

네트워크프로그래밍-3주

Linux 실습 환경 구축

Vmware 네트워크 환경 설정

정인환교수

Vmware + Ubuntu Linux 설치

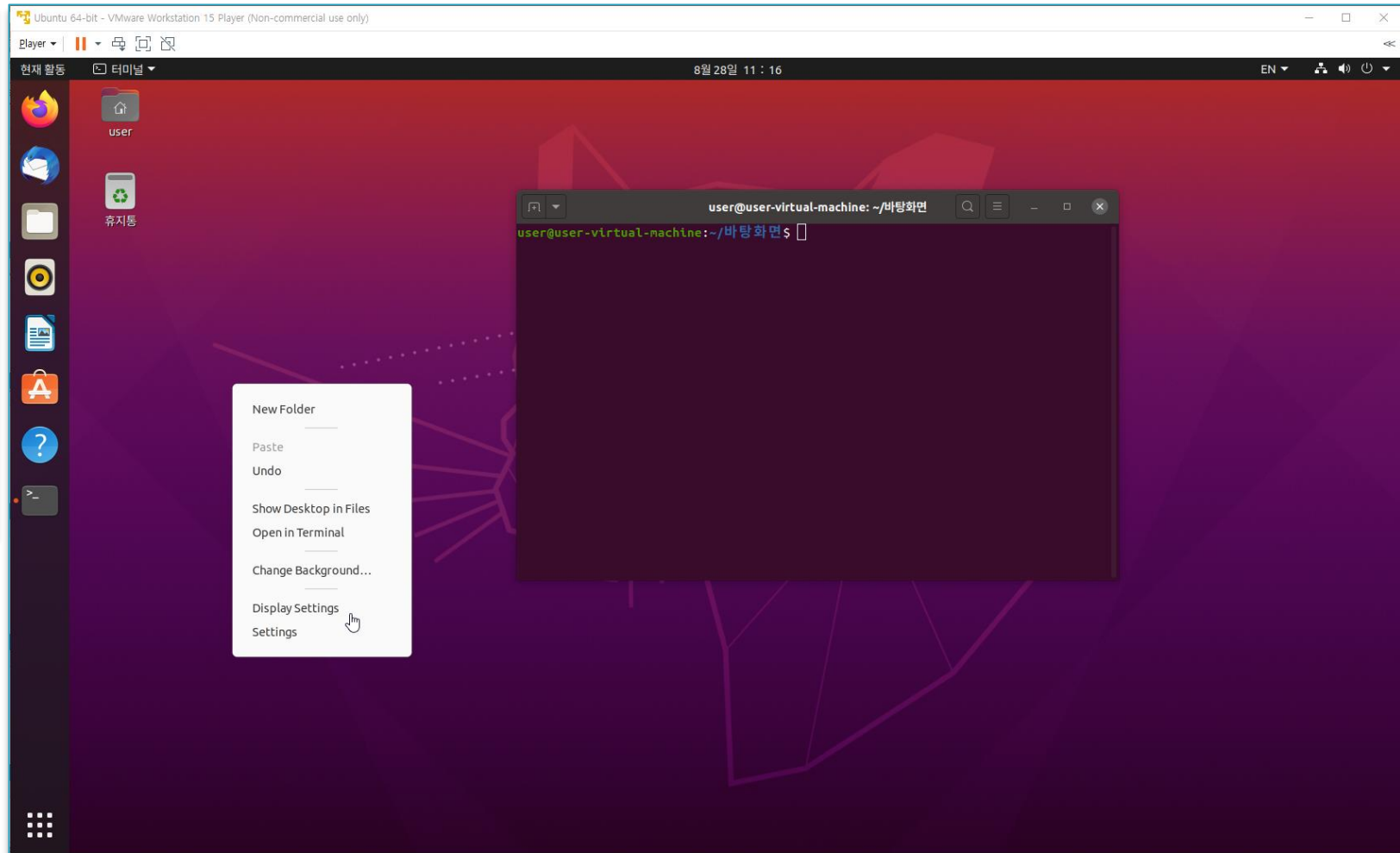
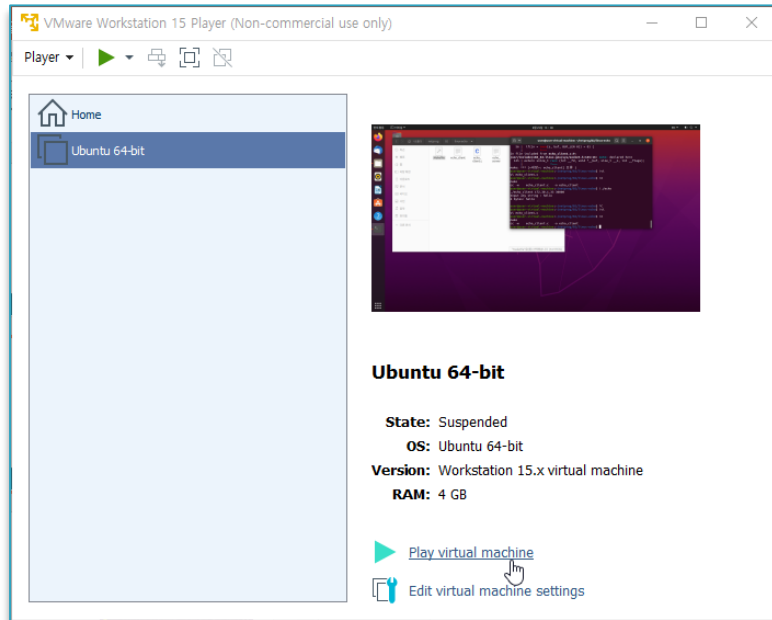
▶ Ubuntu 다운

- <https://ubuntu.com/#download>
- ubuntu-20.04.3-desktop-amd64.iso

▶ Vmware 다운 설치, 실행

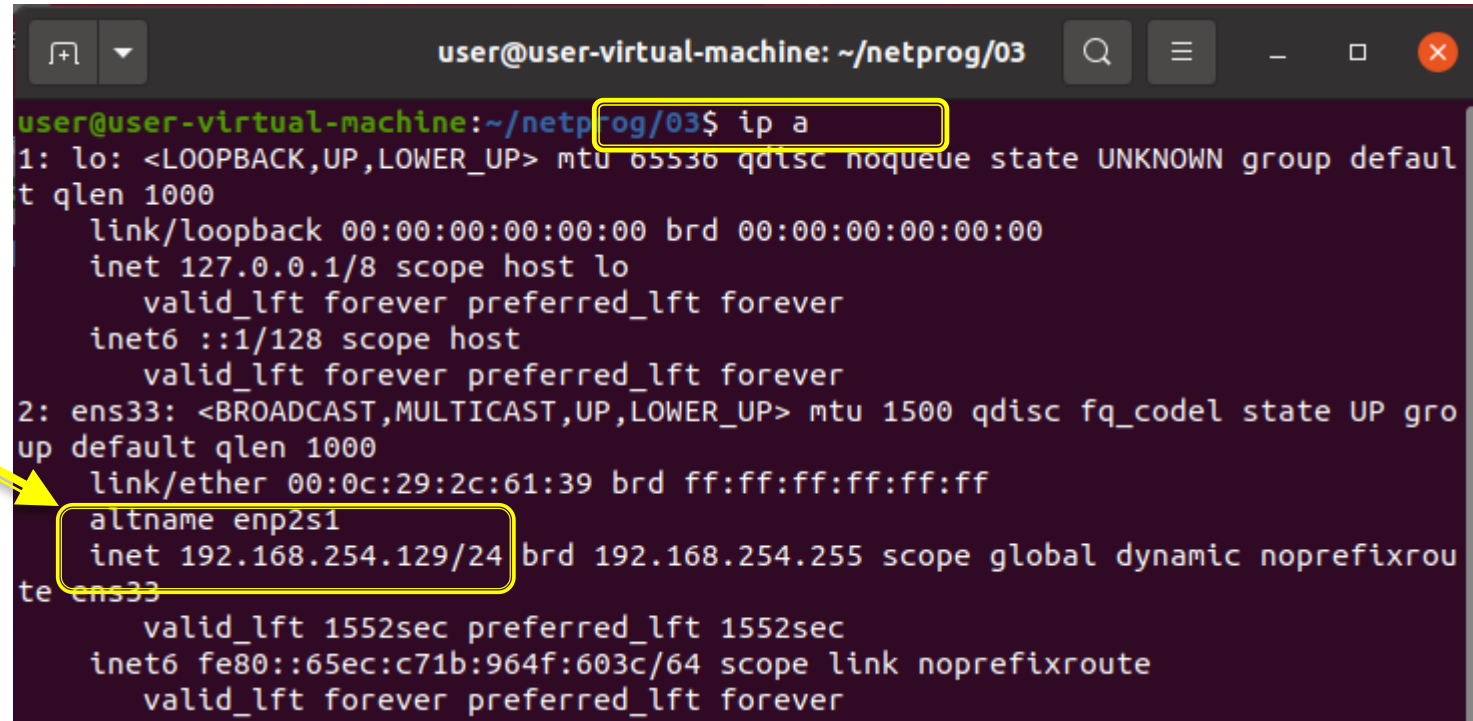
- <https://www.vmware.com/kr/products/workstation-player/workstation-player-evaluation.html>
- VMware-player-16.1.2-17966106.exe
- VMware 실행
 - Create New Virtual Machine
 - ubuntu-20.04.3-desktop-amd64.iso 설정
 - Ubuntu Virtual Machine 실행
 - Ubuntu 설치 진행

