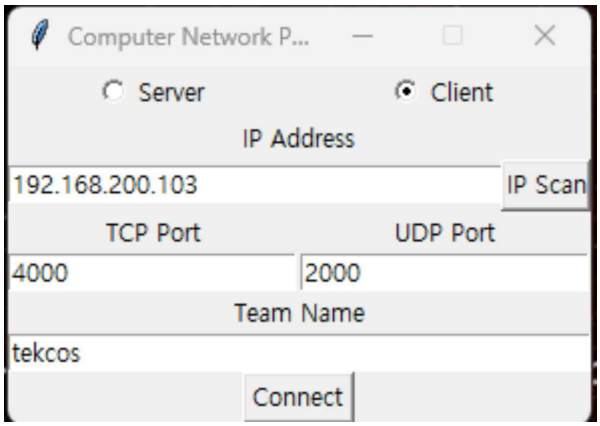


- IP Scan 동작





- IP Scan 완료



4) Wireshark를 사용해 sender (ARP packet 발생시킨 host)와 receiver (ARP packet 수신한 host) 각각의 ARP 패킷 관찰 스크린샷

- ARP Reply

No.	Time	Source	Destination	Protocol	Length	Info
349	20.974549	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.97? Tell 192.168.200.186
350	20.974576	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.97? Tell 192.168.200.186
351	21.076824	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.98? Tell 192.168.200.186
352	21.076852	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.98? Tell 192.168.200.186
353	21.179065	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.99? Tell 192.168.200.186
354	21.179094	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.99? Tell 192.168.200.186
357	21.281429	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.100? Tell 192.168.200.186
358	21.281456	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.100? Tell 192.168.200.186
359	21.384078	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.101? Tell 192.168.200.186
360	21.384110	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.101? Tell 192.168.200.186
361	21.487383	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.102? Tell 192.168.200.186
362	21.487445	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.102? Tell 192.168.200.186
363	21.507236	2a:67:77:99:70:9a	IntelCor_68:3d:5a	ARP	42	192.168.200.100 is at 2a:67:77:99:70:9a
364	21.591226	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.103? Tell 192.168.200.186
365	21.591268	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.103? Tell 192.168.200.186
366	21.652764	86:2d:a7:1e:99:ad	IntelCor_68:3d:5a	ARP	42	192.168.200.101 is at 86:2d:a7:1e:99:ad
367	21.694577	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.104? Tell 192.168.200.186
368	21.694622	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.104? Tell 192.168.200.186
369	21.798105	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.105? Tell 192.168.200.186

```
> Frame 363: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface \Device\NPF_{868BF75F-ADDD-4327-8B6A-FDFC202898F5}, id 0
v Ethernet II, Src: 2a:67:77:99:70:9a (2a:67:77:99:70:9a), Dst: IntelCor_68:3d:5a (18:56:80:68:3d:5a)
  > Destination: IntelCor_68:3d:5a (18:56:80:68:3d:5a)
  > Source: 2a:67:77:99:70:9a (2a:67:77:99:70:9a)
    Type: ARP (0x0806)
v Address Resolution Protocol (reply)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: reply (2)
    Sender MAC address: 2a:67:77:99:70:9a (2a:67:77:99:70:9a)
    Sender IP address: 192.168.200.100
    Target MAC address: IntelCor_68:3d:5a (18:56:80:68:3d:5a)
    Target IP address: 192.168.200.186
```

