System Programming & OS 실습

3. SSH, Port Forwarding

정지헌, 안석현, 김선재

Dankook University

{wlgjsjames7224, seokhyun, rlatjswo0824}@dankook.ac.kr

Index

- SSH
- Port Forwarding
- SSH Installation
- Putty
- Window Terminal

SSH(Secure Shell)

❖ SSH (Secure Shell)

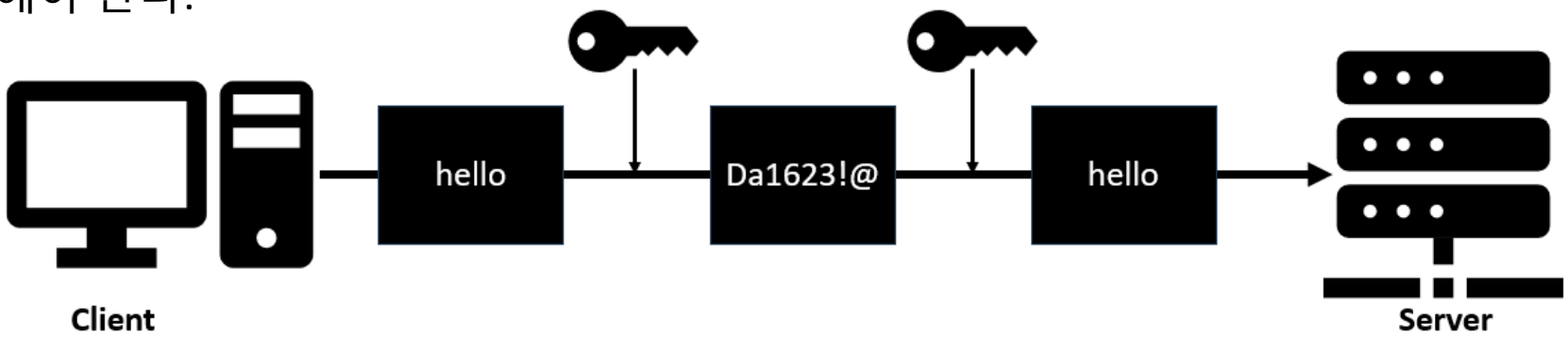
- 원격 호스트에 접속하기 위해 사용되는 프로토콜
- 네트워크 상의 다른 컴퓨터에 로그인, 원격 시스템에서 명령을 실행, 다른 시스템으로 파일을 복사할 수 있음
- Client와 Server의 통신이 암호화되어 안전하게 통신

SSH(Secure Shell)

❖ SSH (Secure Shell) 사용 이유

- 사용자 및 자동화 된 프로세스에 원격 접속 시
- 자동화된 파일 전송 시
- 원격 명령 실행 시
- 네트워크 인프라와 중요 시스템 관리 시

=> 안전한 통신을 하기 위해 사용해야 한다.



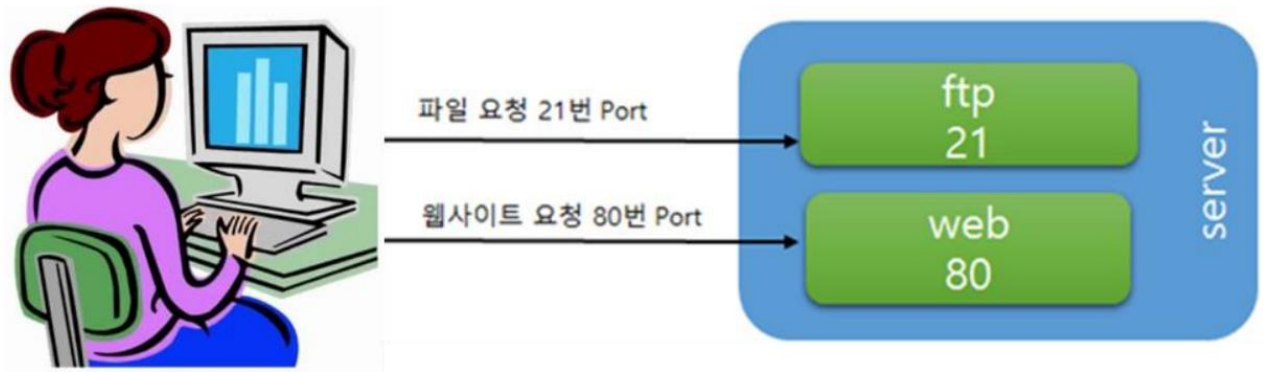
Port Forwarding

❖ Port

- 통신을 필요로 하는 프로그램이 다수일 때, 이를 구별할 수 있는 번호로 “논리적인 접속장소 " 를 의미
- 각각의 응용 프로그램에 정해진 포트 번호를 이용해 구분