Vmware Linux 실행



Ubuntu 개발 환경 설정

- ▶ gcc, make
 - sudo apt install gcc
 - sudo apt install make
- ▶ Network tools (ifconfig, netstat ..)
 - sudo apt install net-tools
- ▶ Network 환경 확인
 - ip a 로 확인
 - 192.168.254.129



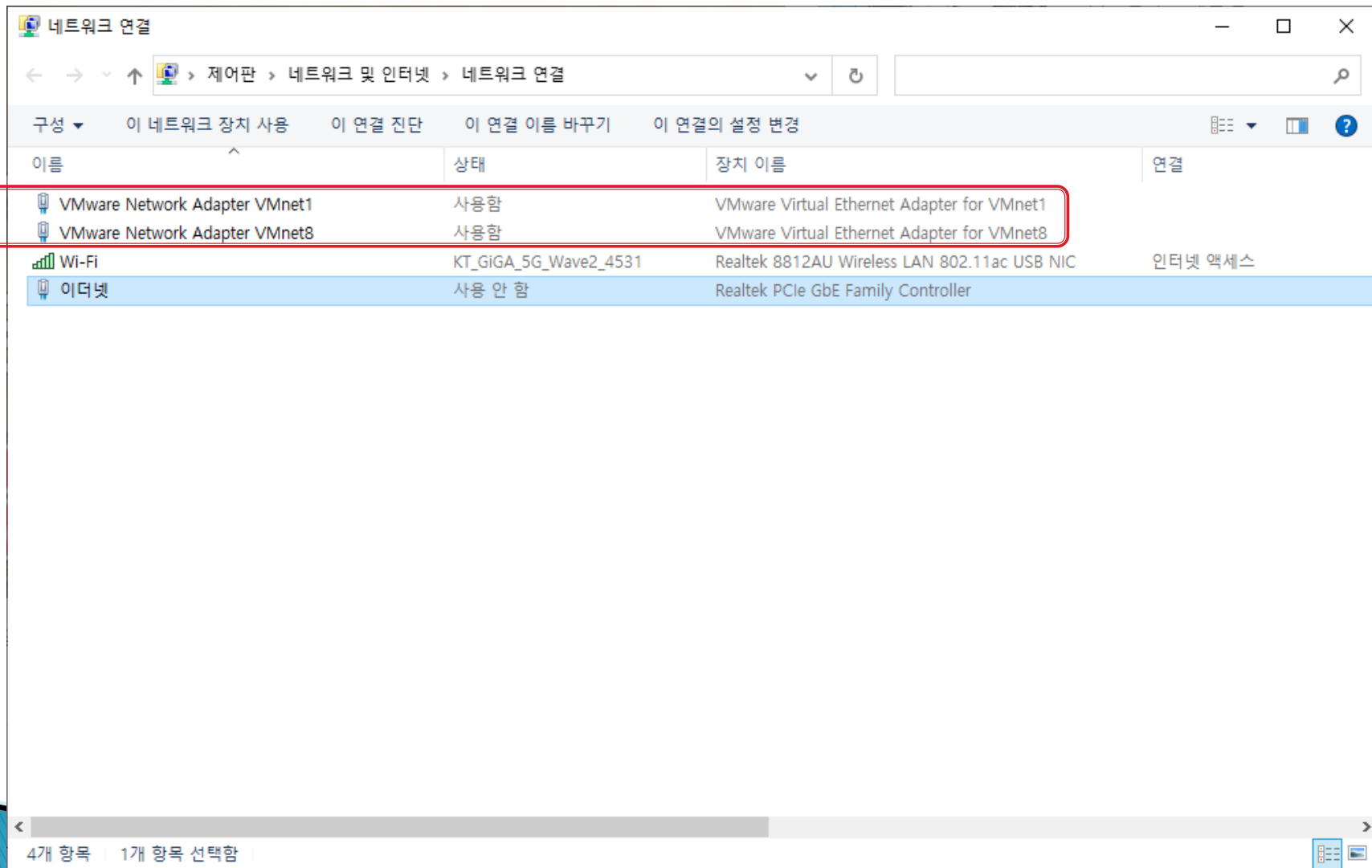
```
user@user-virtual-machine: ~/netprog/03
user@user-virtual-machine:~/netprog/03$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:2c:61:39 brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 192.168.254.129/24 brd 192.168.254.255 scope global dynamic noprefixroute ens33
        valid_lft 1552sec preferred_lft 1552sec
    inet6 fe80::65ec:c71b:964f:603c/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
```

