

네트워크프로그래밍-4주 화상강의 자료

정인환교수

네트워크프로그래밍 4주 화상강의

▶ 시간표

- 9/22(수)
 - A, 7, N반 휴일 휴강
- 9/23(목)
 - B반 : 11:00
 - 8반 : 16:00
 - O반 : 18:00

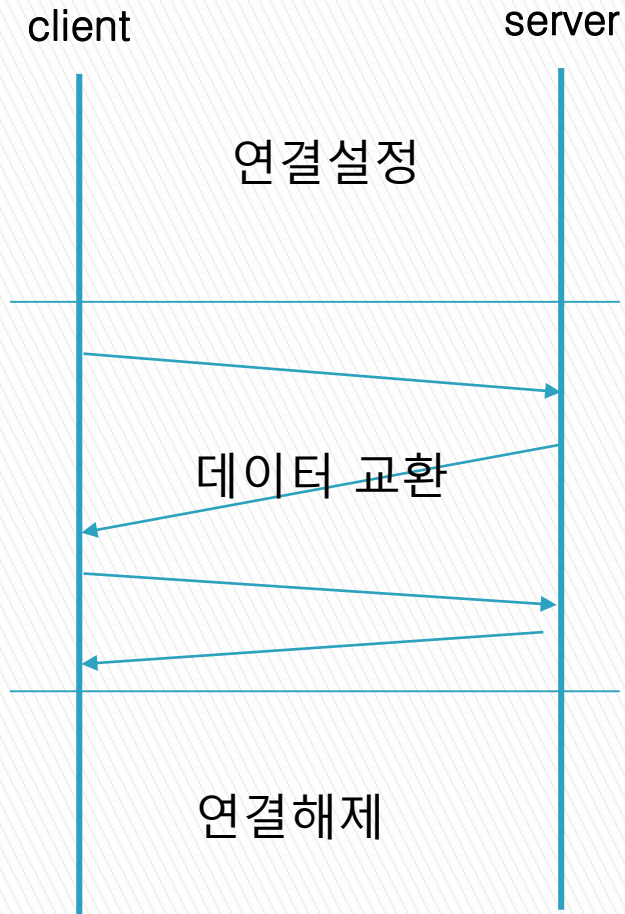
A, 7, N반은 B, 8, O반 시간에 출석
채팅창에
분반, 학번, 이름 입력

4주 화상강의 내용

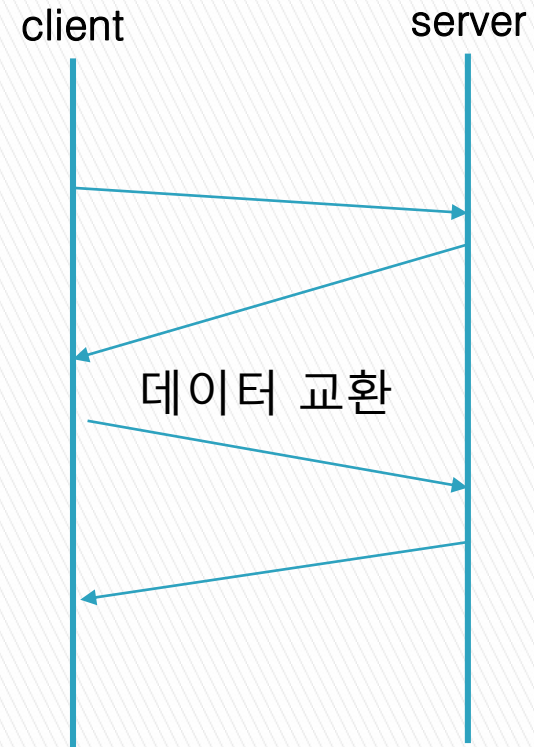
- ▶ Time Client/Server 통신 절차 복습
- ▶ Vmware + Ubuntu(Centos) or Virtual Box, MacOS 환경 확인
 - ip a, netstat -nr, ifconfig
 - Network 방식
 - Bridged Mode, NAT Mode, Host Only ??
- ▶ Q&A 사례
- ▶ time client/server 실습 복습
 - Windows Client <> Linux Server 문제 ??
 - Wireshark 이용 Windows / Linux 통신 capturing
 - TCP/UDP
 - 원격접속 Test
 - Port Forwarding 30000-40000
- ▶ 4주 강의 요약
 - time client/server 설명
 - echo client/server
 - 4주 과제
 - echo client/server 응용