ex) 컴퓨터에 여러 개의 서버가 실행되고 있을 때, 포트 번호를 통해 어느 서버에 접속해야 하는지 컴퓨터에게 알려줄 수 있음

- SSH -> 22 / HTTP -> 80 / FTP -> 21, …

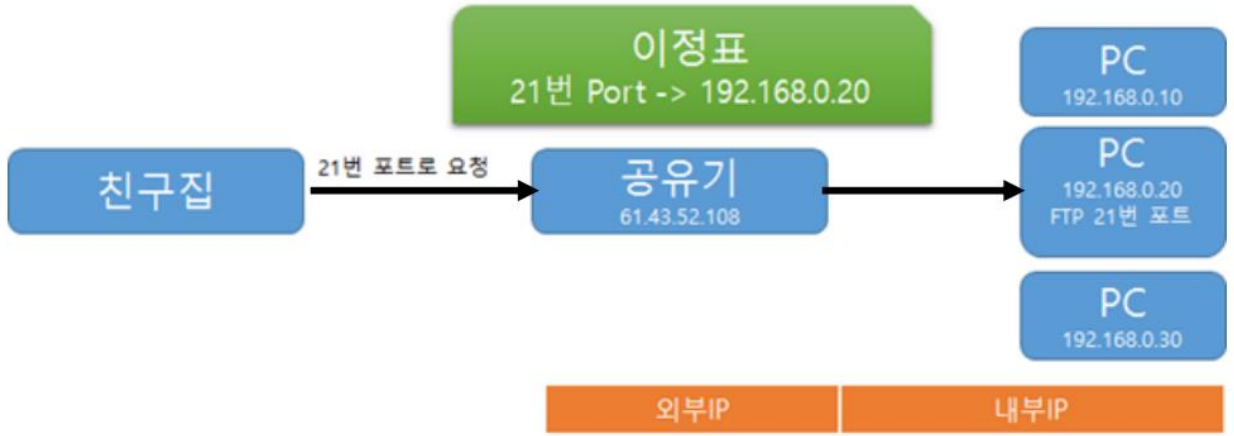


Port Forwarding

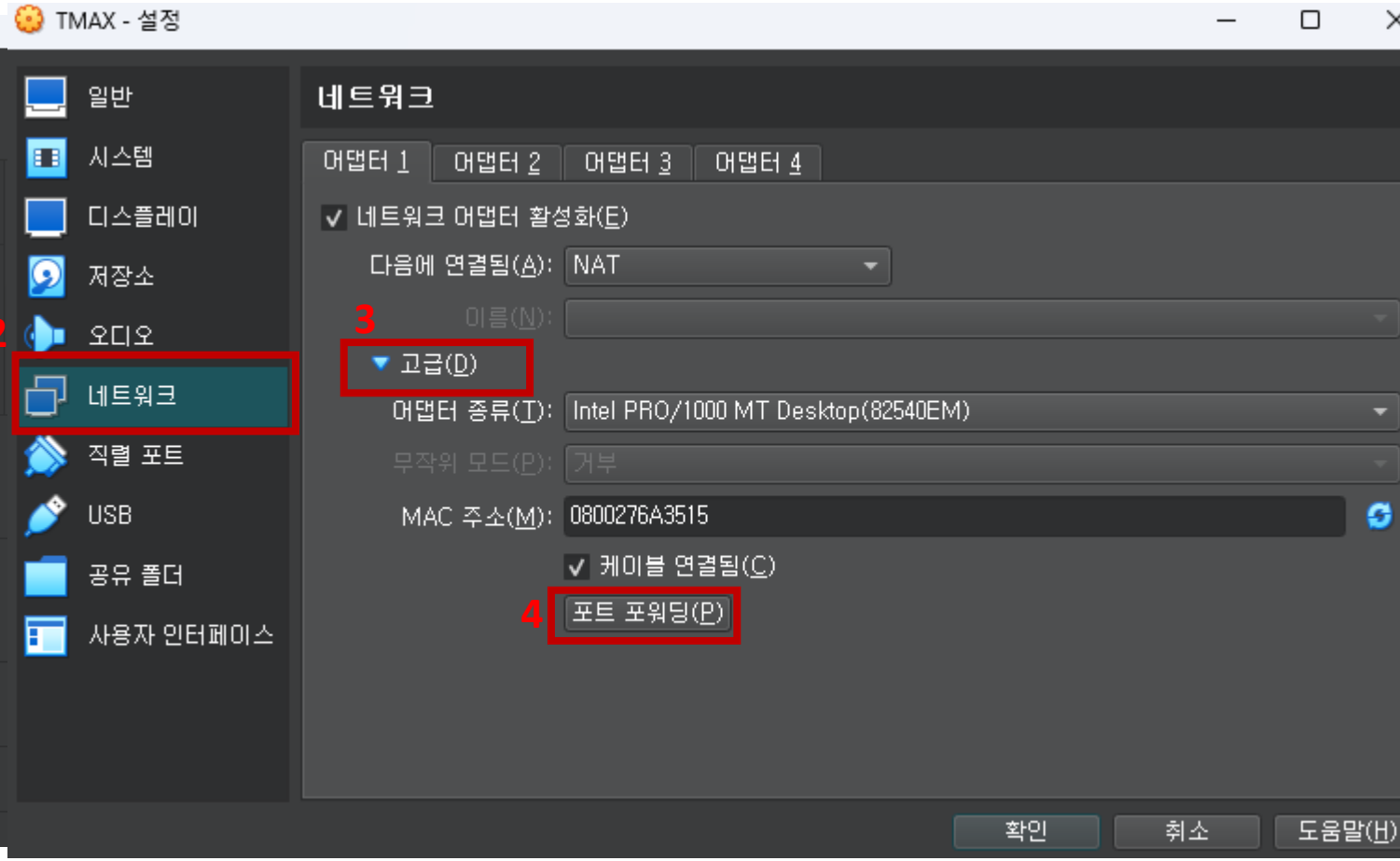
❖ Port Forwarding

- 특정한 포트로 들어오는 데이터 패킷을 다른 포트로 바꿔서 다시 전송해주는 포트 전달
- 외부에서 공유기에 연결된 PC에 통신을 요청할 때, 공유기에 이정표를 달아주는 작업

ex) 21번 포트로 요청이 오면 공유기는 이정표를 참조해 192.168.0.20번 PC로 전달 가능



Virtual Box Port Forwarding



Virtual Box Port Forwarding

- 호스트 IP
  - 172.23.XXX.XXX
- 호스트 Port
  - 10621 (임의)
- 게스트 IP
  - 10.0.2.15
- 게스트 Port
  - 22

Virtual Box SSH Installation

1

```
[seokhyun@localhost ~]$ sudo yum install openssh-server

We trust you have received the usual lecture from the local System
Administrator. It usually boils down to these three things:

    #1) Respect the privacy of others.
    #2) Think before you type.
    #3) With great power comes great responsibility.

[sudo] password for seokhyun:
CentOS Stream 9 - BaseOS                                12 kB/s | 6.4 kB     00:00
CentOS Stream 9 - AppStream                             11 kB/s | 6.5 kB     00:00
CentOS Stream 9 - Extras packages                       27 kB/s | 6.5 kB     00:00
Package openssh-server-8.7p1-43.el9.x86_64 is already installed.
Dependencies resolved.
Nothing to do.
Complete!
[seokhyun@localhost ~]$
```

- yum 명령어를 통한 ssh 설치
- sudo yum install openssh-server

```
[seokhyun@localhost ~]$ sudo yum -y install openssh-server openssh-clients openssh-askpass
Last metadata expiration check: 0:04:32 ago on Fri 09 Aug 2024 03:36:54 AM KST.
Package openssh-server-8.7p1-43.el9.x86_64 is already installed.
Package openssh-clients-8.7p1-43.el9.x86_64 is already installed.
Dependencies resolved.
```

- 1번 명령어로 설치가 안될 시
  - sudo yum –y install openssh-server openssh-clients openssh-askpass

Virtual Box SSH Installation


```
[seokhyun@localhost ~]$ yum list installed | grep ssh
libssh.x86_64                           0.10.4-13.el9                @anaconda
libssh-config.noarch                    0.10.4-13.el9                @anaconda
