

Mininet

Installation & How to use

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What is Mininet?

- "Mininet is a network emulator which creates a network of virtual hosts, switches, controllers, and links. Mininet hosts run standard Linux network software, and its switches support OpenFlow for highly flexible custom routing and Software-Defined Networking." – Mininet overview
- You can create various network situation by manipulating link rate, link delay, queue length, loss rate, topology etc.

Installation and Setting

1. Install Virtual Machine

- We recommend to use VirtualBox.
- Download package
(<https://www.virtualbox.org/wiki/Downloads>)
- Select according to you OS
- Install the package



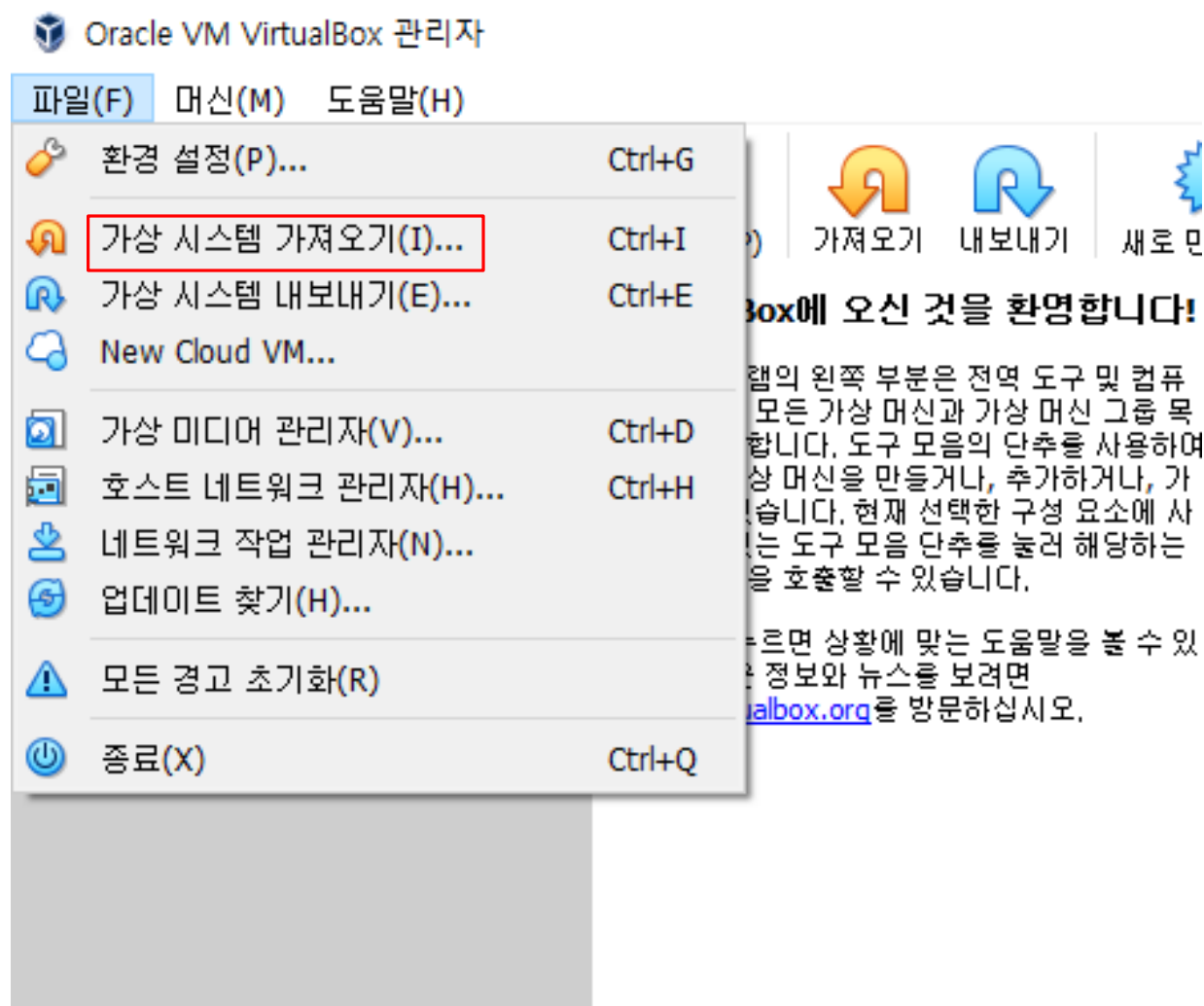
2. Download Mininet image

- Mininet image with provided codes is available at following link.
(Recommended)
(<https://drive.google.com/file/d/129AYz4JE4g7ncItpIj2vqLzfplzHxDxb/view?usp=sharing>)
- If you want to download original Mininet image, it is available at following link.
(<https://github.com/mininet/mininet/releases>)