Client / Server 통신 절차

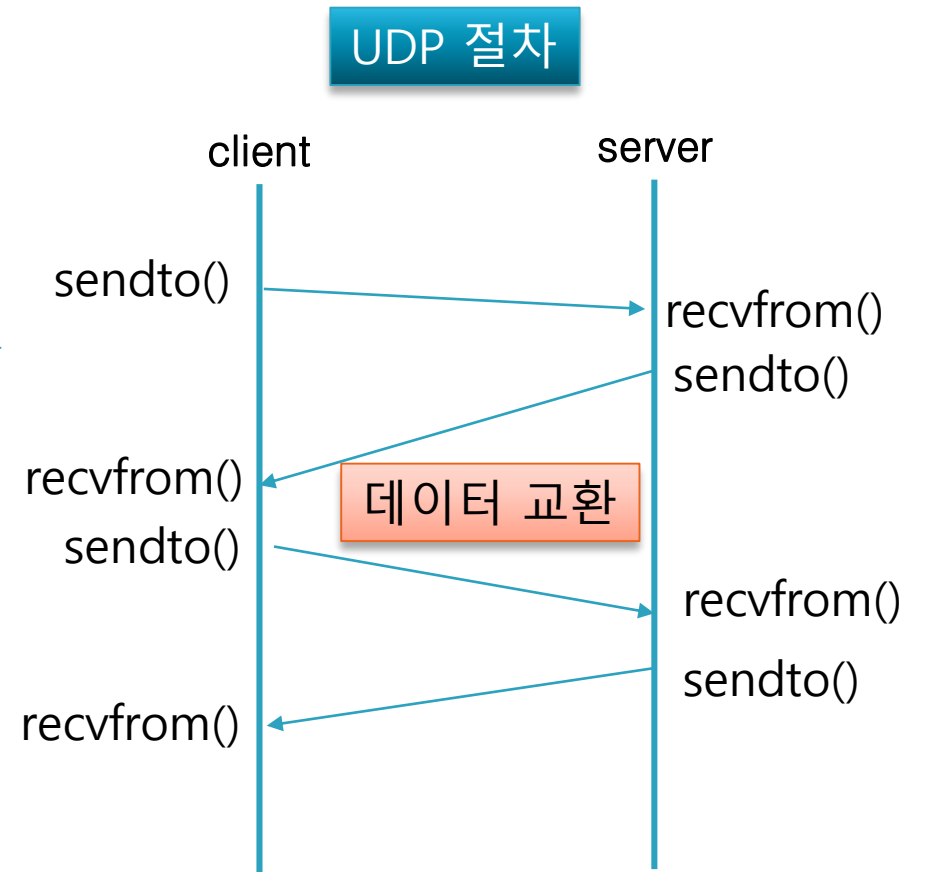
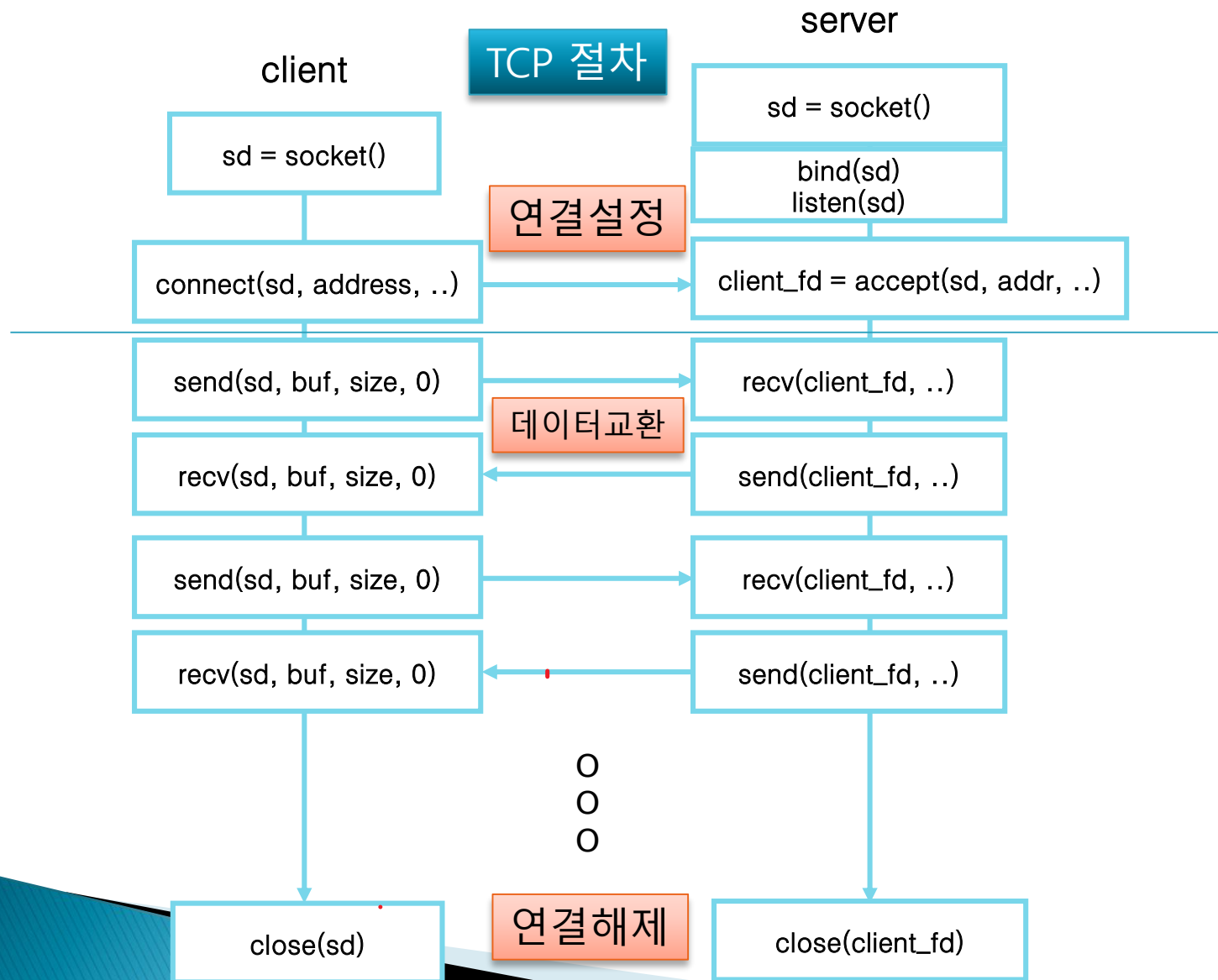
▶ TCP 통신 : 연결형



