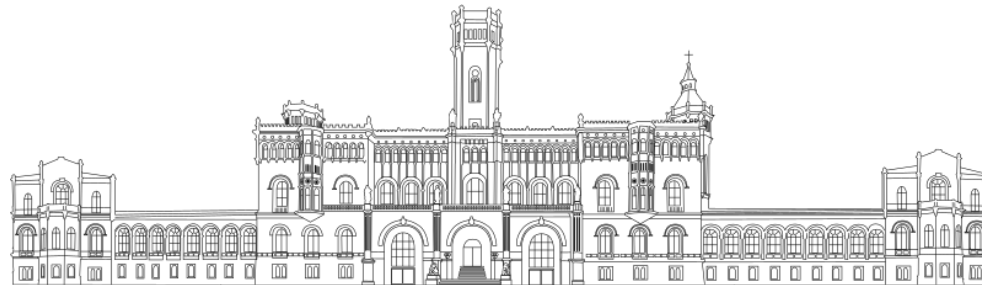




Future Internet

Mininet Tutorial 1



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Winter Semester 2022 / 2023



- Mininet is a network emulator that let you create networks of many switches, routers, and hosts, and emulate different link properties between them.
- The different devices (routers and hosts) are run in separate containers.
- Switches are emulated by creating virtual interfaces and linking the containers to them.
- Link properties are emulated using tc (linux traffic control) and netem.
- Many resources are available on the Mininet web page:
<http://mininet.org/>



Use the Mininet VM

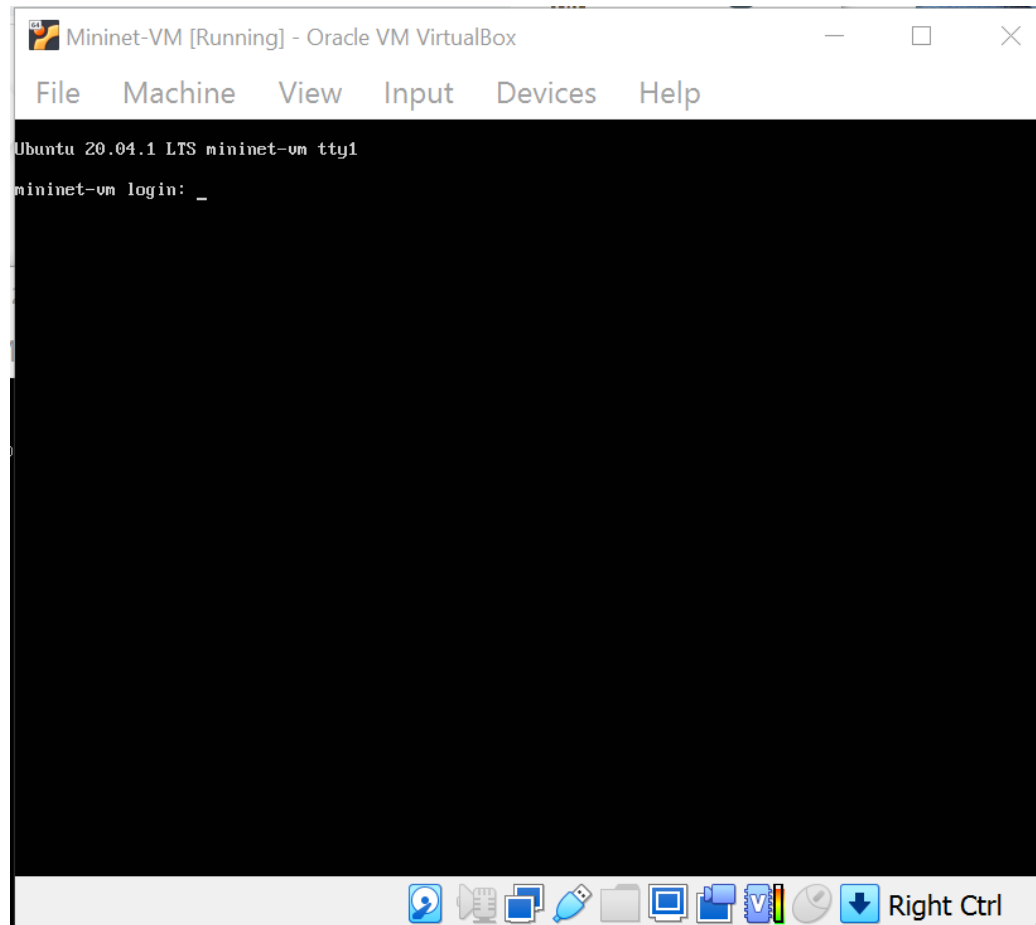
- Download VM image here:
<https://github.com/mininet/mininet/releases/>
- We will use the latest image:
mininet-2.3.0-210211-ubuntu-20.04.1-legacy-server-amd64-ovf.zip
- You can run the VM image in VirtualBox, VMware, KVM, Qemu, or Hyper-V.
- These instructions will be based on using VirtualBox, but others are similar.