3. Import Virtual System

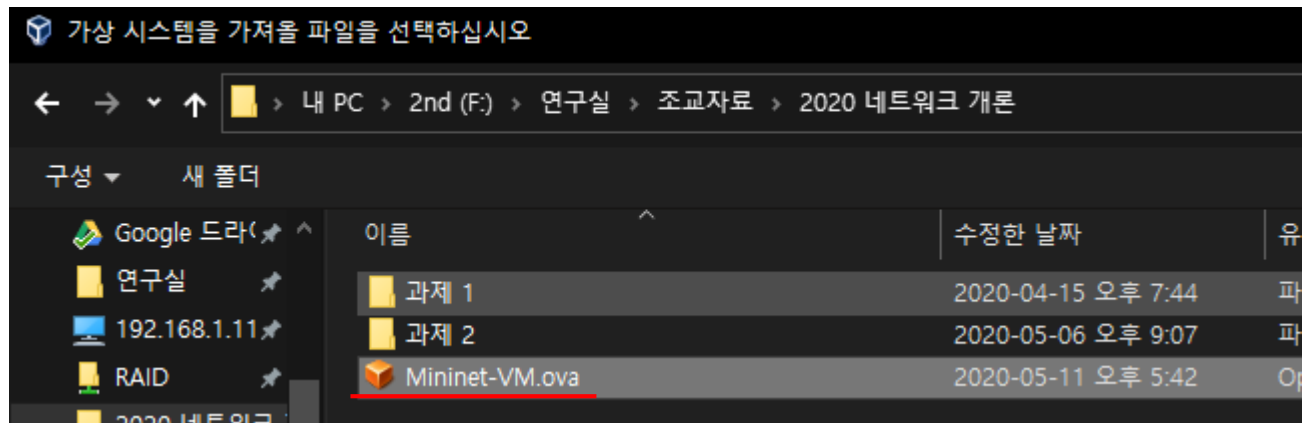
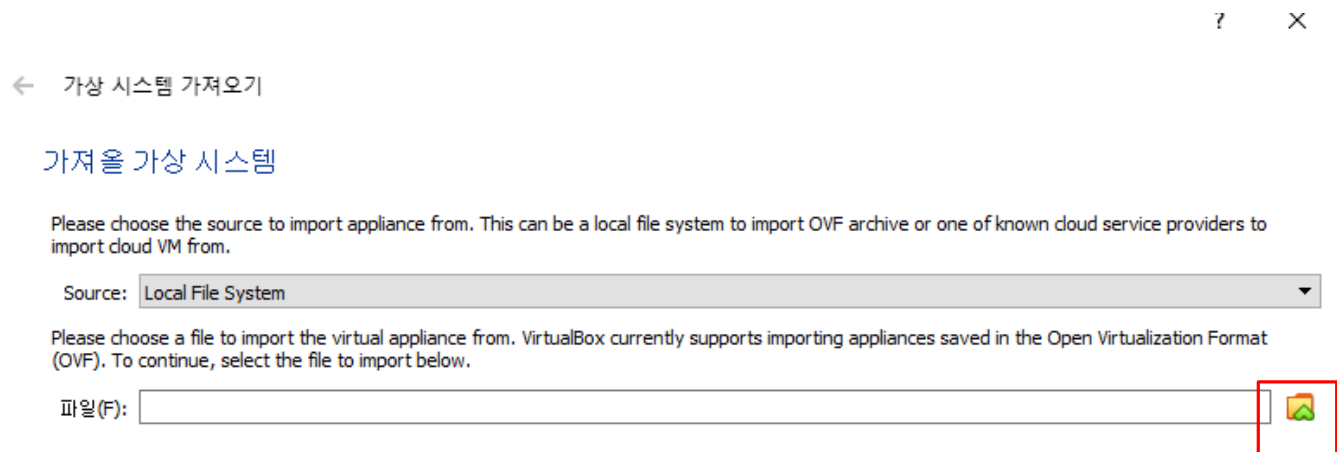


3. Import Virtual System



3. Import Virtual System

Select Mininet image



3. Import Virtual System

Continue to create virtual machine

?

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← 가상 시스템 가져오기

가상 시스템 설정

아래 목록은 가상 시스템 설명 파일에 나와 있는 가상 머신이며, 이를 VirtualBox로 가져왔을 때의 형태입니다. 보여져 있는 속성을 두 번 누르면 변경할 수도 있으며, 체크 상자를 사용해서 비활성화시킬 수도 있습니다.