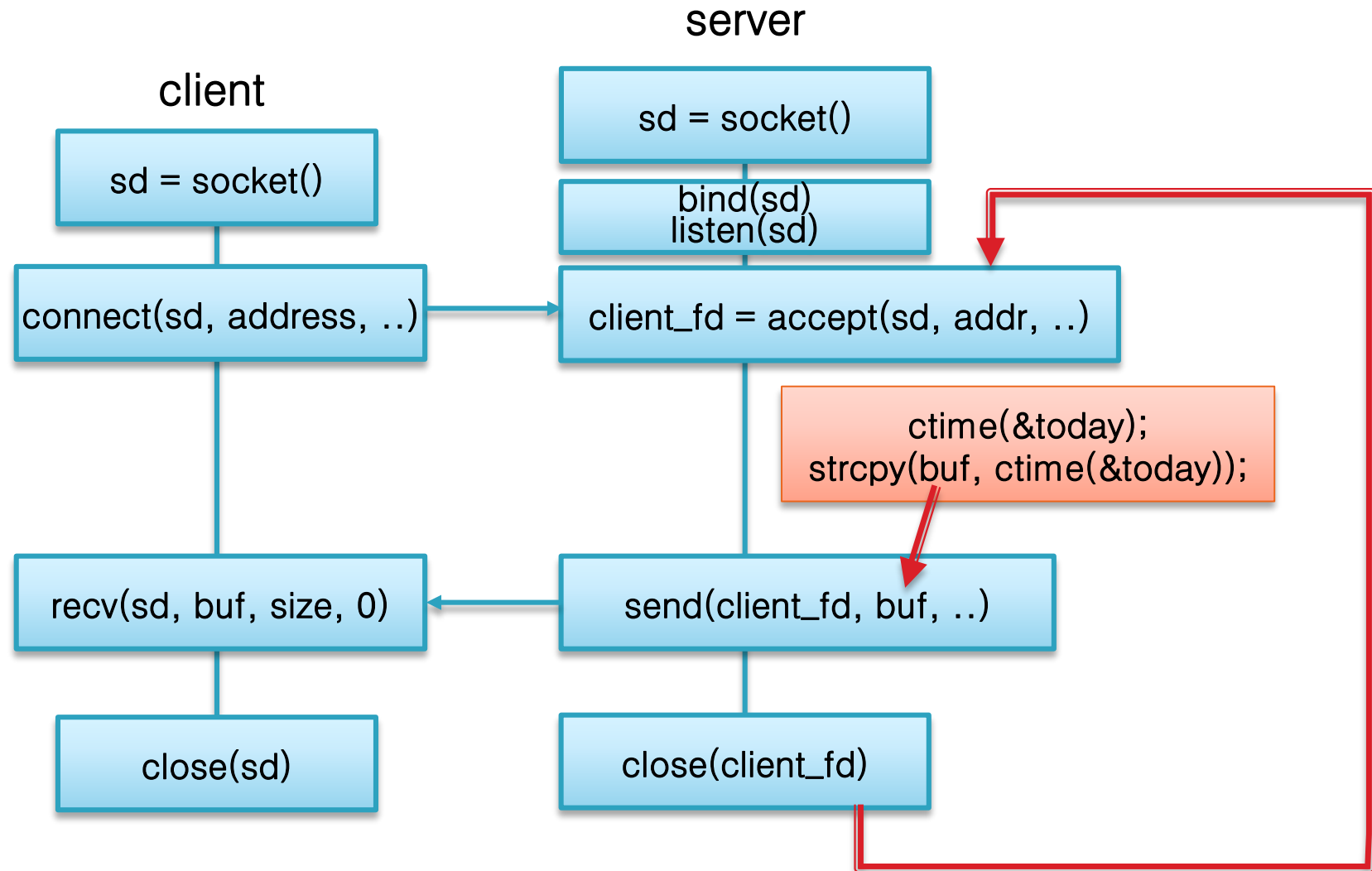
▶ UDP 통신 : 비 연결형



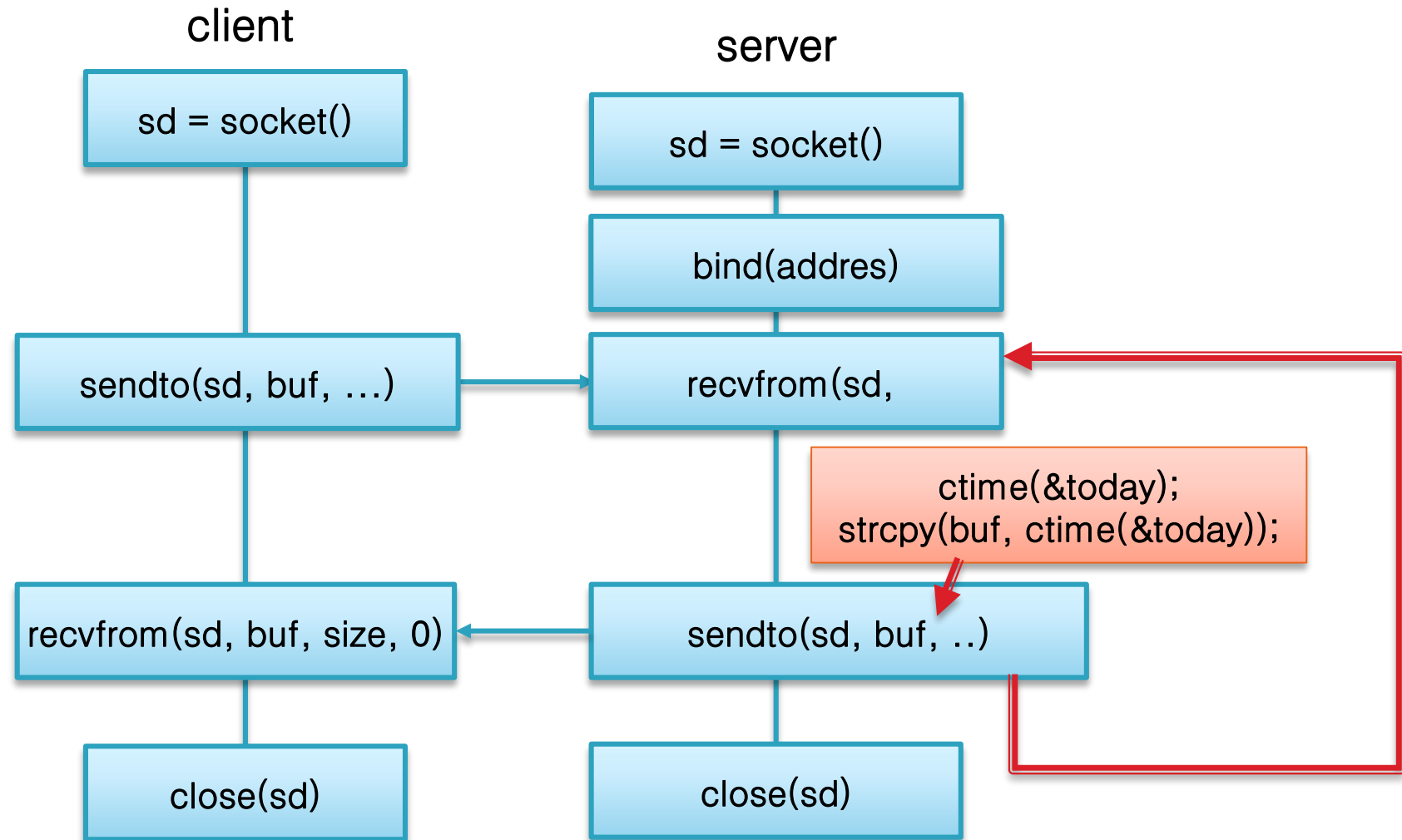
Socket API 흐름 : TCP / UDP



소켓프로그래밍 예1-1 - TCP time client/server



소켓프로그램 예1-2 - UDP time client/server



Vmware + Linux 환경

▶ ip a

```
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
```

▶ netstat -nr

- netstat 없으면 설치
- sudo apt install net-tools

```
user@user-virtual-machine: ~/바탕화면
user@user-virtual-machine:~/바탕화면$ netstat -nr
Kernel IP routing table
Destination      Gateway         Genmask         Flags         MSS Window  irtt  Iface
0.0.0.0          192.168.126.2  0.0.0.0         UG            0 0        0     ens33
169.254.0.0      0.0.0.0        255.255.0.0     U             0 0        0     ens33
192.168.126.0    0.0.0.0        255.255.255.0   U             0 0        0     ens33
user@user-virtual-machine:~/바탕화면$
```


Linux 설치 후 IP 확인 화면 (예)