Install Mininet directly (linux only)

- You can install from source, or from packages. Instructions for both are here:
<http://mininet.org/download/>



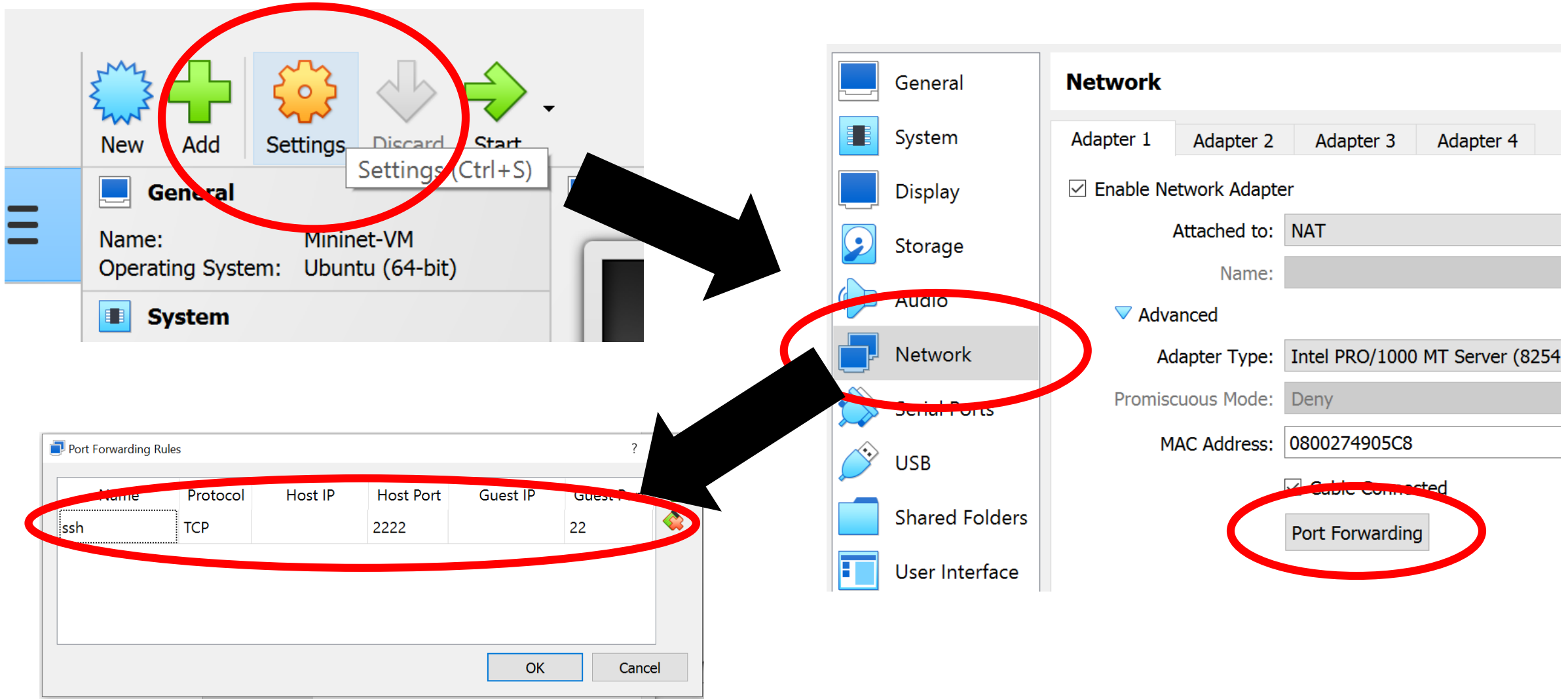
Use the console window



Connect through ssh

- Can have multiple windows open.
- Easier to cut and paste text from an ssh terminal.
- Can move data to/from the VM using scp or sftp.
- If you are familiar with VM network setup already, you can do this however you like. We will just show one method.