가상 시스템 1	
이름	Mininet-VM
게스트 운영 체제 종류	Ubuntu (64-bit)
CPU	1
RAM	1024 MB
USB 컨트롤러	<input checked="" type="checkbox"/>
사운드 카드	<input checked="" type="checkbox"/> ICH AC97
네트워크 어댑터	<input checked="" type="checkbox"/> Intel PRO/1000 MT Server (82545EM)
저장소 컨트롤러(SCSI)	LsiLogic
가상 디스크 이미지	Mininet-VM-disk001.vmdk
기본 폴더	C:\Users\PC1\VirtualBox VMs
주 그룹	/

Machine Base Folder: C:\Users\PC1\VirtualBox VMs

MAC 주소 정책(P): NAT 네트워크 어댑터 MAC 주소만 포함

추가 옵션: ☒ VDI로 하드 드라이브 가져오기(I)

가상 시스템이 서명되지 않았음

기본값 복원

가져오기

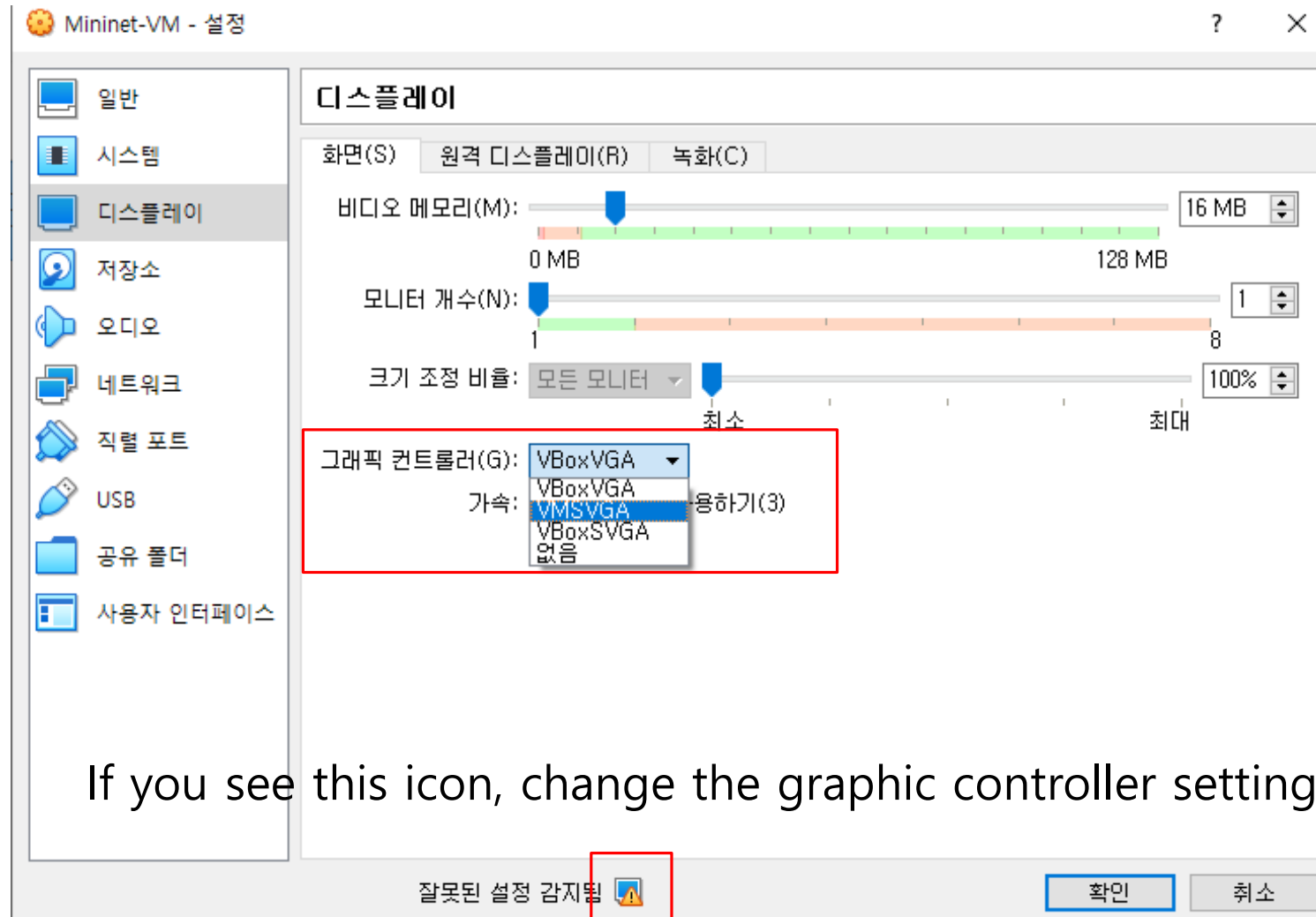
취소

4. Setting Virtual Machine

Click "setting"