- ▶ ifconfig
 - sudo apt install net-tools

```
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 90290 bytes 129757753 (129.7 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 38048 bytes 3038366 (3.0 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

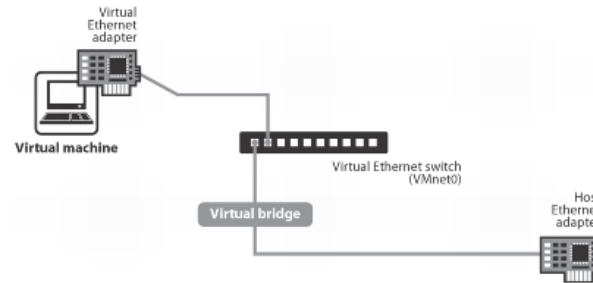
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 1018 bytes 106482 (106.4 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 1018 bytes 106482 (106.4 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

user@user-virtual-machine:~/netprog/03$
```

Vmware Network 방식

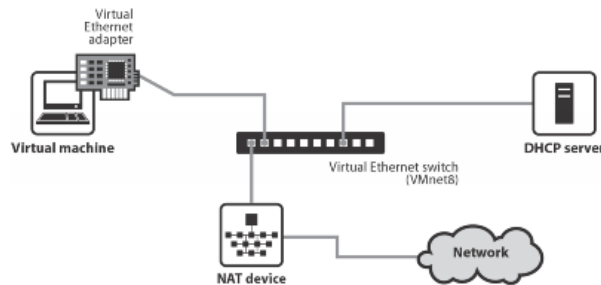
- ▶ https://www.vmware.com/support/ws55/doc/ws_net_configurations_common.html
- ▶ Bridged
- ▶ NAT
- ▶ Host Only

Bridged Networking



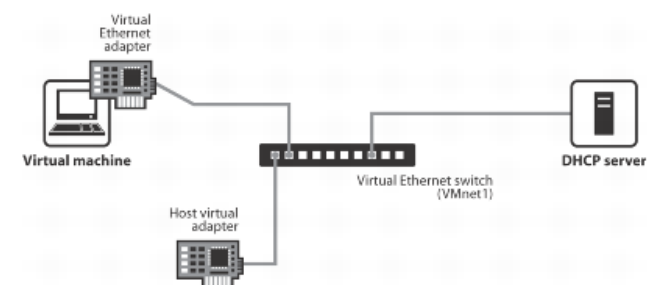
Bridged networking connects a virtual machine to a network using the host computer's Ethernet adapter.

Network Address Translation (NAT)



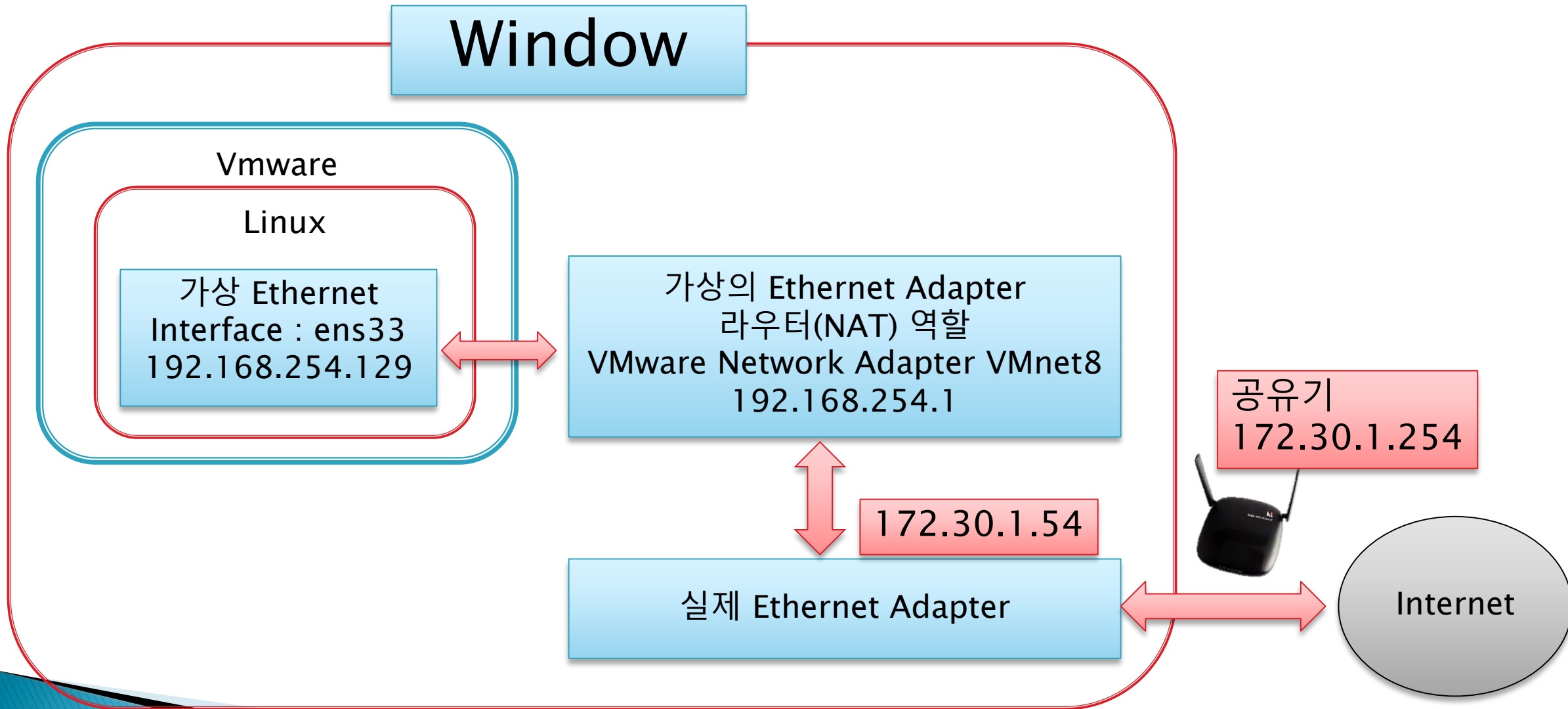
NAT gives a virtual machine access to network resources using the host computer's IP address.

Host-Only Networking



Host-only networking creates a network that is completely contained within the host computer.