Connecting to the VM through ssh (Virtual Box, 3 clicks)



The image shows the VirtualBox settings for a VM named 'Mininet-VM' with an Ubuntu (64-bit) operating system. The 'Settings (Ctrl+S)' button is circled in red. A black arrow points to the 'Network' category in the left-hand settings list, which is also circled in red. Another black arrow points to the 'Port Forwarding' button in the 'Advanced' network settings, which is circled in red. Below, a 'Port Forwarding Rules' dialog box is shown with a table containing one rule for 'ssh' on port 2222, and its 'Add' button is circled in red.

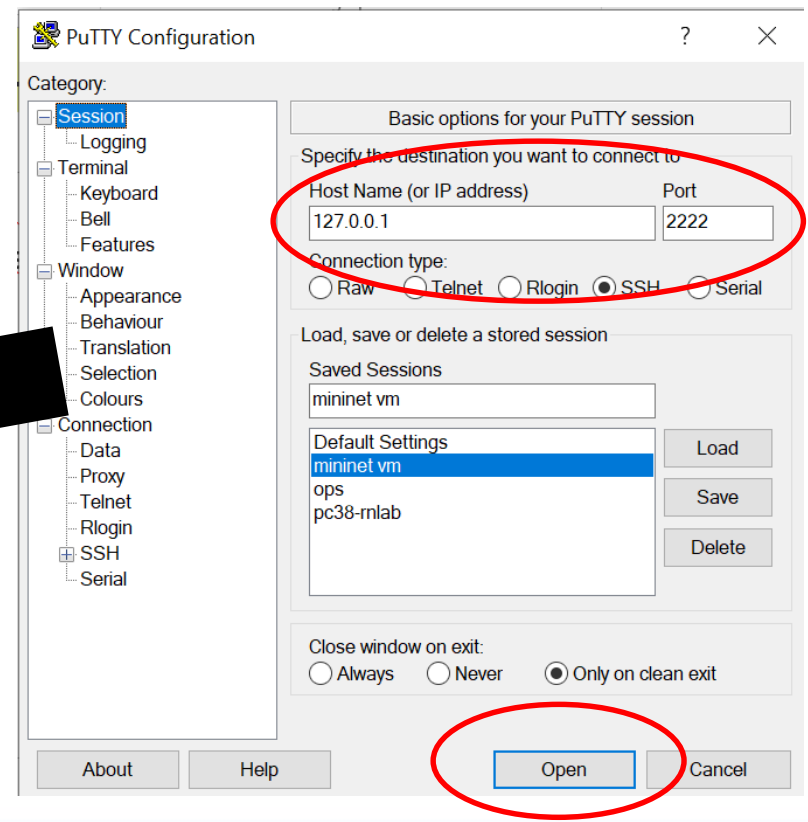
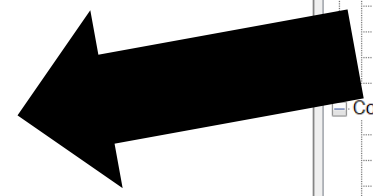
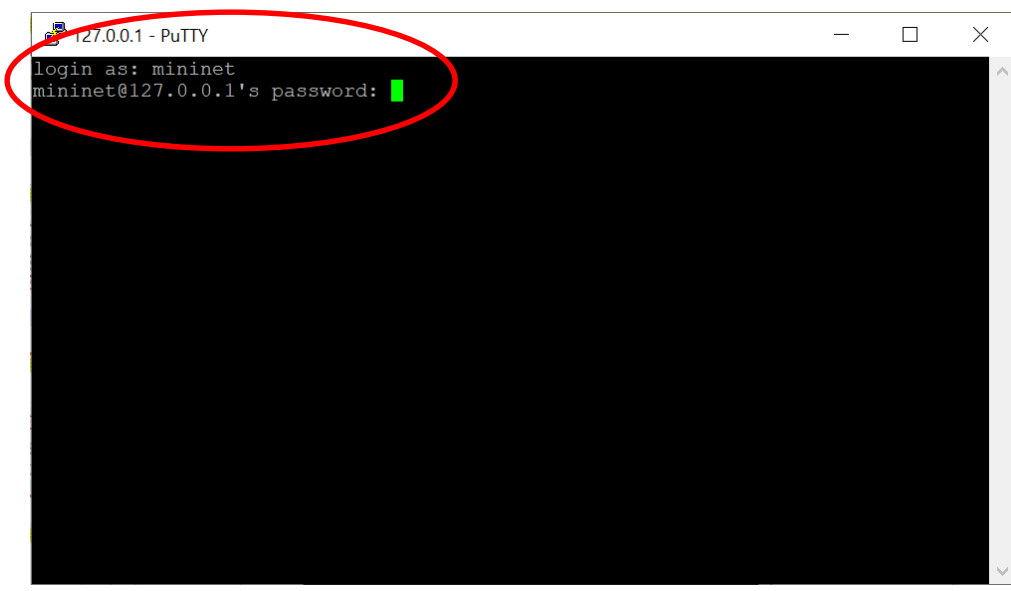
Name	Protocol	Host IP	Host Port	Guest IP	Guest Port
ssh	TCP		2222		22