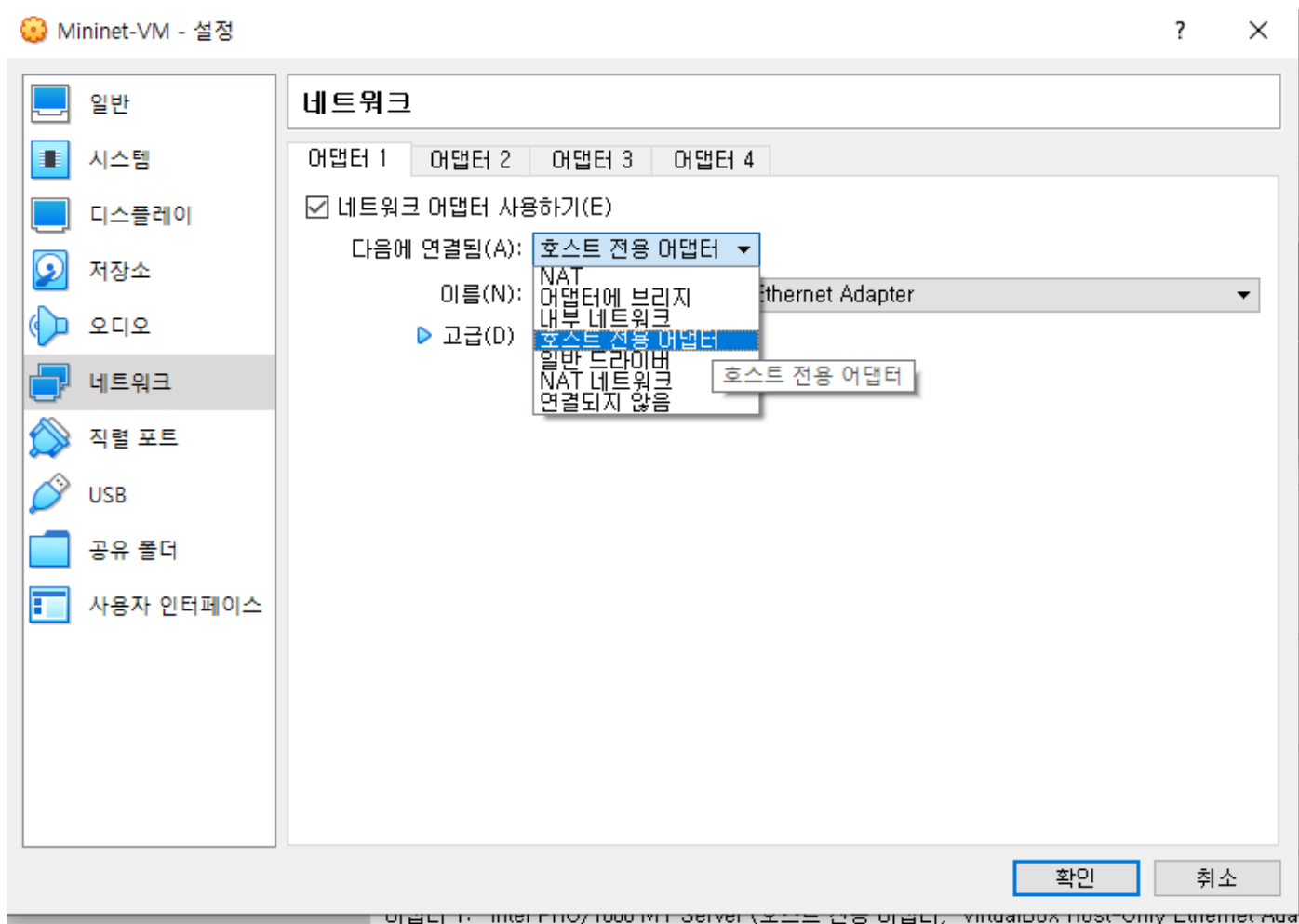
4. Setting Virtual Machine



If you see this icon, change the graphic controller setting to VMSVGA

4. Setting Virtual Machine

Change network from NAT(by default) to Host-only-adapter



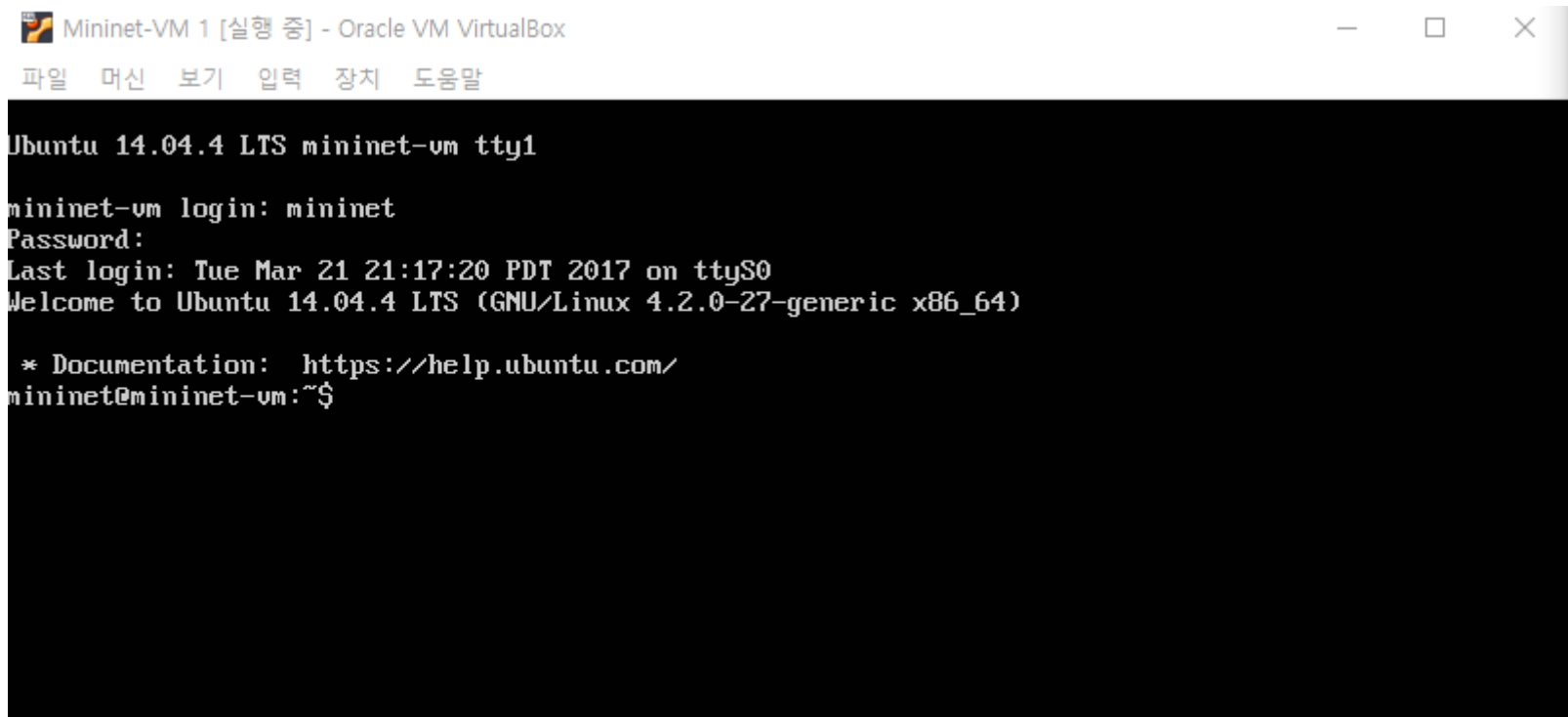
5. Start Mininet-VM

Start VM by double clicking it



6. Login

Both ID and password is 'Mininet'



```
Mininet-VM 1 [실행 중] - Oracle VM VirtualBox
파일  머신  보기  입력  장치  도움말

Ubuntu 14.04.4 LTS mininet-vm tty1

mininet-vm login: mininet
Password:
Last login: Tue Mar 21 21:17:20 PDT 2017 on ttyS0
Welcome to Ubuntu 14.04.4 LTS (GNU/Linux 4.2.0-27-generic x86_64)

 * Documentation:  https://help.ubuntu.com/
mininet@mininet-vm:~$
```