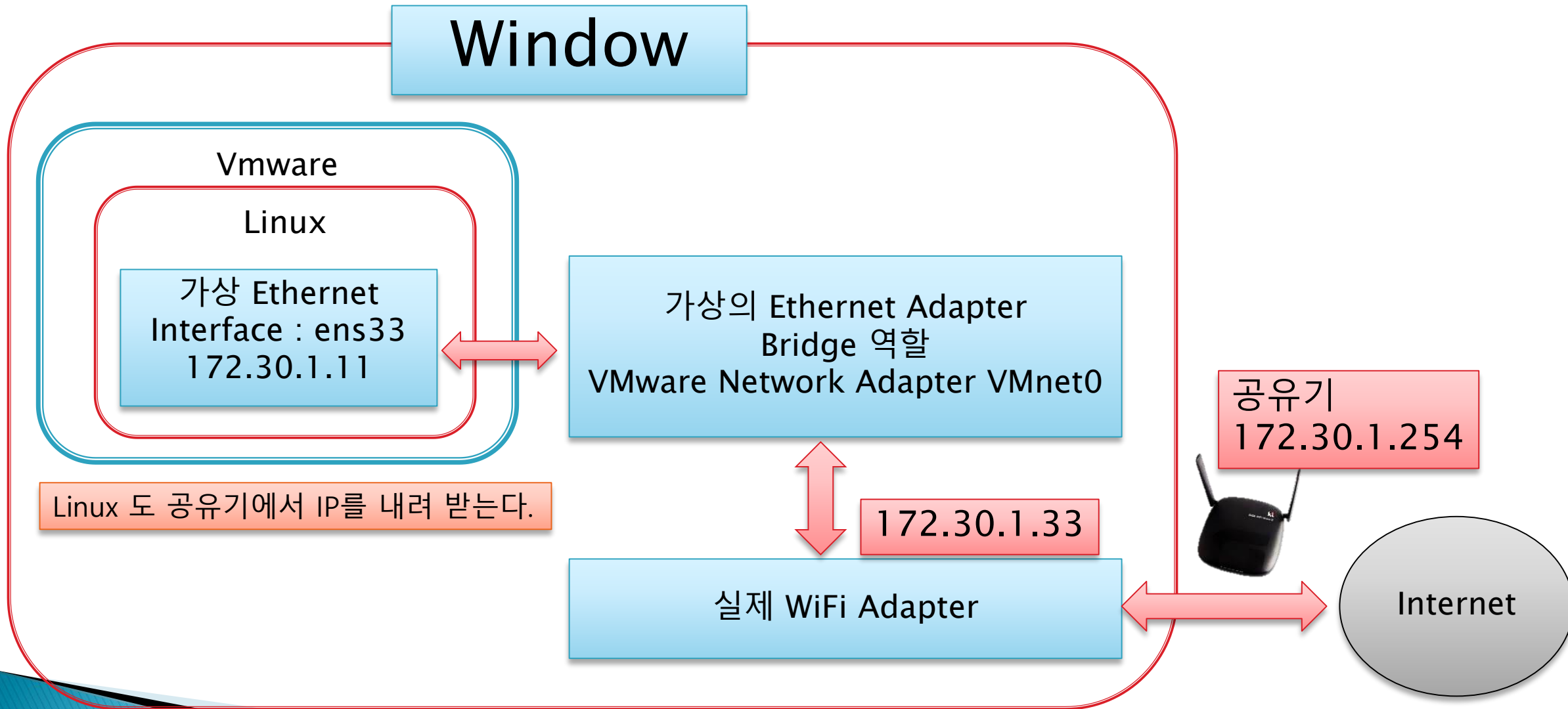
NAT 방식 - VMnet8 이 공유기 역할



NAT Mode

```
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
    aliasname enp2s1
    inet 192.168.254.129/24 brd 192.168.254.255 scope global dynamic noprefixroute
        valid_lft 1552sec preferred_lft 1552sec
    inet6 fe80::65ec:c71b:964f:603c/64 scope link noprefixroute
        valid_lft forever preferred_lft forever
```

Bridged방식 - VMnet0을 통해 외부로 직접 연결

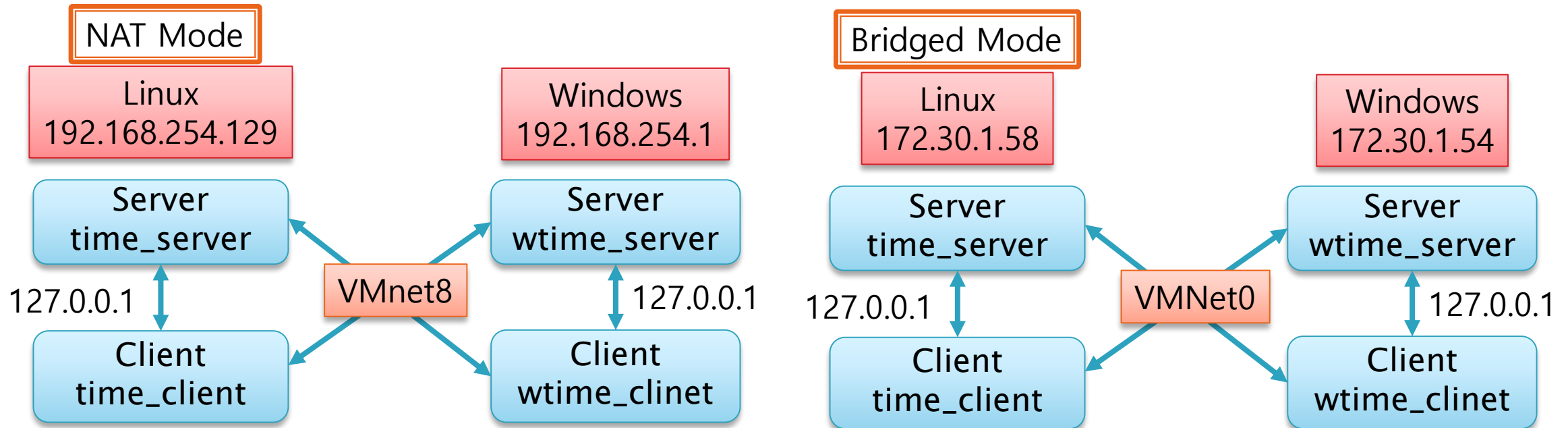


Bridged Mode

```
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
    aliasname 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
```