ifconfig 로 IP 확인

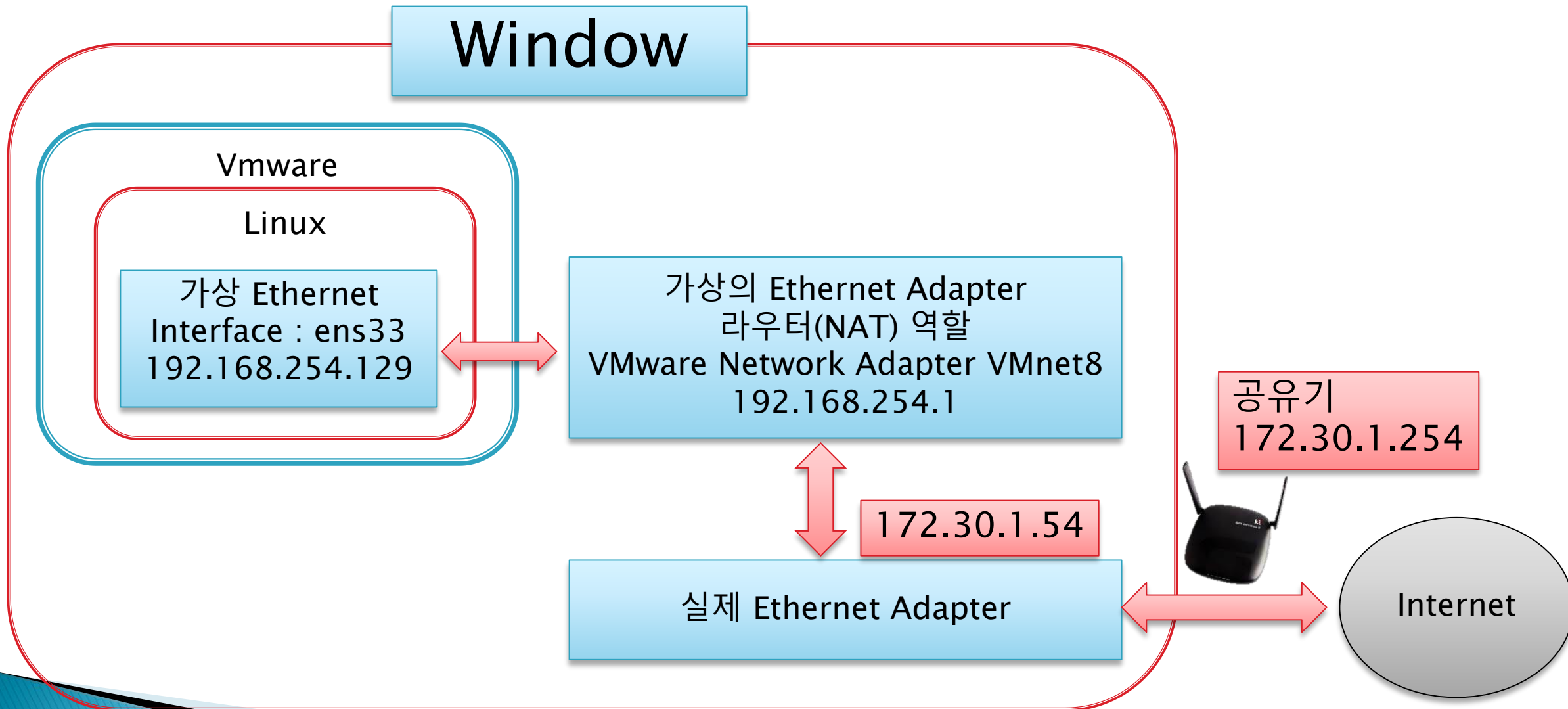
```
user@user-virtual-machine: ~/netprog/03
user@user-virtual-machine:~/netprog/03$ ifconfig
ens33: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.254.129 netmask 255.255.255.0 broadcast 192.168.254.255
    inet6 fe80::65ec:c71b:964f:603c prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:2c:61:39 txqueuelen 1000 (Ethernet)
    RX packets 346 bytes 201248 (201.2 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 302 bytes 42415 (42.4 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 213 bytes 18115 (18.1 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 213 bytes 18115 (18.1 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Vmware 설치되면 Virtual Ethernet Adapter 생성됨

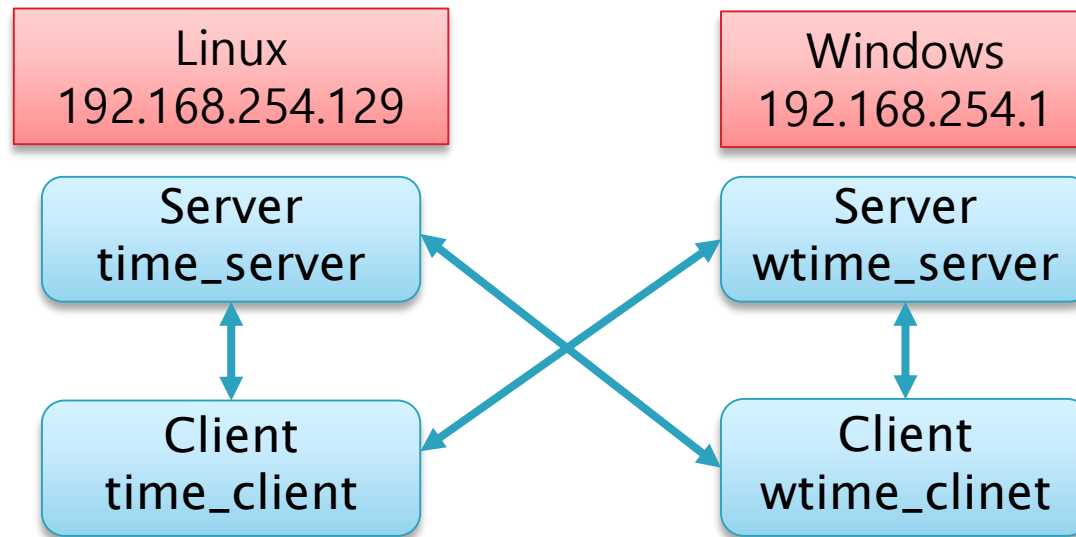


Linux / Windows Network 원리 (기본 NAT 모드)



소켓프로그래밍 테스트 (NAT 모드)

- (1) Linux Client / Linux Server
- (2) Windows Client / Windows Server
- (3) Windows Client / Linux Server
- (4) Linux Client / Windows Server



(1) Linux Client / Linux Server

Ubuntu 64-bit-NAT - VMware Workstation 15 Player (Non-commercial use only)

현재 활동 터미널 9월 11일 16:06 EN

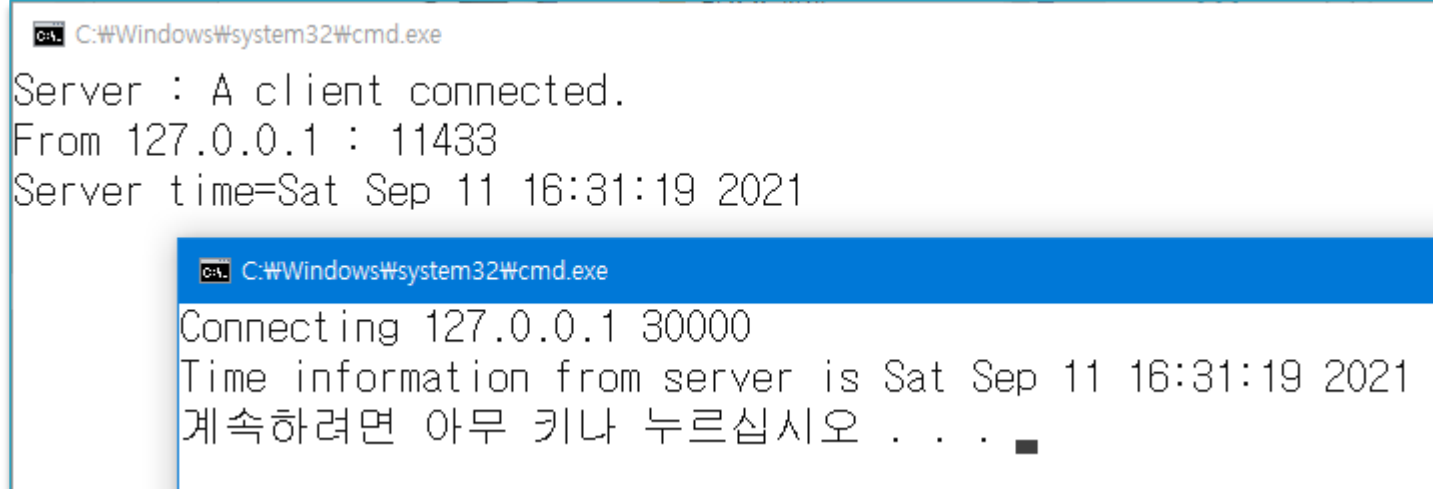
```
user@user-virtual-machine: ~/netprog/03
user@user-virtual-machine:~/netprog/03$ ls
Makefile      time_client  time_server.c  udp_time_server
NetP-03.zip   time_client.c  udp_time_client  udp_time_server.c
NetP03-linux.zip  time_server  udp_time_client.c
user@user-virtual-machine:~/netprog/03$ ./time_server
Server : waiting connection request
Server : A client connected.
From 127.0.0.1 : 35712
Server time=Sat Sep 11 16:06:21 2021

```

```
user@user-virtual-machine:~/netprog/03$ ./time_client
Time information from server is Sat Sep 11 16:06:21 2021
user@user-virtual-machine:~/netprog/03$
```

(2) Windows Client / Windows Server

- ▶ wtime_server [30000]
- ▶ wtime_client [127.0.0.1] [30000]



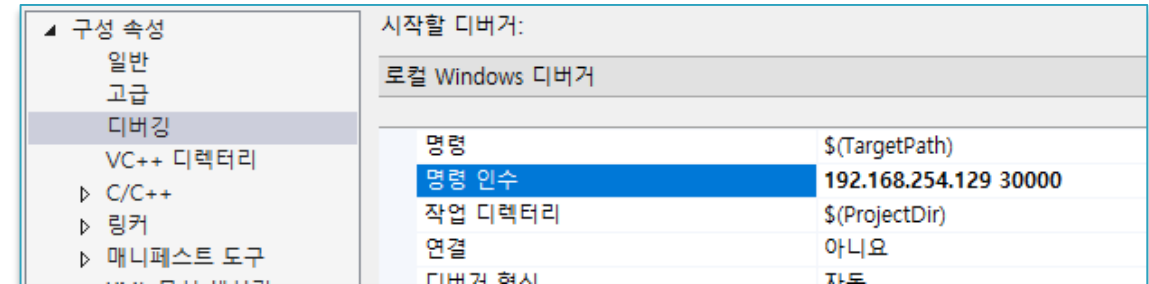
The image shows two overlapping Windows command prompt windows. The background window is titled 'C:\Windows\system32\cmd.exe' and displays the output of the wtime_server program: 'Server : A client connected.', 'From 127.0.0.1 : 11433', and 'Server time=Sat Sep 11 16:31:19 2021'. The foreground window, also titled 'C:\Windows\system32\cmd.exe', displays the output of the wtime_client program: 'Connecting 127.0.0.1 30000', 'Time information from server is Sat Sep 11 16:31:19 2021', and a Korean prompt '계속하려면 아무 키나 누르십시오 . . . ' followed by a cursor.

```
C:\Windows\system32\cmd.exe
Server : A client connected.
From 127.0.0.1 : 11433
Server time=Sat Sep 11 16:31:19 2021

C:\Windows\system32\cmd.exe
Connecting 127.0.0.1 30000
Time information from server is Sat Sep 11 16:31:19 2021
계속하려면 아무 키나 누르십시오 . . . █
```

(3) Windows Client / Linux Server

- ▶ Linux time_server
 - ./time_server 30000
- ▶ Window wtime_client
 - wtime_client 192.168.254.129 30000



```
user@user-virtual-machine: ~/netprog/03
ls
Makefile      time_client  time_server.c  udp_time_server
NetP-03.zip   time_client.c  udp_time_client  udp_time_server.c
NetP03-linux.zip time_server  udp_time_client.c
user@user-virtual-machine:~/netprog/03$ ./time_server
Server : waiting connection request.
Server : A client connected.
From 127.0.0.1 : 35712
Server time=Sat Sep 11 16:06:21 2021
Server : A client connected.
From 192.168.254.1 : 2358
Server time=Sat Sep 11 16:08:32 2021