7. Check IP

Use "ifconfig" to check ip address of Mininet machine

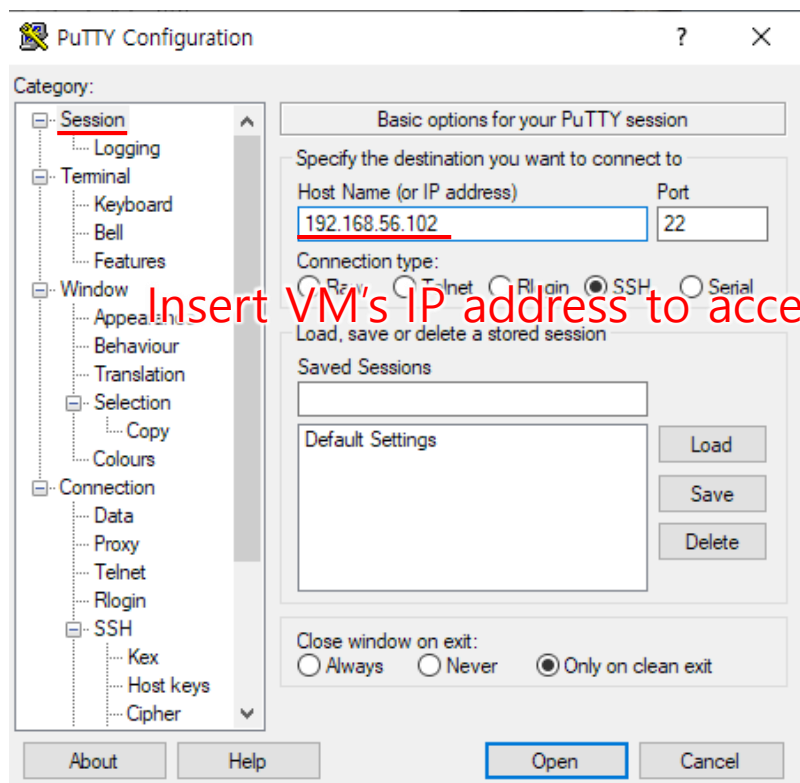
```
mininet@mininet-vm:~$ ifconfig
eth0      Link encap:Ethernet  HWaddr 08:00:27:2c:7d:07
          inet addr:192.168.56.102  Bcast:192.168.56.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:3 errors:0 dropped:0 overruns:0 frame:0
          TX packets:2 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1240 (1.2 KB)  TX bytes:684 (684.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:152 errors:0 dropped:0 overruns:0 frame:0
          TX packets:152 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:12144 (12.1 KB)  TX bytes:12144 (12.1 KB)
```

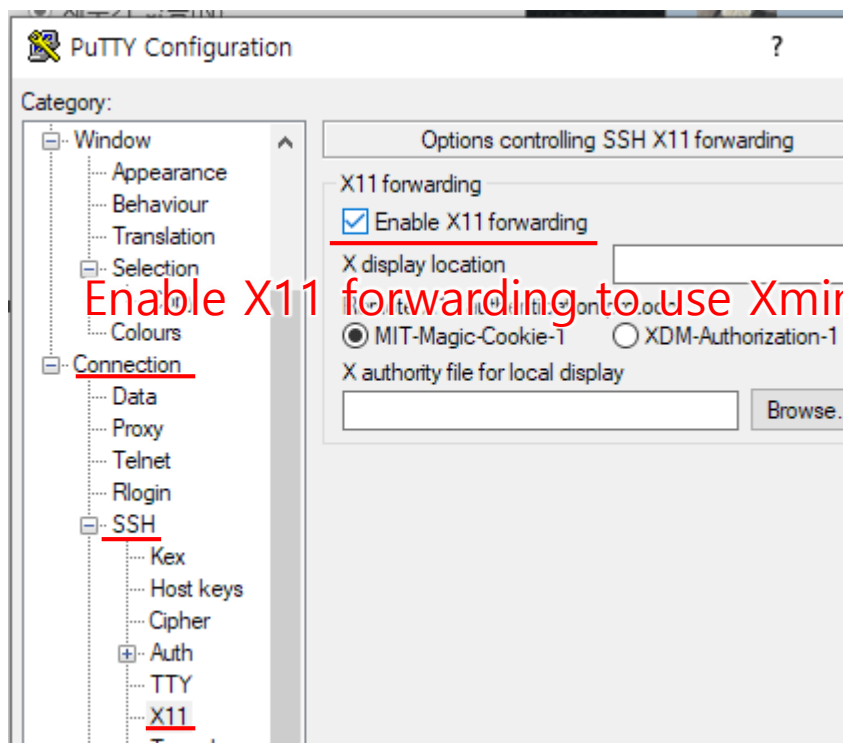
How to use Mininet

Use SSH and SFTP

- SSH is for access terminal and GUI platform(wireshark etc).
- We recommend to use "Putty" and "Xming" to use SSH.
- Turn on the the Xming.