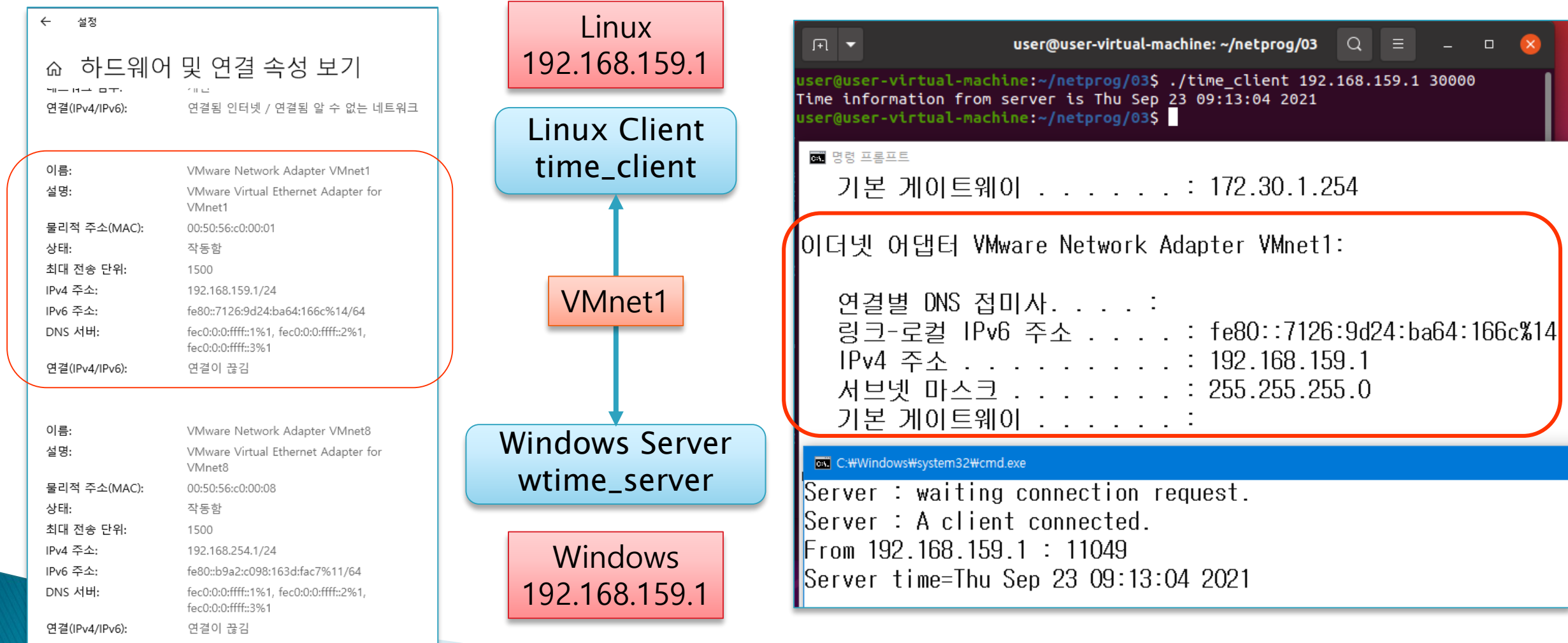
TCP/UDP time client/server 실행 환경

- ▶ Linux Client / Linux Server
- ▶ Windows Client / Windows Server
- ▶ Windows Client / Linux Server
- ▶ Linux Client / Windows Server



VMnet1 사용시

- ▶ Linux Client > Windows Server 안되는 경우 시도해 볼 것



Q&A 정리

- ▶ Server 가 실행이 되지 않은 상태로 Test
 - Server 실행중인지 확인 필요
- ▶ Linux AWS EC2 사용 (9/16 A반)
 - Windows > EC2 OK
 - EC2 > Windows X ➔ 집 공유기 Port forwarding 필요
- ▶ Vmware 대신 Virtual Box, MacOS사용
 - MacOS 환경 확인 (B반, 8반)
- ▶ Visual Studio 2017 ➔ Header file 오류 ➔ 2019 사용할 것
- ▶ Linux (192.168.247.128) ➔ Windows (172.18.58.193) 경우
 - Windows Server에 Linux Client IP 가 172.18.58.193 으로 보임
 - 원래는 192.168.247.1 로 접근해야 하는데 172.18.58.193 연결하면
 - Server 쪽으로 들어오는 Packet의 출발지가 자기자신으로 보이게 됨
- ▶ Linux > VMnet1 (193.168.159.1) > Windows 통신 가능

Q&A 사례 (2020)

- ▶ NAT/Bridged Mode 설정
 - 공유기를 사용하지 않는 경우
 - Bridged Mode 설정했지만, Vmware가 NAT로 동작중임게 됨
 - NAT Mode 설정 (안되는 경우 Vmware 재설치)
 - Oracle Virtual Box
 - NAT Mode 사용시 Linux 주소가 10.0.2.XXX 로 설정, Windows > Linux 통신 X
 - Port Forwarding 설정이 필요
 - Bridged Mode 사용 권장 (공유기 사용환경의 경우)
 - NAT Mode 설정후 VMnet8 이 169.254.XXX.XXX 인 경우
 - Vmware 재설치 192.168.XXX.1로 보이면 OK
- ▶ 방화벽
 - Centos Linux 는 기본 방화벽 On >> Off 로
- ▶ Visual Studio
 - 시작프로젝트를 설정하고 실행해야 됨
 - CTRL-F5 로 시작해야 화면이 멈추고 결과를 볼 수 있음
- ▶ Server 가 실행이 되지 않은 상태로 Test
 - Server 실행중인지 확인 필요

Server 실행중인지 확인하는 방법 netstat

```
user@user-virtual-machine: ~/다운로드/NetP03-linux
user@user-virtual-machine:~/다운로드/NetP03-linux$ ./time_server
Server : waiting connection request.

user@user-virtual-machine:~/다운로드/NetP03-linux
user@user-virtual-machine:~/다운로드/NetP03-linux$ ./udp_time_server
Waiting

user@user-virtual-machine:~/다운로드/NetP03-linux
user@user-virtual-machine:~/다운로드/NetP03-linux$ netstat -na | grep 30000
tcp        0      0 0.0.0.0:30000          0.0.0.0:*              LISTEN
udp        0      0 0.0.0.0:30000          0.0.0.0:*
```