Connecting to the VM through ssh (Virtual Box, 3 clicks)



- On linux:
`ssh -p 2222 mininet@127.0.0.1`

- On windows (with putty ssh client):





- These instructions will assume you are using the Mininet VM in VirtualBox. Other methods should be about the same.

1. Install additional software
2. Run Mininet
3. Basic commands
4. Moving files between VM and host

1. Install additional software



- Log into the Mininet VM (user: mininet, password: mininet)
- If you install mininet directly on your computer, you need to install these additional tools on your computer as well.

```
sudo apt-get update
sudo apt-get install ntpdate
sudo ntpdate de.pool.ntp.org
sudo apt-get update
sudo apt-get install iperf3 iftop tcptrack htop d-itg
```




- The Mininet homepage has a good tutorial.
<http://mininet.org/walkthrough/>
- But here are some basic commands.
- To start mininet with the default two-host topology, run:
`mininet@mininet-vm:~$ sudo mn`
- You will then be in the mininet shell:

```
mininet@mininet-vm:~$ sudo mn
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2
*** Adding switches:
s1
*** Adding links:
(h1, s1) (h2, s1)
*** Configuring hosts
h1 h2
*** Starting controller
c0
*** Starting 1 switches
s1 ...
*** Starting CLI:
mininet>
```

3. Basic commands



command	what is does	typical output
net	display all the hosts, switches, controllers, and links	<pre>mininet> net h1 h1-eth0:s1-eth1 h2 h2-eth0:s1-eth2 s1 lo: s1-eth1:h1-eth0 s1-eth2:h2-eth0 c0 mininet></pre>
nodes	list all the nodes in the topology	<pre>mininet> nodes available nodes are: c0 h1 h2 s1 mininet></pre>
dump	more node info	<pre>mininet> dump <Host h1: h1-eth0:10.0.0.1 pid=3169> <Host h2: h2-eth0:10.0.0.2 pid=3171> <OVSSwitch s1: lo:127.0.0.1,s1-eth1:None,s1-eth2:None pid=3176> <Controller c0: 127.0.0.1:6653 pid=3162> mininet></pre>
pingall	all hosts ping each other	<pre>mininet> pingall *** Ping: testing ping reachability h1 -> h2 h2 -> h1 *** Results: 0% dropped (2/2 received) mininet></pre>

3. Basic commands



command	what is does	typical output
<p>h1 <command> h2 <command></p>	<p>run a command on the given host</p>	
<p>h1 ifconfig -a</p>	<p>run 'ifconfig -a' on host h1</p>	<pre>mininet> h1 ifconfig -a h1-eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500 inet 10.0.0.1 netmask 255.0.0.0 broadcast 10.255.255.255 inet6 fe80::f0b0:59ff:fe58:2e3a prefixlen 64 scopeid 0x20<link> ether f2:b0:59:58:2e:3a txqueuelen 1000 (Ethernet) RX packets 31 bytes 2342 (2.3 KB) RX errors 0 dropped 0 overruns 0 frame 0 TX packets 18 bytes 1356 (1.3 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 0 bytes 0 (0.0 B) RX errors 0 dropped 0 overruns 0 frame 0 TX packets 0 bytes 0 (0.0 B) TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0</pre>
<p>h2 iperf -s &</p>	<p>run 'iperf -s' on host h2 and put it in the background</p>	<pre>mininet> h2 iperf -s &</pre>
<p>h1 iperf -c h2 -i 1 -t 3</p>	<p>run iperf client on h1. Connect to iperf server on h2. Run for 3 seconds, with updates every 1 second.</p>	<pre>mininet> h1 iperf -c h2 -i 1 -t 3 ----- Client connecting to 10.0.0.2, TCP port 5001 TCP window size: 85.3 KByte (default) ----- [1] local 10.0.0.1 port 56158 connected with 10.0.0.2 port 5001 [ID] Interval Transfer Bandwidth [1] 0.0000-1.0000 sec 3.86 GBytes 33.2 Gbits/sec [1] 1.0000-2.0000 sec 3.91 GBytes 33.6 Gbits/sec [1] 2.0000-3.0000 sec 3.90 GBytes 33.5 Gbits/sec [1] 0.0000-3.0022 sec 11.7 GBytes 33.4 Gbits/sec</pre>