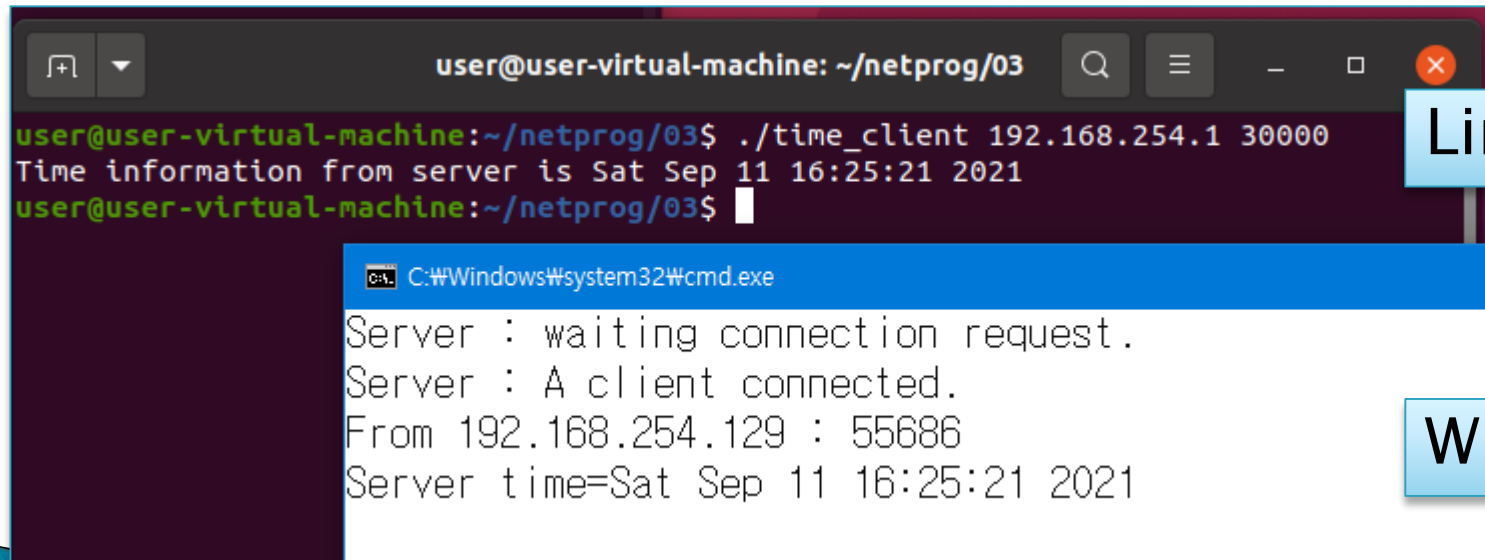
C:\Windows\system32\cmd.exe
Connecting 192.168.254.129 30000
Time information from server is Sat Sep 11 16:08:32 2021
계속하려면 아무 키나 누르십시오 . . .
```

Linux Server

Window Client

(4) Linux Client / Windows Server

- ▶ Linux time_client
 - `./time_client 192.168.254.1 30000`
- ▶ Window wtime_server
 - `wtime_server`



The screenshot shows two overlapping terminal windows. The top window is a Linux terminal with a dark background, titled 'user@user-virtual-machine: ~/netprog/03'. It shows the execution of the command `./time_client 192.168.254.1 30000`, which returns the output 'Time information from server is Sat Sep 11 16:25:21 2021'. The bottom window is a Windows command prompt with a light blue title bar, titled 'C:\Windows\system32\cmd.exe'. It shows the output of the `wtime_server` command: 'Server : waiting connection request.', 'Server : A client connected.', 'From 192.168.254.129 : 55686', and 'Server time=Sat Sep 11 16:25:21 2021'.

```
user@user-virtual-machine: ~/netprog/03
user@user-virtual-machine:~/netprog/03$ ./time_client 192.168.254.1 30000
Time information from server is Sat Sep 11 16:25:21 2021
user@user-virtual-machine:~/netprog/03$