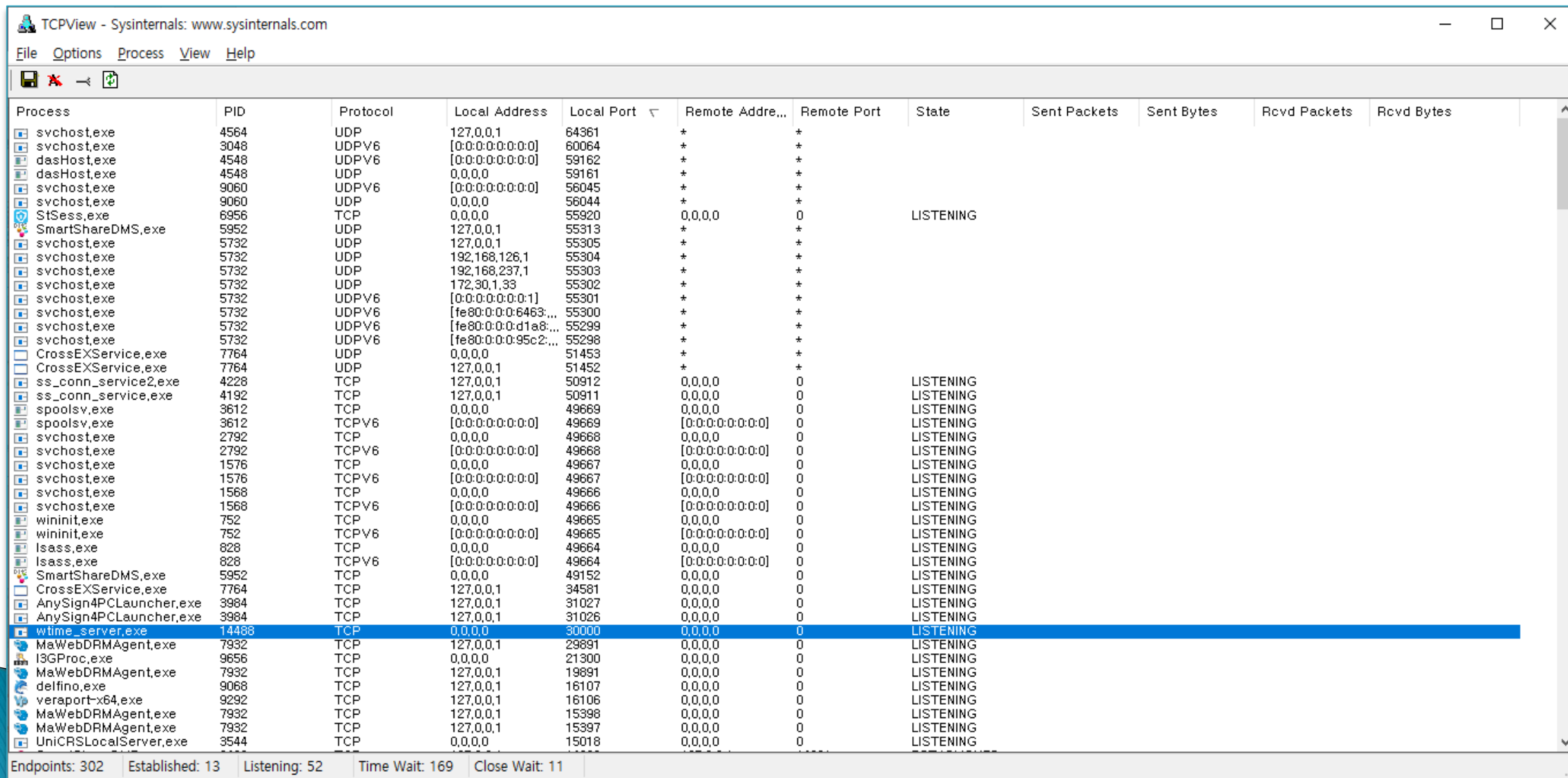
```
C:\Windows\system32\cmd.exe
Server : waiting connection request.
```

```
C:\Windows\system32\cmd.exe
Waiting
```

```
명령 프롬프트
C:\Users\Daddy>netstat -na | find "30000"
TCP    0.0.0.0:30000          0.0.0.0:0              LISTENING
UDP    0.0.0.0:30000          *:*
```

참고 프로그램 Tcpview.exe

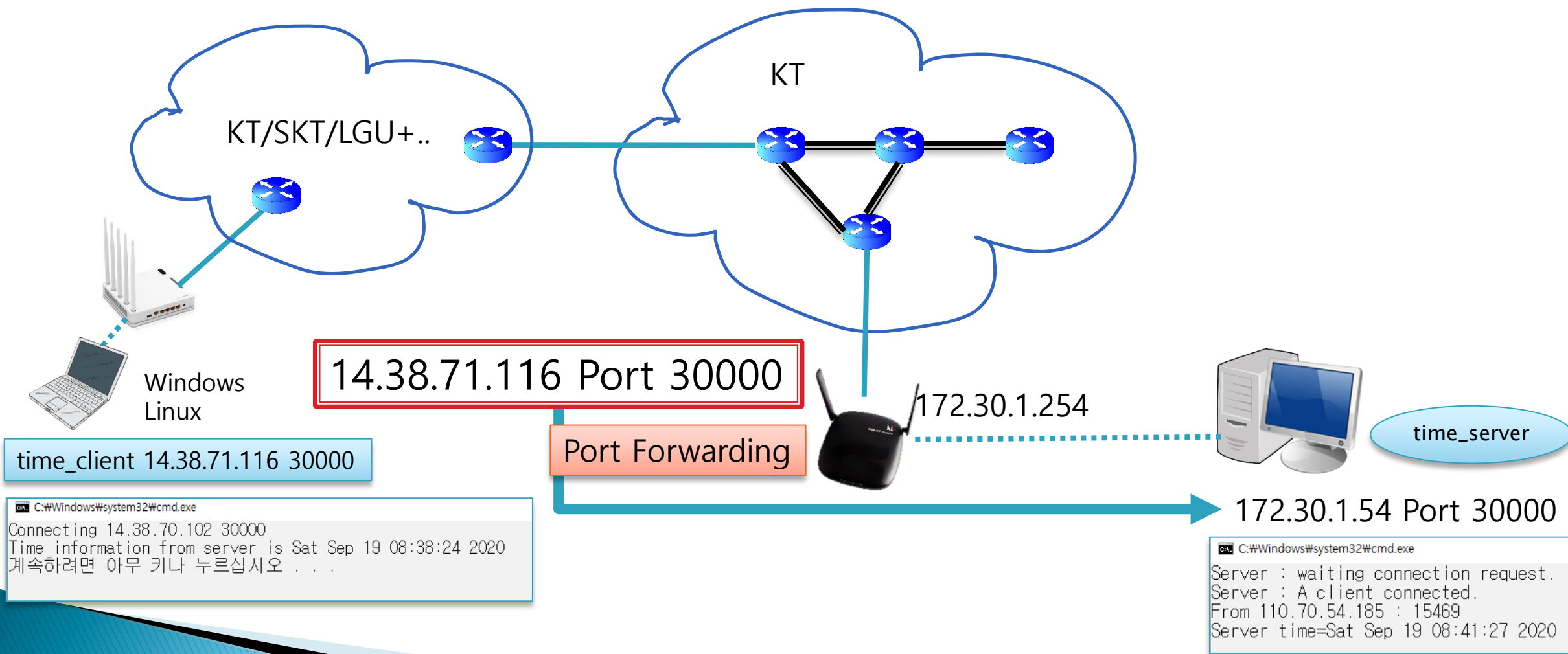
▶ <https://docs.microsoft.com/ko-kr/sysinternals/downloads/tcpview>