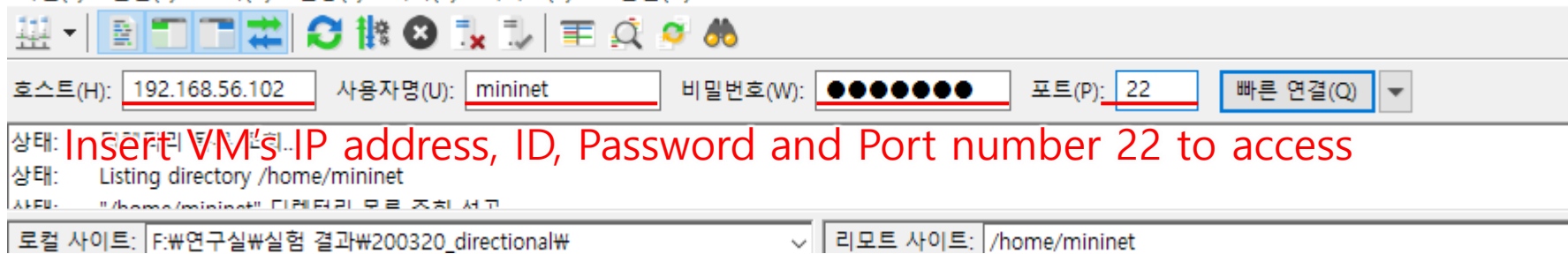
Insert VM's IP address to access



Enable X11 forwarding to use Xming for GUI

Use SSH and SFTP

- SFTP is for access file system via SSH protocol
- We recommend to use "Filezilla" to use SFTP

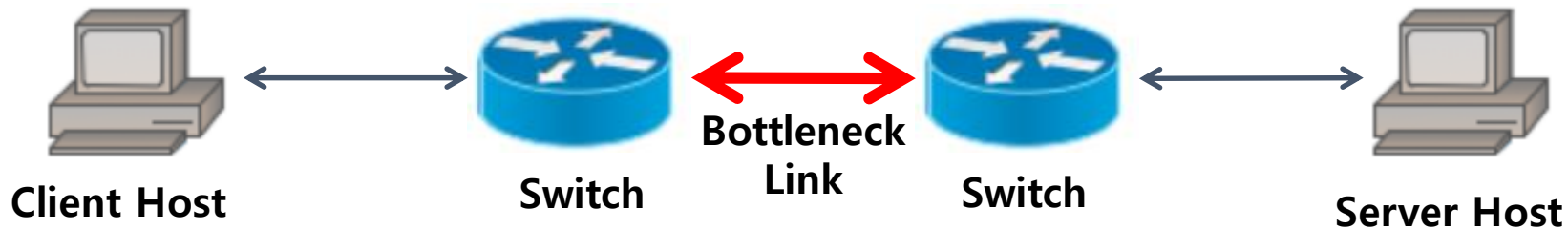


Mininet with python API

- We will give you the Basic python code to use the Mininet.
- Put the code file in Mininet VM and execute it with python.

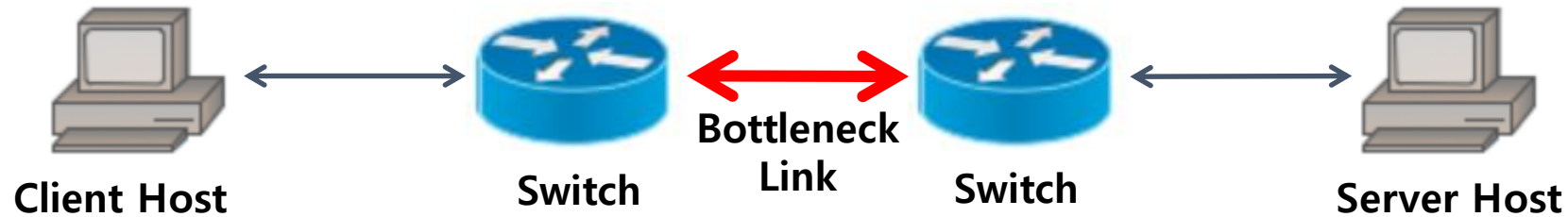
`"sudo python execute_mn.py <window Size, source Filename, Destination Filename>"`

- This will create 2 Hosts, 2 Switches and 3 Link. The link in the middle of Switches is bottleneck link that we are going to manipulate Bandwidth, Delay, Loss rate.



- Please read the comment in code first. Modify it as you want.

Bottleneck Link



- Bottleneck link is the link in between two switches which are connected to each host.
- You can change three properties of the link described below
 - Bandwidth : How many bits can be transferred through link
 - Delay : How much time will be delayed until the packet start to transfer (one-way propagation delay)
 - Loss Rate : Probability of the random packet loss

Ping, Iperf test

- You can check the connectivity and network performance by ping and iperf. In "execute_my.py" you can use these by uncomment the code below.

```
"execute ping for establish switching table"
net.pingAll() #This code must not be removed

"If you want to test with ping and iperf, uncomment this"
"""
net.pingFull([receiver,sender])
net.iperf([receiver,sender],seconds=10)
"""
```

- **"Ping"** is used to test reachability of a host on an IP network. The result of Ping shows packet loss and RTT.
- **"Iperf"** is used to test the performance of network between two hosts. The result of iperf shows bandwidth between two hosts using TCP.
- **Caution:** "net.pingAll()" must not be removed because of switching table initialize.