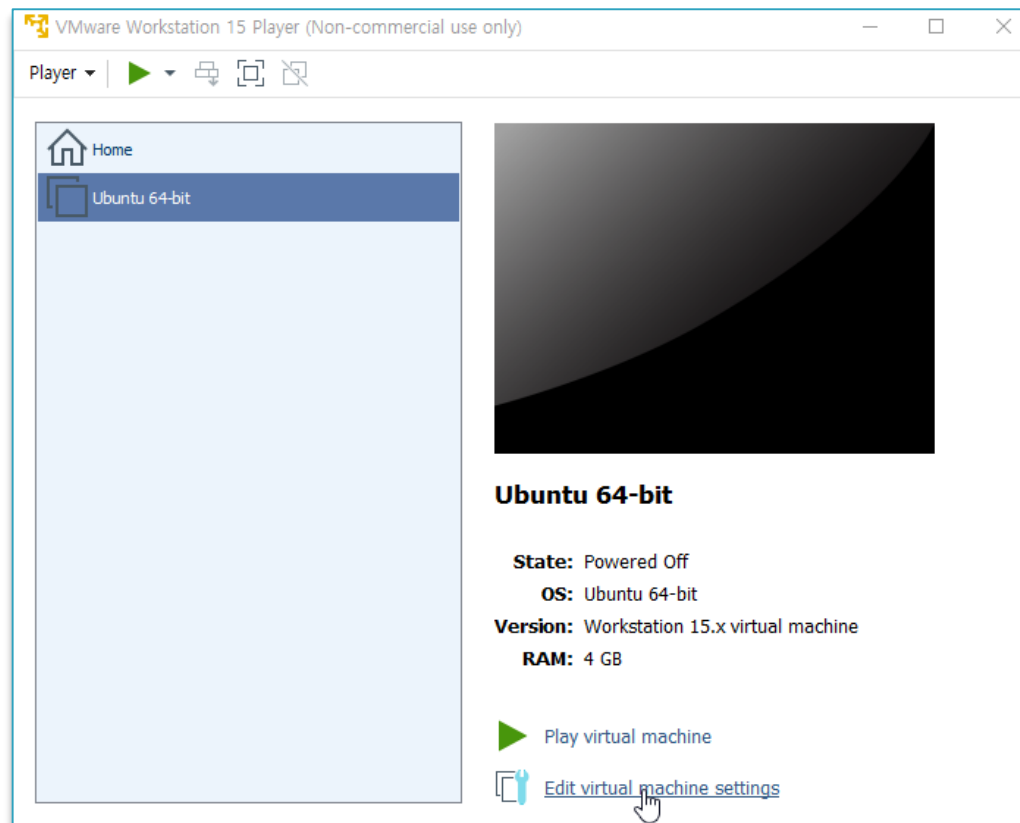
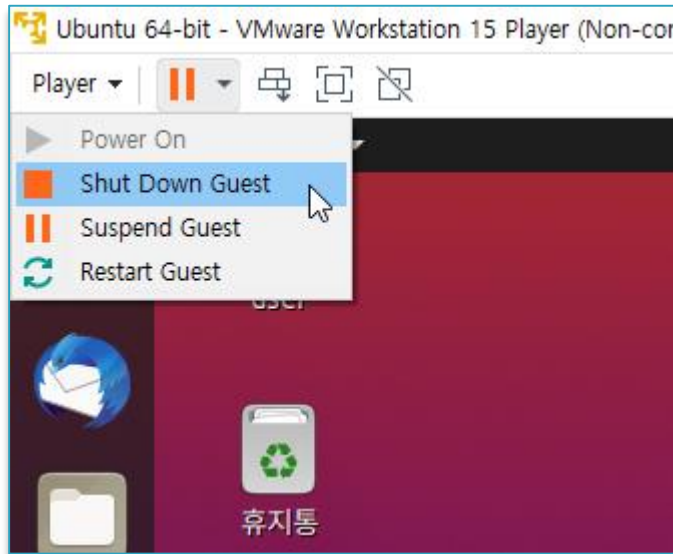
C:\Windows\system32\cmd.exe
Server : waiting connection request.
Server : A client connected.
From 192.168.254.129 : 55686
Server time=Sat Sep 11 16:25:21 2021
```

Linux Client

Window Server

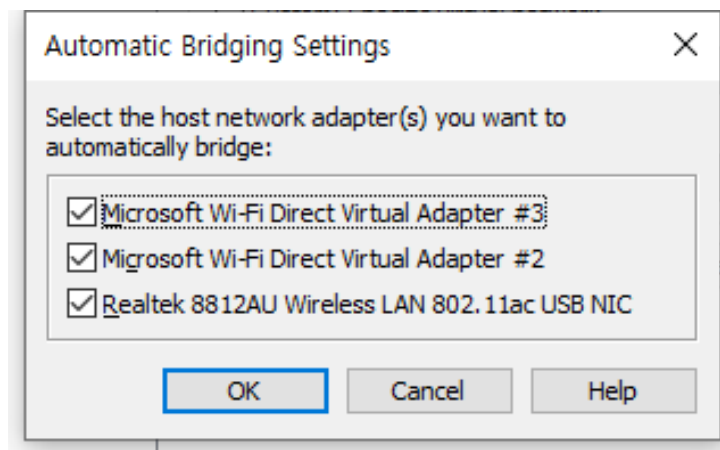
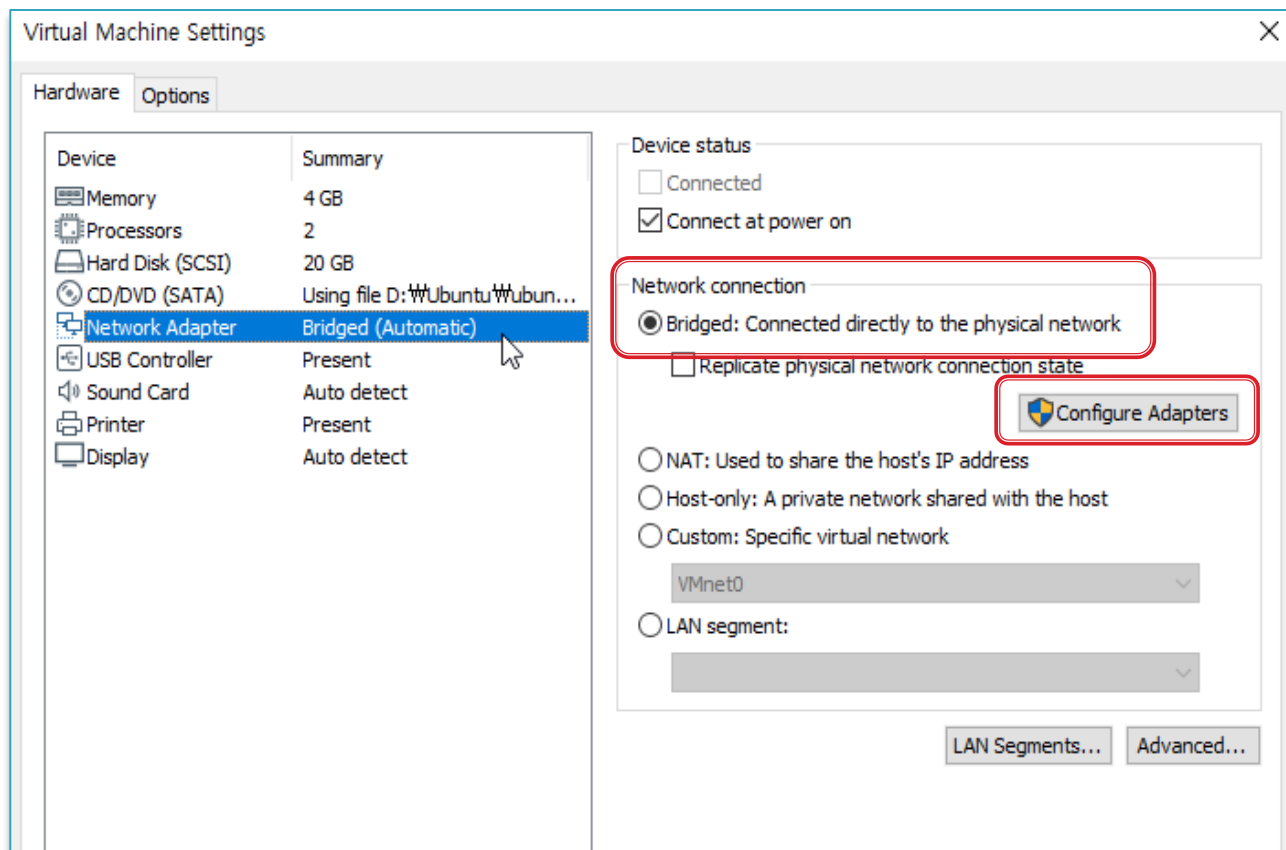
Vmware Linux Bridge 모드설정

- ▶ Vmware Linux를 Shut Down
- ▶ Vmware Edit virtual machine settings

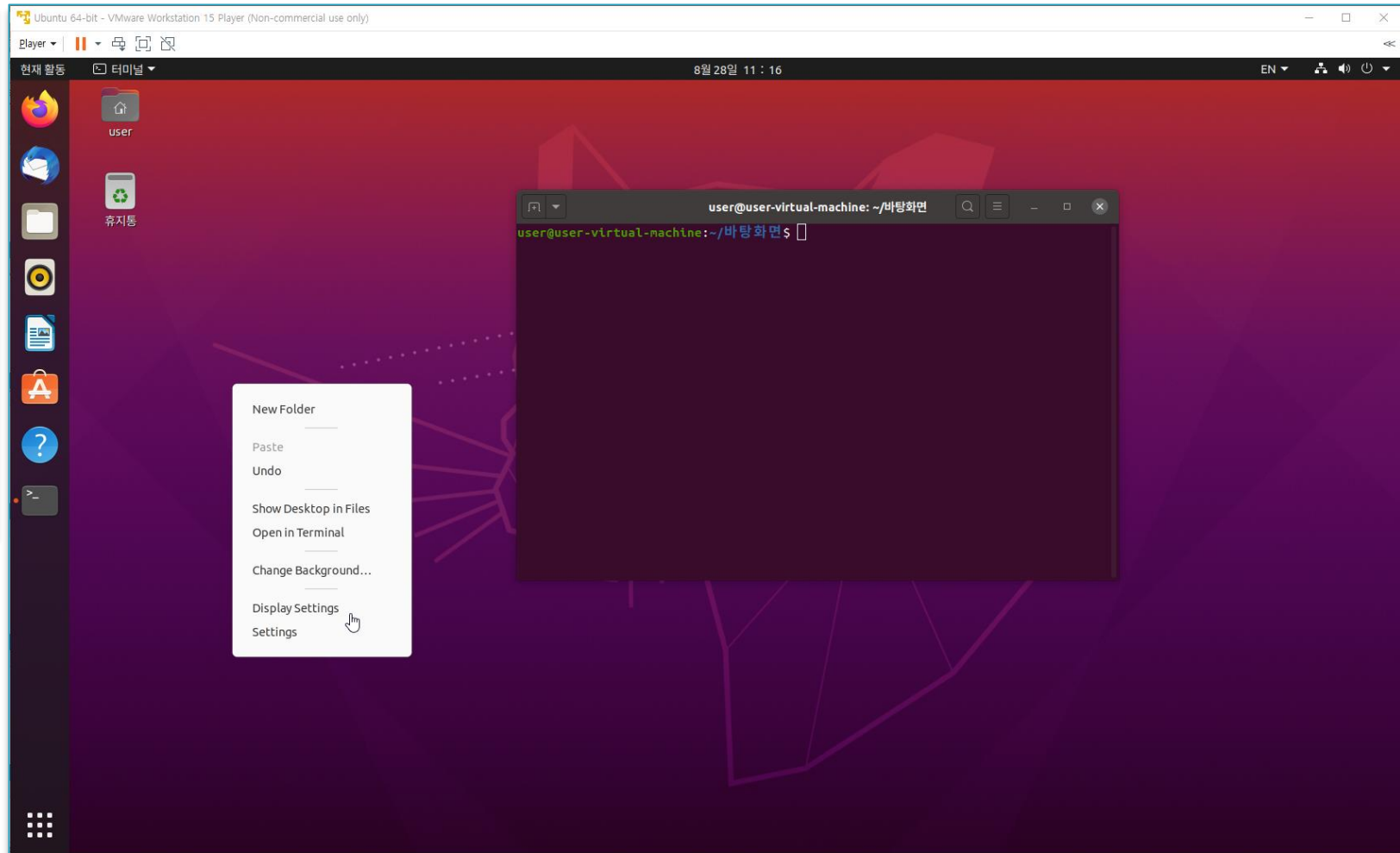
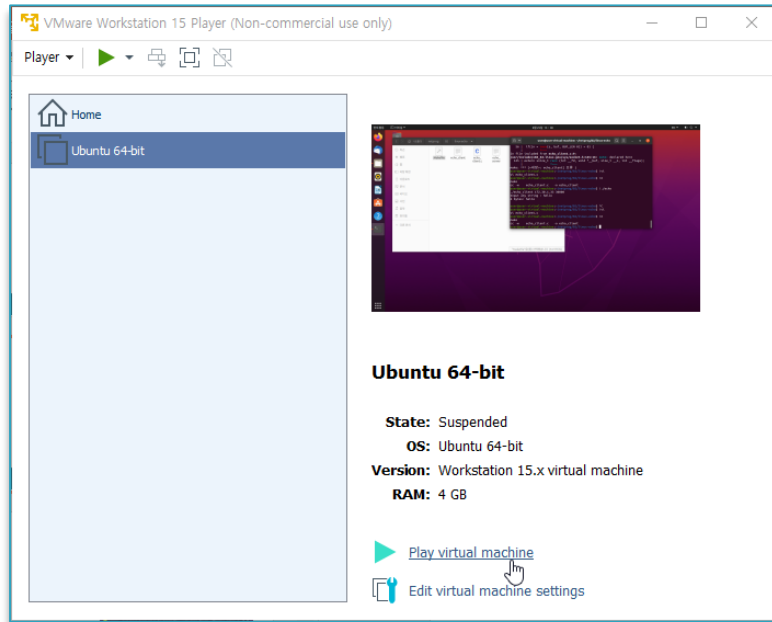


Vmware Linux 설정 변경 (IPTIME 공유기 환경)

▶ Network Adapter 를 Bridged 로 변경

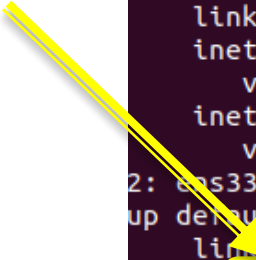


Vmware Linux 실행



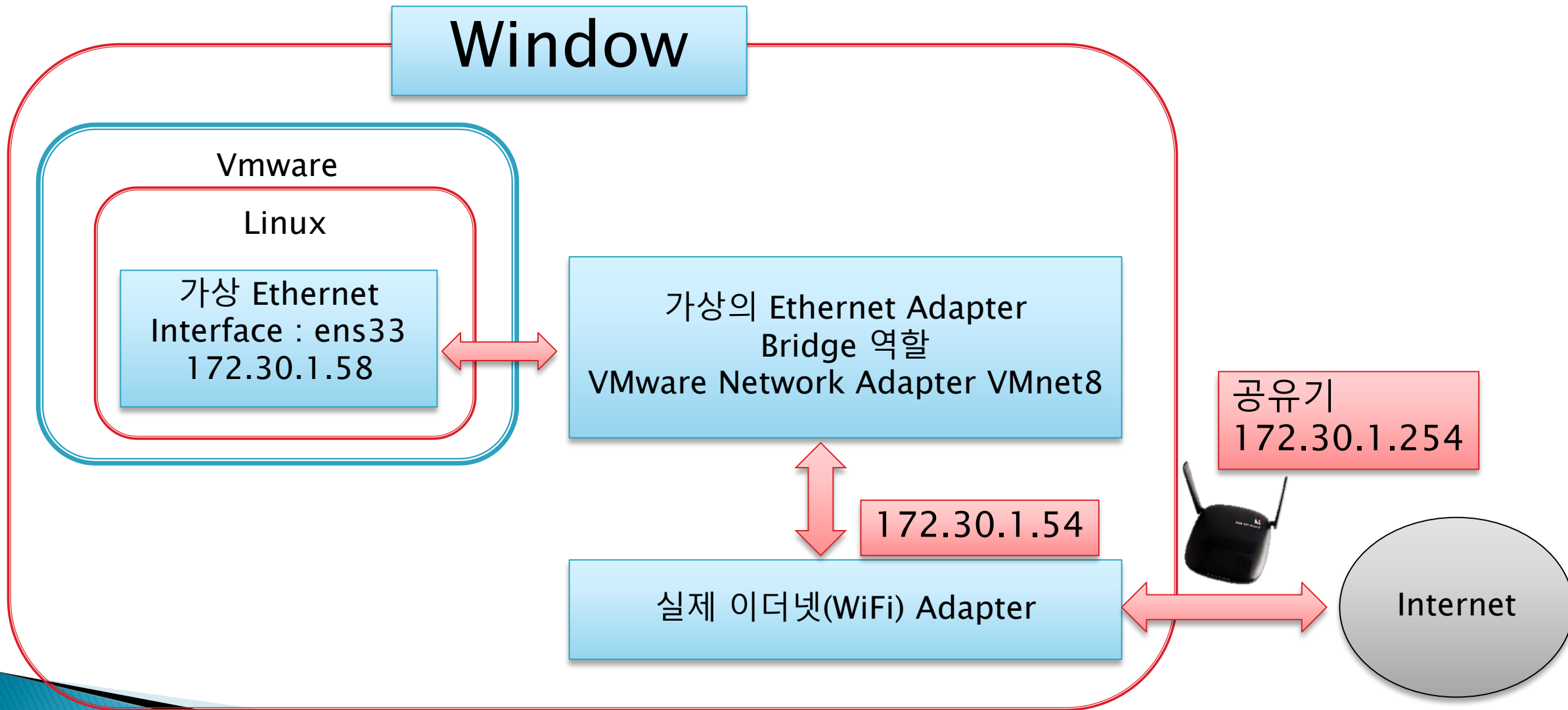
Network 환경 확인 (Bridge 모드)

- ▶ ip a 로 확인
 - 172.30.1.58



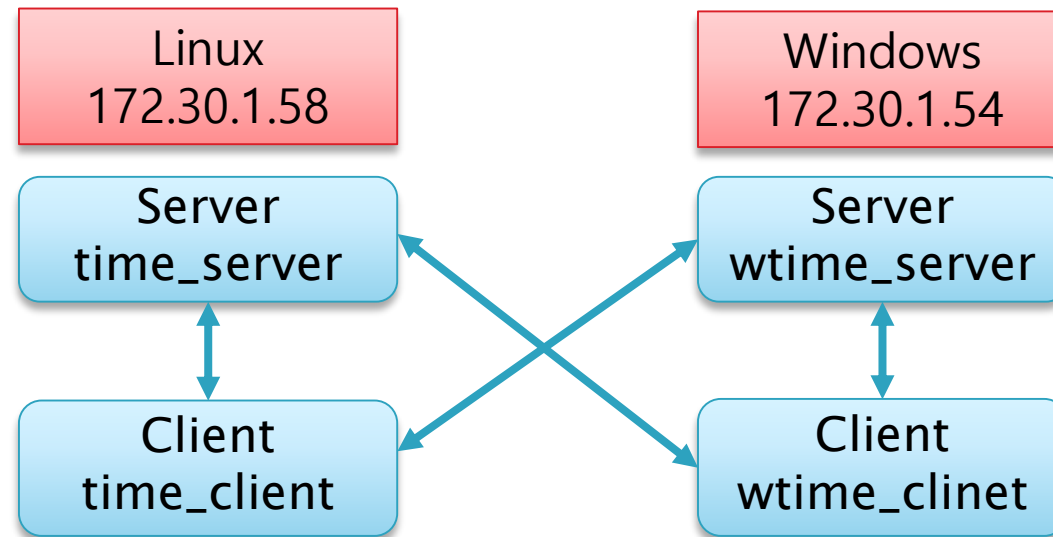
```
user@user-virtual-machine: ~/netprog/NetP03-linux
user@user-virtual-machine:~/netprog/NetP03-linux$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: ens33: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
    link/ether 00:0c:29:e2:34:9d brd ff:ff:ff:ff:ff:ff
    altname enp2s1
    inet 172.30.1.58/24 brd 172.30.1.255 scope global dynamic noprefixroute ens33
        valid_lft 3595sec preferred_lft 3595sec
    inet6 fe80::ff2f:865b:b797:1bd5/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
```

Linux / Windows Network 설정 결과 (Bridge 모드)



Bridge 모드 후 소켓프로그래밍 테스트

- (1) Linux Client / Linux Server
- (2) Windows Client / Windows Server
- (3) Windows Client / Linux Server
- (4) Linux Client / Windows Server