Process	PID	Protocol	Local Address	Local Port	Remote Address	Remote Port	State	Sent Packets	Sent Bytes	Rcvd Packets	Rcvd Bytes
svchost.exe	4564	UDP	127.0.0.1	64361	*	*					
svchost.exe	3048	UDPv6	[0:0:0:0:0:0:0:0]	60064	*	*					
dasHost.exe	4548	UDPv6	[0:0:0:0:0:0:0:0]	59162	*	*					
svchost.exe	9060	UDP	0.0.0.0	59161	*	*					
svchost.exe	9060	UDPv6	[0:0:0:0:0:0:0:0]	56045	*	*					
svchost.exe	9060	UDP	0.0.0.0	56044	*	*					
StSess.exe	6956	TCP	0.0.0.0	55920	0.0.0.0	0	LISTENING				
SmartShareDMS.exe	5952	UDP	127.0.0.1	55313	*	*					
svchost.exe	5732	UDP	127.0.0.1	55305	*	*					
svchost.exe	5732	UDP	192.168.126.1	55304	*	*					
svchost.exe	5732	UDP	192.168.237.1	55303	*	*					
svchost.exe	5732	UDP	172.30.1.33	55302	*	*					
svchost.exe	5732	UDPv6	[0:0:0:0:0:0:0:1]	55301	*	*					
svchost.exe	5732	UDPv6	[fe80:0:0:6463::...]	55300	*	*					
svchost.exe	5732	UDPv6	[fe80:0:0:d1a8::...]	55299	*	*					
svchost.exe	5732	UDPv6	[fe80:0:0:95c2::...]	55298	*	*					
CrossEXService.exe	7764	UDP	0.0.0.0	51453	*	*					
CrossEXService.exe	7764	UDP	127.0.0.1	51452	*	*					
ss_conn_service2.exe	4228	TCP	127.0.0.1	50912	0.0.0.0	0	LISTENING				
ss_conn_service.exe	4192	TCP	127.0.0.1	50911	0.0.0.0	0	LISTENING				
spoolsv.exe	3612	TCP	0.0.0.0	49669	0.0.0.0	0	LISTENING				
spoolsv.exe	3612	TCPv6	[0:0:0:0:0:0:0:0]	49669	[0:0:0:0:0:0:0:0]	0	LISTENING				
svchost.exe	2792	TCP	0.0.0.0	49668	0.0.0.0	0	LISTENING				
svchost.exe	2792	TCPv6	[0:0:0:0:0:0:0:0]	49668	[0:0:0:0:0:0:0:0]	0	LISTENING				
svchost.exe	1576	TCP	0.0.0.0	49667	0.0.0.0	0	LISTENING				
svchost.exe	1576	TCPv6	[0:0:0:0:0:0:0:0]	49667	[0:0:0:0:0:0:0:0]	0	LISTENING				
svchost.exe	1568	TCP	0.0.0.0	49666	0.0.0.0	0	LISTENING				
svchost.exe	1568	TCPv6	[0:0:0:0:0:0:0:0]	49666	[0:0:0:0:0:0:0:0]	0	LISTENING				
wininit.exe	752	TCP	0.0.0.0	49665	0.0.0.0	0	LISTENING				
wininit.exe	752	TCPv6	[0:0:0:0:0:0:0:0]	49665	[0:0:0:0:0:0:0:0]	0	LISTENING				
lsass.exe	828	TCP	0.0.0.0	49664	0.0.0.0	0	LISTENING				
lsass.exe	828	TCPv6	[0:0:0:0:0:0:0:0]	49664	[0:0:0:0:0:0:0:0]	0	LISTENING				
SmartShareDMS.exe	5952	TCP	0.0.0.0	49152	0.0.0.0	0	LISTENING				
CrossEXService.exe	7764	TCP	127.0.0.1	34581	0.0.0.0	0	LISTENING				
AnySign4PCLauncher.exe	3984	TCP	127.0.0.1	31027	0.0.0.0	0	LISTENING				
AnySign4PCLauncher.exe	3984	TCP	127.0.0.1	31026	0.0.0.0	0	LISTENING				
wtime_server.exe	14488	TCP	0.0.0.0	30000	0.0.0.0	0	LISTENING				
MaWebDRMAgent.exe	7932	TCP	127.0.0.1	29891	0.0.0.0	0	LISTENING				
I3GProc.exe	9656	TCP	0.0.0.0	21300	0.0.0.0	0	LISTENING				
MaWebDRMAgent.exe	7932	TCP	127.0.0.1	19891	0.0.0.0	0	LISTENING				
delfino.exe	9068	TCP	127.0.0.1	16107	0.0.0.0	0	LISTENING				
veraport-x64.exe	9292	TCP	127.0.0.1	16106	0.0.0.0	0	LISTENING				
MaWebDRMAgent.exe	7932	TCP	127.0.0.1	15398	0.0.0.0	0	LISTENING				
MaWebDRMAgent.exe	7932	TCP	127.0.0.1	15397	0.0.0.0	0	LISTENING				
UniCRSLocalServer.exe	3544	TCP	0.0.0.0	15018	0.0.0.0	0	LISTENING				

Endpoints: 302 Established: 13 Listening: 52 Time Wait: 169 Close Wait: 11

원격 PC time_client <WiFi> <ISP> time_server





상태정보

 간편개통설정
(2.4GHz) 간편개통설정
(5GHz) **장치설정**

- 네트워크 관리
- 무선 관리(2.4GHz)
- 무선 관리(5GHz)
- 스위치 관리
- **트래픽 관리**
- 보안 기능
- 부가 기능
- 시스템 관리

트래픽 관리• **포트 포워딩 설정**

• 포트 통계 정보

- DMZ 설정
- ALG 설정

포트 포워딩 설정

소스 IP 주소	<input type="text"/>
소스 포트	<input type="text"/> ~ <input type="text"/>
외부 포트	<input type="text"/> ~ <input type="text"/>
내부 IP 주소	<input type="text"/>
내부 포트	<input type="text"/> ~ <input type="text"/>
프로토콜	TCP ▼
설명	<input type="text"/> 32자 이하로 입력하세요.

추가

선택	소스IP 주소	소스포트	외부포트	내부 IP 주소	내부 포트	프로토콜	설명	플래그
<input type="checkbox"/>		-	80-80	172.30.1.54	80-80	TCP	http	
<input type="checkbox"/>		-	30000-40000	172.30.1.54	30000-40000	TCP	test	

삭제

4주 강의 요약

- ▶ time client/server 상세 설명
- ▶ echo client/server 기본 + 응용
- ▶ 과제
 - echo client/server 복습 및 응용
 - login 기능 추가하기