Bandwidth test

- You can check the bandwidth by the iperf result.

```
myTopo = Assignment3Topo(bw_v = 10, delay_v="10ms", loss_v=0)
```



```
Starting test...
*** Ping: testing ping reachability
h1 -> h2
h2 -> h1
*** Results: 0% dropped (2/2 received)
h1 -> h2
h2 -> h1
*** Results:
  h1->h2: 1/1, rtt min/avg/max/mdev 21.350/21.350/21.350/0.000 ms
  h2->h1: 1/1, rtt min/avg/max/mdev 21.169/21.169/21.169/0.000 ms
*** Iperf: testing TCP bandwidth between h1 and h2
*** Results: ['9.55 Mbits/sec', '11.6 Mbits/sec']
Testing finished
```

```
myTopo = Assignment3Topo(bw_v = 100, delay_v="10ms", loss_v=0)
```

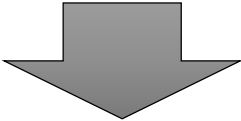


```
Starting test...
*** Ping: testing ping reachability
h1 -> h2
h2 -> h1
*** Results: 0% dropped (2/2 received)
h1 -> h2
h2 -> h1
*** Results:
  h1->h2: 1/1, rtt min/avg/max/mdev 20.833/20.833/20.833/0.000 ms
  h2->h1: 1/1, rtt min/avg/max/mdev 21.231/21.231/21.231/0.000 ms
*** Iperf: testing TCP bandwidth between h1 and h2
*** Results: ['90.5 Mbits/sec', '99.1 Mbits/sec']
Testing finished
```

Delay test

- You can check the delay by the ping result.

```
myTopo = Assignment3Topo(bw_v = 10, delay_v='10ms', loss_v=0)
```



```
Starting test...
*** Ping: testing ping reachability
h1 -> h2
h2 -> h1
*** Results: 0% dropped (2/2 received)
h1 -> h2
h2 -> h1
*** Results:
  h1->h2: 1/1, rtt min/avg/max/mdev 21.407/21.407/21.407/0.000 ms
  h2->h1: 1/1, rtt min/avg/max/mdev 21.143/21.143/21.143/0.000 ms
*** Iperf: testing TCP bandwidth between h1 and h2
*** Results: ['9.55 Mbits/sec', '11.6 Mbits/sec']
Testing finished
```

```
myTopo = Assignment3Topo(bw_v = 10, delay_v='100ms', loss_v=0)
```



```
Starting test...
*** Ping: testing ping reachability
h1 -> h2
h2 -> h1
*** Results: 0% dropped (2/2 received)
h1 -> h2
h2 -> h1
*** Results:
  h1->h2: 1/1, rtt min/avg/max/mdev 201.310/201.310/201.310/0.000 ms
  h2->h1: 1/1, rtt min/avg/max/mdev 201.359/201.359/201.359/0.000 ms
*** Iperf: testing TCP bandwidth between h1 and h2
*** Results: ['9.19 Mbits/sec', '12.7 Mbits/sec']
Testing finished
```

Loss Rate test

- You can check the bandwidth by the ping result.

```
myTopo = Assignment3Topo(bw_v = 10, delay_v="10ms", loss_v=0)
```



```
Starting test...
*** Ping: testing ping reachability
h1 -> h2
h2 -> h1
*** Results: 0% dropped (2/2 received)
h1 -> h2
h2 -> h1
*** Results:
  h1->h2: 1/1, rtt min/avg/max/mdev 21.407/21.407/21.407/0.000 ms
  h2->h1: 1/1, rtt min/avg/max/mdev 21.143/21.143/21.143/0.000 ms
*** Iperf: testing TCP bandwidth between h1 and h2
*** Results: ['9.55 Mbits/sec', '11.6 Mbits/sec']
Testing finished
```

```
myTopo = Assignment3Topo(bw_v = 10, delay_v="10ms", loss_v=10)
```



```
*** Ping: testing ping reachability
h1 -> h2
h2 -> X
*** Results: 50% dropped (1/2 received)
h1 -> X
h2 -> h1
*** Results:
  h1->h2: 1/0, rtt min/avg/max/mdev 0.000/0.000/0.000/0.000 ms
  h2->h1: 1/1, rtt min/avg/max/mdev 22.383/22.383/22.383/0.000 ms
*** Iperf: testing TCP bandwidth between h1 and h2
*** Results: ['1.31 Mbits/sec', '1.48 Mbits/sec']
Testing finished
```

Caution: Ping only sent one packet. So packet loss may not be occurred depend on the probability.

Clearing Mininet

- If the program was not terminated successfully(maybe because of error or something) please type following order first.

`"sudo mn -c"`

This will clear the Mininet.

Q&A

- If you want to know more about the Mininet, use Mininet official website (<http://mininet.org/>)
- If you have any question, please use google sheet.