```
user@user-virtual-machine: ~/netprog/NetP03-linux
user@user-virtual-machine:~/netprog/NetP03-linux$ ./time_server
Server : waiting connection request.
Server : A client connected.
From 127.0.0.1 : 38512
Server time=Sat Sep 11 16:36:19 2021
Server : A client connected.
From 172.30.1.54 : 13501
Server time=Sat Sep 11 16:37:54 2021
[]

user@user-virtual-machine: ~/netprog/NetP03-linux
user@user-virtual-machine:~/netprog/NetP03-linux$ ./time_client 127.0.0.1 30000
Time information from server is Sat Sep 11 16:36:19 2021
user@user-virtual-machine:~/netprog/NetP03-linux$ ./time_client 172.30.1.54 30000
Time information from server is Sat Sep 11 16:38:26 2021
user@user-virtual-machine:~/netprog/NetP03-linux$
```

Linux Server

(1)

Linux Client

```
C:\Windows\system32\cmd...
Server : A client
From 127.0.0.1 : 9321
Server time=Sat Sep 11 16:37:00 2021
Server : A client connected.
From 172.30.1.58 : 59402
Server time=Sat Sep 11 16:38:26 2021

C:\Windows\system32\cmd.exe
Connecting 127.0.0.1 30000
Time information from server is Sat Sep 11 16:37:00 2021
계속하려면 아무 키나 누르십시오 . . .

C:\Windows\system32\cmd.exe
Connecting 172.30.1.58 30000
Time information from server is Sat Sep 11 16:37:54 2021
계속하려면 아무 키나 누르십시오 . . .
```

Windows Server

(2)

Windows Client

```
C:\Windows\system32\cmd.exe
Connecting 172.30.1.58 30000
Time information from server is Sat Sep 11 16:37:54 2021
계속하려면 아무 키나 누르십시오 . . .
```

구성 속성	
일반	
고급	
디버깅	
VC++ 디렉터리	
C/C++	
링커	
로컬 Windows 디버거	
명령	\$(TargetPath)
명령 인수	172.30.1.58 30000
작업 디렉터리	\$(ProjectDir)
연결	아니오

Windows Client

Linux 용 wireshark 설치

1. `sudo add-apt-repository ppa:pi-rho/security`
2. `sudo apt-get update`
3. `sudo apt-get install wireshark`
4. `sudo dpkg-reconfigure wireshark-common` (YES 선택)
5. `sudo usermod -a -G wireshark $USER`
6. `gnome-session-quit --logout --no-prompt`
7. 시스템 재시작 Vmware Linux Restart
8. `sudo setcap 'CAP_NET_RAW+eip CAP_NET_ADMIN+eip' /usr/bin/dumpcap`
9. 시스템 재시작 Vmware Linux Restart

Linux Wireshark 설치 (1)

linux mint(ubuntu)에 wireshark 설치 (ppa) | Mint / Linux

2014. 3. 31. 20:00

<https://blog.naver.com/undersky03/207279210> [복사](#)

[번역하기](#)

민트에 내장 되어 있는 소프트웨어 센터에도 wireshark가 있으나.. 버전이 낮은 이유로...
ppa를 찾았다.

wireshark 홈페이지에 있는 걸 설치하려면.. 의존성 문제로 매우 귀찮고.. (사실 잘 알아 보지도 않았다.)