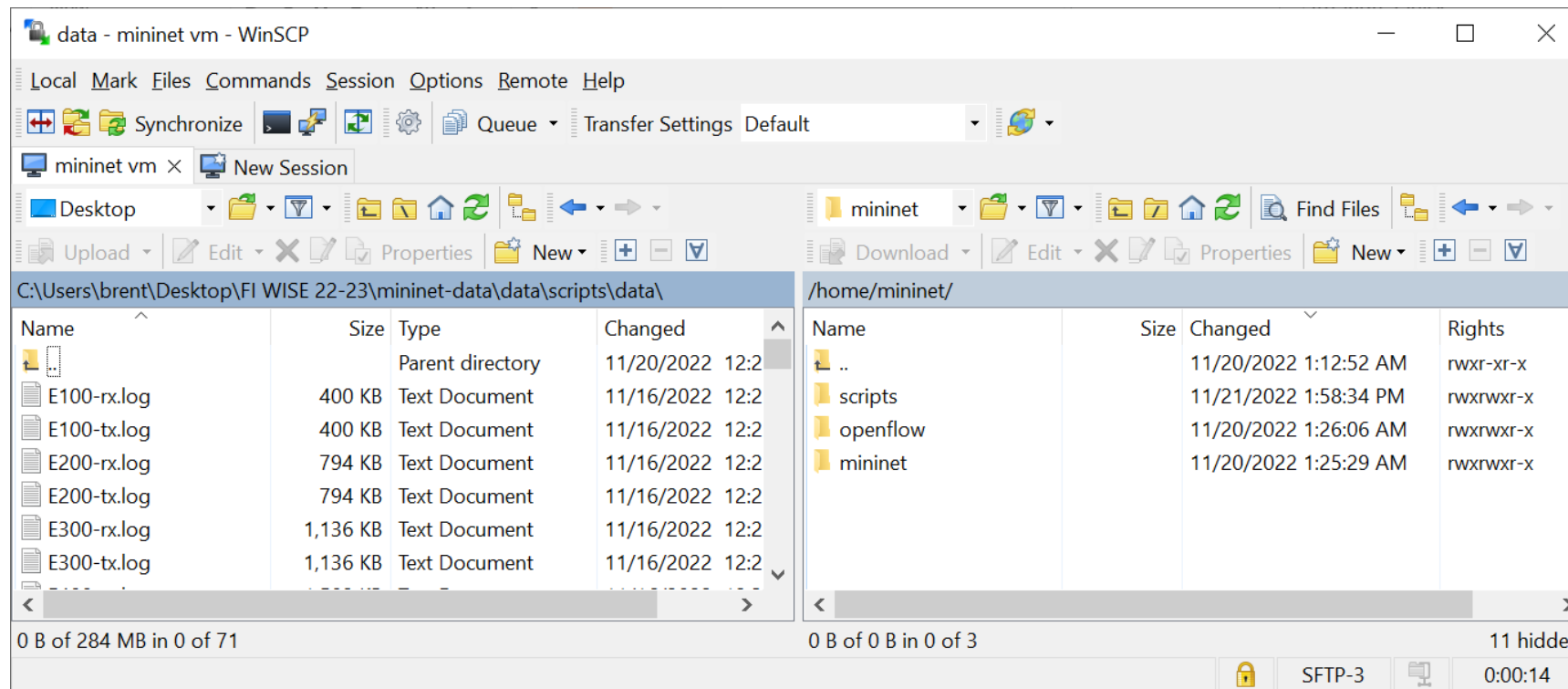
4. Moving files between VM and host

- There are many ways to do this. If you already know how, that is great.
- If not, I suggest either of these two methods:
 - scp or sftp to the VM
 - Shared folders

4. Moving files between VM and host



- scp or sftp
- On Windows I use WinSCP



4. Moving files between VM and host



■ Shared folders

ubuntu 22.04 mininet - Settings

Shared Folders

Shared Folders

Name	Path	Access	Auto Mount	At
Machine Folders				
Transient Folders				

Add Share

Folder Path:

Folder Name:

Mount point:

Read-only

All When checked, the guest OS will not be able to write to the s

Make Permanent

OK Cancel