- ARP Request

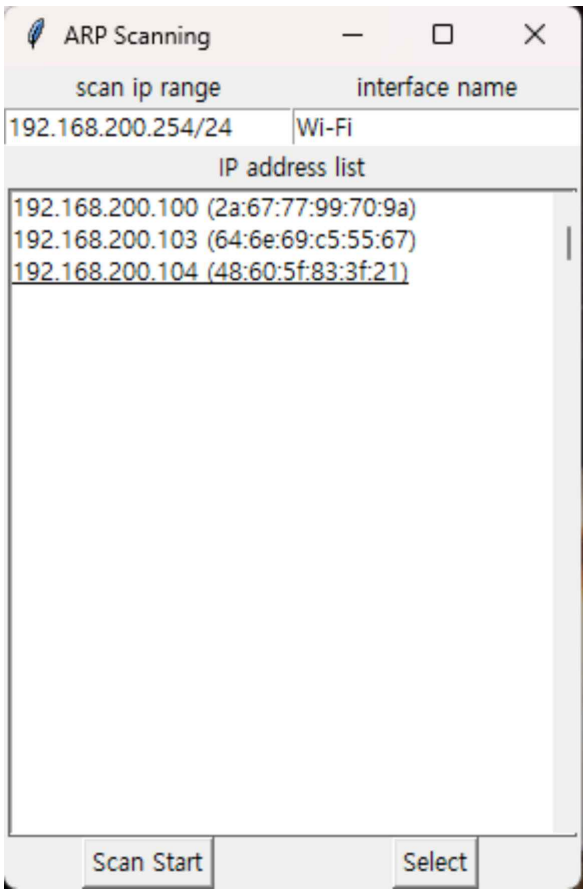
No.	Time	Source	Destination	Protocol	Length	Info
349	20.974549	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.97? Tell 192.168.200.186
350	20.974576	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.97? Tell 192.168.200.186
351	21.076824	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.98? Tell 192.168.200.186
352	21.076852	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.98? Tell 192.168.200.186
353	21.179065	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.99? Tell 192.168.200.186
354	21.179094	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.99? Tell 192.168.200.186
357	21.281429	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.100? Tell 192.168.200.186
358	21.281456	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.100? Tell 192.168.200.186
359	21.384078	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.101? Tell 192.168.200.186
360	21.384110	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.101? Tell 192.168.200.186
361	21.487383	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.102? Tell 192.168.200.186
362	21.487445	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.102? Tell 192.168.200.186
363	21.507236	2a:67:77:99:70:9a	IntelCor_68:3d:5a	ARP	42	192.168.200.100 is at 2a:67:77:99:70:9a
364	21.591226	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.103? Tell 192.168.200.186
365	21.591268	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.103? Tell 192.168.200.186
366	21.652764	86:2d:a7:1e:99:ad	IntelCor_68:3d:5a	ARP	42	192.168.200.101 is at 86:2d:a7:1e:99:ad
367	21.694577	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.104? Tell 192.168.200.186
368	21.694622	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.104? Tell 192.168.200.186
369	21.798105	IntelCor_68:3d:5a	Broadcast	ARP	42	Who has 192.168.200.105? Tell 192.168.200.186

```
> Frame 357: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface \Device\NPF_{868BF75F-ADDD-4327-8B6A-FDFC202898F5}, id 0
v Ethernet II, Src: IntelCor_68:3d:5a (18:56:80:68:3d:5a), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
  > Destination: Broadcast (ff:ff:ff:ff:ff:ff)
  > Source: IntelCor_68:3d:5a (18:56:80:68:3d:5a)
    Type: ARP (0x0806)
v Address Resolution Protocol (request)
    Hardware type: Ethernet (1)
    Protocol type: IPv4 (0x0800)
    Hardware size: 6
    Protocol size: 4
    Opcode: request (1)
    Sender MAC address: IntelCor_68:3d:5a (18:56:80:68:3d:5a)
    Sender IP address: 192.168.200.186
    Target MAC address: 00:00:00_00:00:00 (00:00:00:00:00:00)
    Target IP address: 192.168.200.100
```

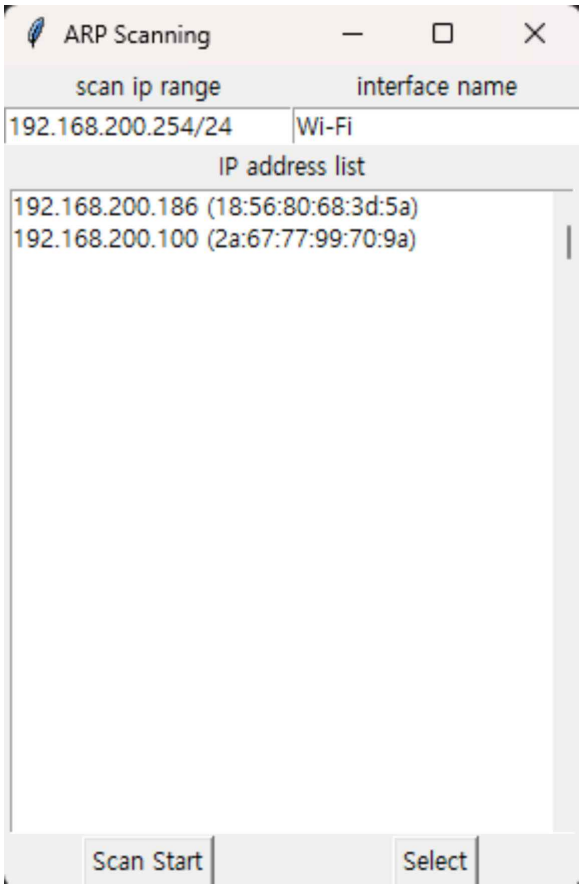
5) Mobility에 따른 IP address 및 ARP table 확인