```
sudo add-apt-repository ppa:pi-rho/security
```

```
sudo apt-get update
```

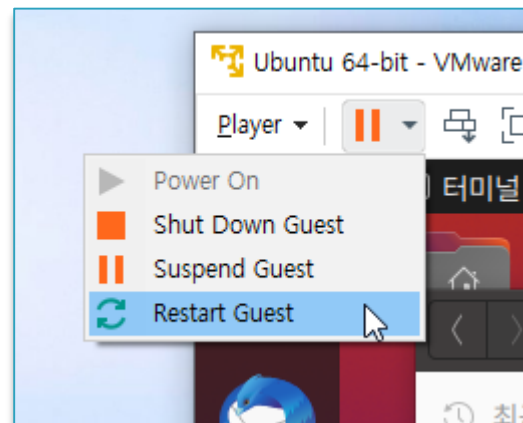
```
sudo apt-get install wireshark
```

적힌대로 실행하면 wireshark가 설치 된다.

추가적으로 linux에서는 wireshark를 그냥 실행 할 경우에 네트워크 인터페이스를 찾지 못해 캡처가 되지 않는다.
권한 문제로써.. 일반 user에서 실행이 가능 하도록 하려면 다음과 같이 입력한다.

```
$ sudo apt-get install wireshark
$ sudo dpkg-reconfigure wireshark-common
$ sudo usermod -a -G wireshark $USER
$ gnome-session-quit --logout --no-prompt ( 혹은 재로그인 )
```

gnome-sesseion-quit 실행시 모든 창 꺼진 후 재기동 되므로 조심하자.



설치 후 **Vmware Linux Restart**

Wireshark 설치 (2)

- ▶ (1) 까지 해도 안되는 경우 아래 내용을 추가하고 **Vmware Restart**

2010. 8. 20. 16:10

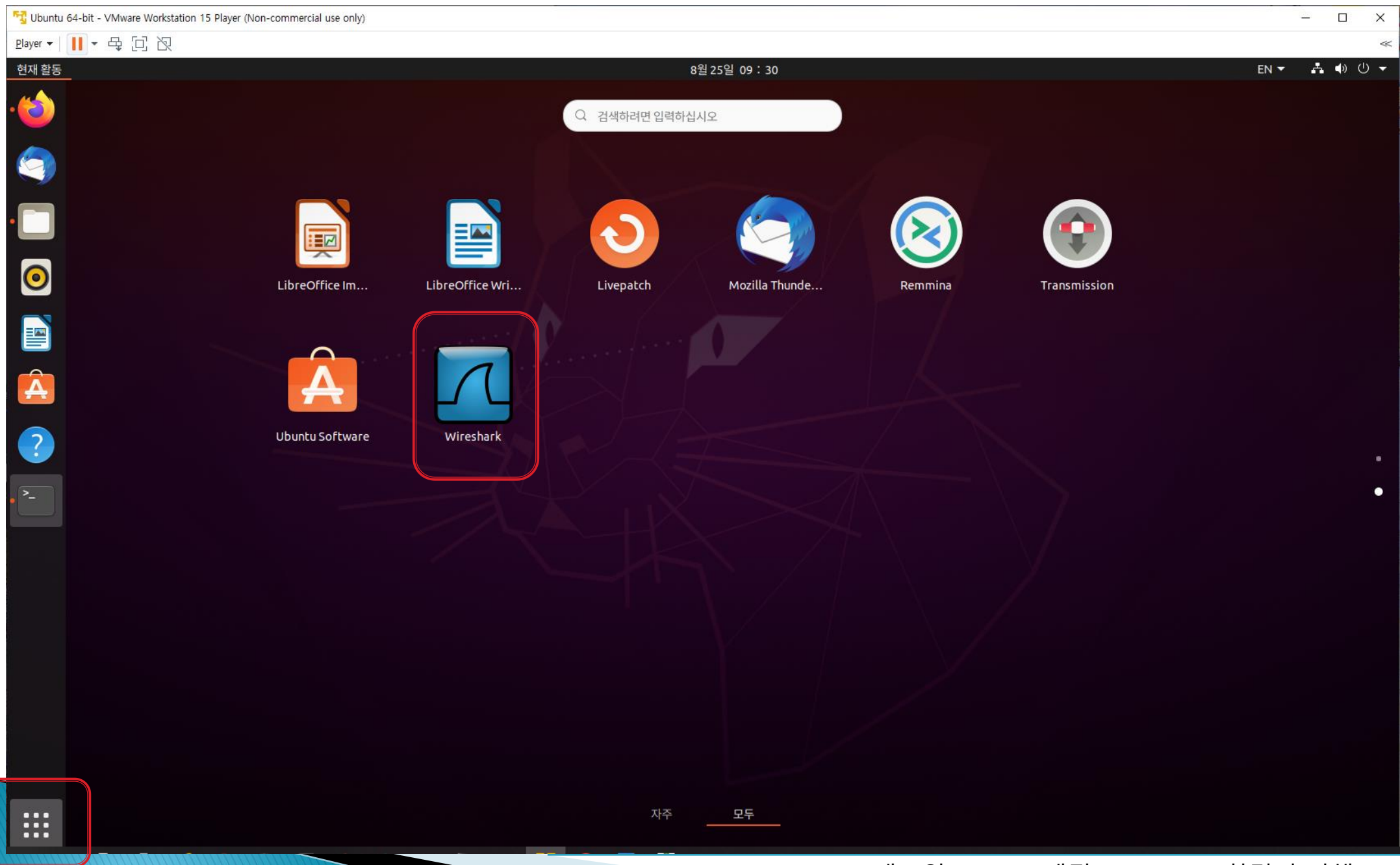
리눅스에서 Wireshark 실행시 인터페이스가 나타나지 않는 문제는, Wireshark 가 인터페이스에 직접 Access할 수 없기 때문이라고 합니다.
보안상의 문제로 Root로 작업하는 것을 권장하지 않는다고 하며,
dumpcap 에 대하여 네트워크 권한을 지정해주면 해결할 수 있다고 하네요.

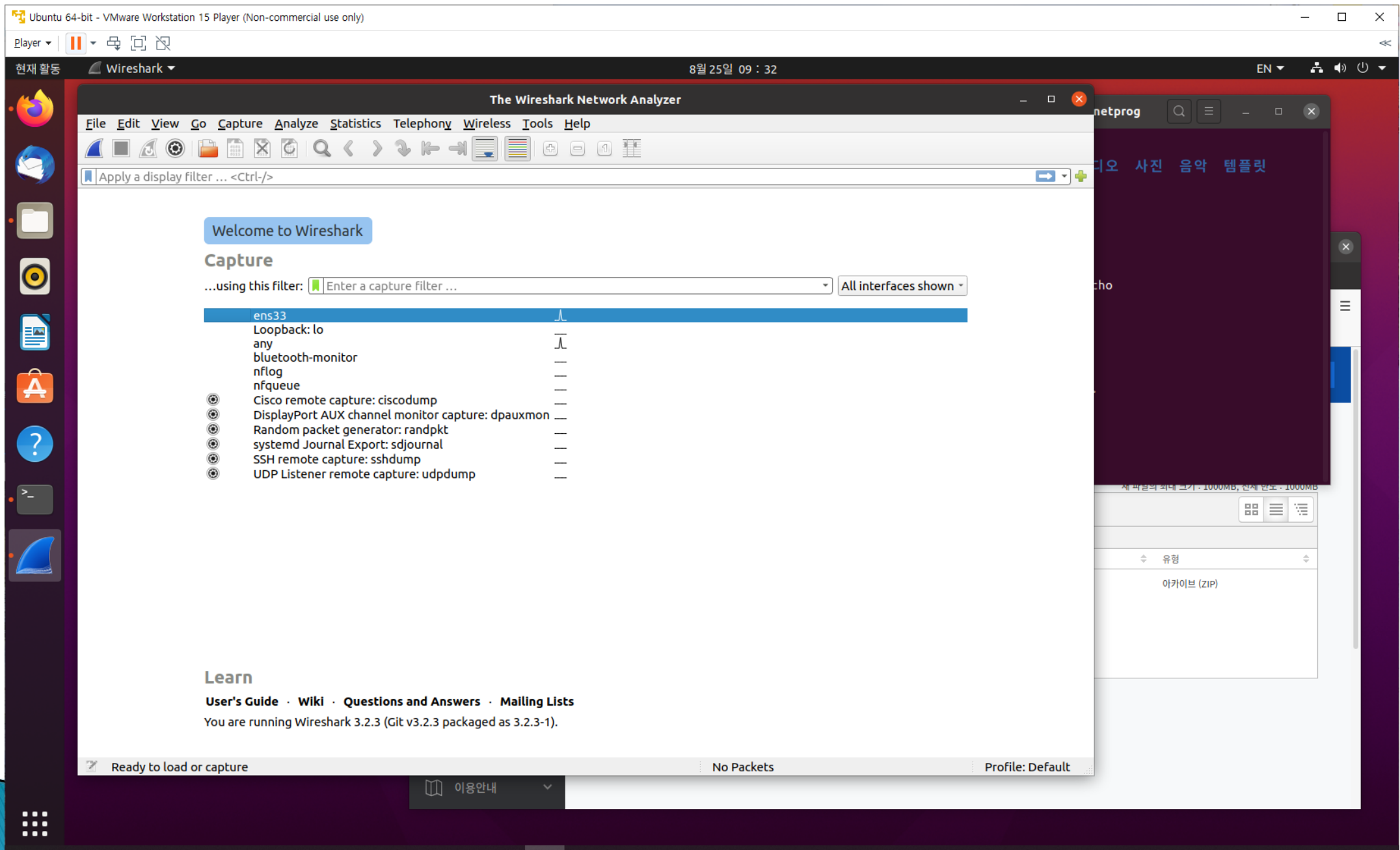
<http://wiki.wireshark.org/CaptureSetup/CapturePrivileges>

간단하게 리눅스에서

아래 명령만 실행시키면 된다고 합니다. ^^

```
user@ubuntu:~$ sudo setcap 'CAP_NET_RAW+eip CAP_NET_ADMIN+eip' /usr/bin/dumpcap
```





Ubuntu 64-bit-2021-NAT - VMware Workstation 15 Player (Non-commercial use only)

Player | Wireshark | 9월 11일 15 : 36

현재 활동

user

휴지통

*ens33

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/>

No.	Time	Source	Destination	Protocol	Length	Info
1169	50.785067177	192.168.254.128	52.219.146.20	TCP	54	56462 → 443 [RST] Seq=676 Win=0 Len=0
1170	51.298496724	52.219.146.20	192.168.254.128	TLSv1.2	85	Encrypted Alert
1171	51.298580713	192.168.254.128	52.219.146.20	TCP	54	56458 → 443 [ACK] Seq=1211 Ack=6214 Win=62786
1172	51.299049826	192.168.254.128	52.219.146.20	TLSv1.2	85	Encrypted Alert
1173	51.299422722	192.168.254.128	52.219.146.20	TCP	54	56458 → 443 [FIN, ACK] Seq=1242 Ack=6214 Win=
1174	51.299609201	52.219.146.20	192.168.254.128	TCP	60	443 → 56458 [ACK] Seq=6214 Ack=1242 Win=64246
1175	51.299960955	52.219.146.20	192.168.254.128	TCP	60	443 → 56458 [ACK] Seq=6214 Ack=1243 Win=64239
1176	51.307422856	52.219.146.20	192.168.254.128	TCP	60	443 → 56458 [FIN, PSH, ACK] Seq=6214 Ack=1243
1177	51.307462907	192.168.254.128	52.219.146.20	TCP	54	56458 → 443 [ACK] Seq=1243 Ack=6215 Win=62786

Frame 1: 107 bytes on wire (856 bits), 107 bytes captured (856 bits) on interface ens33, id 0

- Ethernet II, Src: VMware_51:f7:d1 (00:0c:29:51:f7:d1), Dst: IPv6mcast_fb (33:33:00:00:00:fb)
- Internet Protocol Version 6, Src: fe80::211e:e151:4c16:1caf, Dst: ff02::fb
- User Datagram Protocol, Src Port: 5353, Dst Port: 5353
- Multicast Domain Name System (query)

```
0000 33 33 00 00 00 fb 00 0c 29 51 f7 d1 86 dd 60 0f 33.....)Q....
0010 84 f6 00 35 11 ff fe 80 00 00 00 00 00 00 21 1e ...5.....!
0020 e1 51 4c 16 1c af ff 02 00 00 00 00 00 00 00 ..QL.....
0030 00 00 00 00 00 fb 14 e9 14 e9 00 35 69 fa 00 00 .....5i...
0040 00 00 00 02 00 00 00 00 00 00 05 5f 69 70 70 73 ....._ipps
0050 04 5f 74 63 70 05 6c 6f 63 61 6c 00 00 0c 00 01 ._tcp.lo cal...
0060 04 5f 69 70 70 c0 12 00 0c 00 01 ._ipp... ..
```

wireshark_ens33_20210911153515_SSX8G2.pcapng

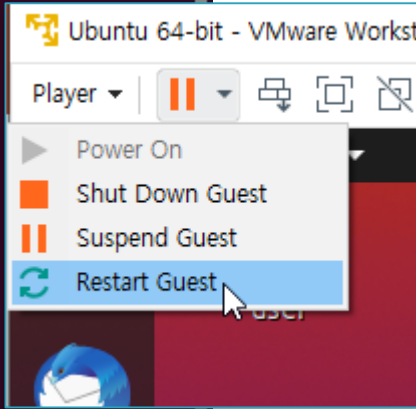
Packets: 1177 · Displayed: 1177 (100.0%) Profile: Default

Linux 방화벽 설정 / Restart

```
user@user-virtual-machine: ~/바탕화면
user@user-virtual-machine:~/바탕화면$ sudo ufw status verbose
[sudo] user의 암호:
상태: 비활성
user@user-virtual-machine:~/바탕화면$ sudo ufw allow 30000
규칙이 업데이트됐습니다
규칙이 업데이트됐습니다(v6)
user@user-virtual-machine:~/바탕화면$
user@user-virtual-machine:~/바탕화면$
user@user-virtual-machine:~/바탕화면$ sudo ufw status verbose
상태: 비활성
user@user-virtual-machine:~/바탕화면$ sudo ufw enable
방화벽이 활성 상태이며 시스템이 시작할 때 사용됩니다
user@user-virtual-machine:~/바탕화면$ sudo ufw status verbose
상태: 활성
로깅: on (low)
기본 설정: deny (내부로 들어옴), allow (외부로 나감), disabled (라우팅 된)
새 프로필: skip

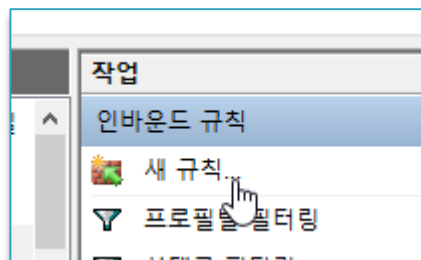
목적                동작                출발
--                --                --
30000                ALLOW IN            Anywhere
30000 (v6)           ALLOW IN            Anywhere (v6)

user@user-virtual-machine:~/바탕화면$
```



Windows 방화벽 설정 추가

- ▶ 인바운드 규칙
- ▶ TCP 30000 을 허용으로 변경



☐ 프로그램(P)
프로그램의 연결을 제어하는 규칙

☒ 포트(O)
TCP 또는 UDP 포트의 연결을 제어하는 규칙

☐ 미리 정의됨(E):
@FirewallAPI.dll, -80200
Windows 환경의 연결을 제어하는 규칙

☐ 사용자 지정(C)
사용자 지정 규칙

이 규칙은 TCP에 적용됩니다, UDP에 적용됩니다?

☒ TCP(T)
☐ UDP(U)

이 규칙은 모든 로컬 포트에 적용됩니다, 특정 로컬 포트에만 적용됩니다?

☐ 모든 로컬 포트(A)
☒ 특정 로컬 포트(S): 30000
예: 80, 443, 5000-5010

지정된 조건과 연결이 일치할 경우 어떤 작업을 수행해야 합니까?

☒ 연결 허용(A)
IPsec으로 보호되는 연결과 보호되지 않은 연결이 포함됩니다.

☐ 보안 연결만 허용(C)
IPsec을 사용하여 인증된 연결만 포함됩니다. 연결 보안 규칙 노드의 IPsec 속성 및 규칙 설정을 사용하여 연결이 보호됩니다.

☐ 사용자 지정(Z)...

☐ 연결 차단(K)

☒ 도메인(D)
컴퓨터가 회사 도메인에 연결된 경우 적용됩니다.

☒ 개인(P)
컴퓨터가 개인 네트워크 위치(가정 또는 직장)에 연결된 경우 적용됩니다.

☒ 공용(U)
컴퓨터가 공용 네트워크 위치에 연결된 경우 적용됩니다.

이름(N):
30000C

설명(옵션)(D):