5-1) 장소 A에 있을 때

5-1-1) Wireless network interface를 disable 시키기 전



5-1-2) Wireless network interface를 disable 시킨 후

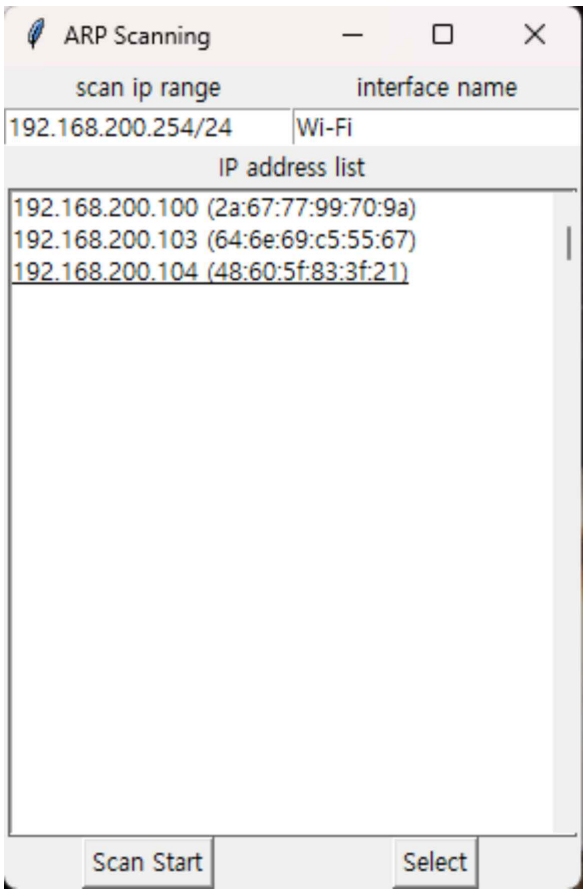


5-1-3) IP Address list의 목록은 변하는것 처럼 보이나, 서브넷 주소에는 변화가 없다. Broadcasting 결과, IP Address list가 변화하더라도 여전히 서브넷 주소는 동일하다.

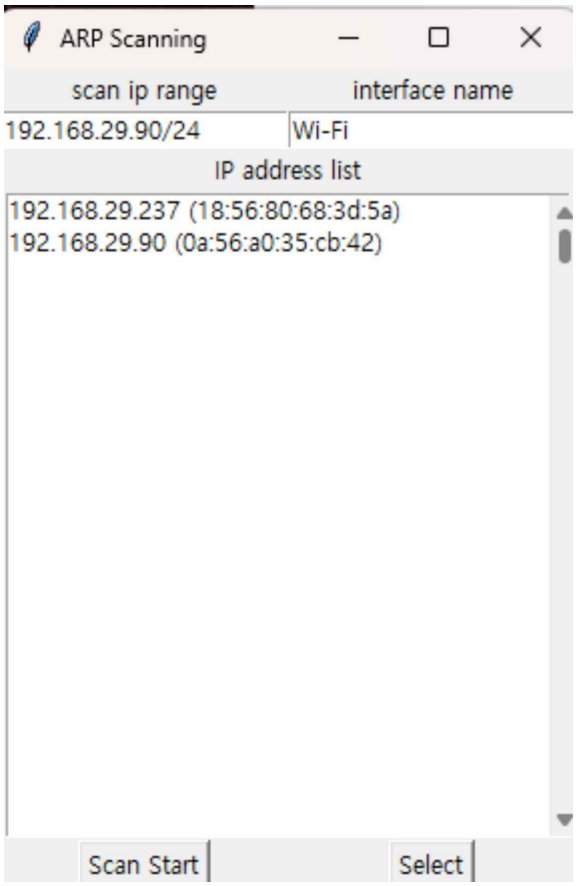
5-2) 장소 A에서 B로 이동했을 때

- 방법 2. 하나의 모바일 기기의 테더링을 활성화시켜 공유기로 설정

5-2-1) Wireless network interface를 disable 시키기 전



5-2-2) 연결을 끊고 다른 공유기에 연결



5-2-3) 연결을 끊고 다른 공유기에 연결했을 때 서브넷 주소가 변경된 것을 확인할 수 있다. 서브넷 주소가 변화함에 따라 다시 Broadcasting을 수행하여 얻어진 IP Address list 역시 해당 서브넷 주소를 갖는 IP들의 목록으로 변화함을 관찰할 수 있다.

5-3) 장소 A에서는 동일한 LAN 상에 있어 IP 서브넷이 유지되나, 장소 A에서 B로 이동하면 다른 LAN으로 옮겨져 IP 서브넷이 변경된다. 네트워크 변경시 DHCP 서버가 동적으로 새로운 IP주소를 할당해 IP 주소가 변경된다. ARP는 IP 주소를 MAC 주소와 매핑하는 프로토콜로, 네트워크 변경 시 새로운 IP와 이에 대응하는 MAC 주소를 찾고자 브로드캐스팅을 수행, 새로운 ARP Table을 생성한다.