openssh.x86_64                          8.7p1-43.el9                 @anaconda
openssh-askpass.x86_64                  8.7p1-43.el9                 @appstream
openssh-clients.x86_64                  8.7p1-43.el9                 @anaconda
openssh-server.x86_64                   8.7p1-43.el9                 @anaconda
```

- grep을 통해 ssh 설치 확인
- yum list installed | grep ssh

```
[seokhyun@localhost ~]$ sudo cat /etc/ssh/sshd_config
#       $OpenBSD: sshd_config,v 1.104 2021/07/02 05:11:21 dtucker Exp $

# This is the sshd server system-wide configuration file.  See
# sshd_config(5) for more information.

# This sshd was compiled with PATH=/usr/local/bin:/usr/bin:/usr/local/sbin:/usr/sbin

# The strategy used for options in the default sshd_config shipped with
# OpenSSH is to specify options with their default value where
# possible, but leave them commented.  Uncommented options override the
# default value.

# To modify the system-wide sshd configuration, create a  *.conf  file under
#  /etc/ssh/sshd_config.d/  which will be automatically included below
Include /etc/ssh/sshd_config.d/*.conf

# If you want to change the port on a SELinux system, you have to tell
# SELinux about this change.
# semanage port -a -t ssh_port_t -p tcp #PORTNUMBER
#
#Port 22
#AddressFamily any
#ListenAddress 0.0.0.0
#ListenAddress ::
```

- cat을 통해 설정 파일 확인
- sudo cat /etc/ssh/sshd_config

Virtual Box SSH Installation


```
# If you want to change the port on a SELinux system, you have to tell
# SELinux about this change.
# semanage port -a -t ssh_port_t -p tcp #PORTNUMBER
#
Port 22
```

```
[seokhyun@localhost ~]$ cat /etc/ssh/sshd_config
cat: /etc/ssh/sshd_config: Permission denied
[seokhyun@localhost ~]$ sudo cat /etc/ssh/sshd_config
#       $OpenBSD: sshd_config,v 1.104 2021/07/02 05:11:21 dtucker Exp $

# This is the sshd server system-wide configuration file.  See
# sshd_config(5) for more information.

# This sshd was compiled with PATH=/usr/local/bin:/usr/bin:/usr/local/sbin:/usr/sbin

# The strategy used for options in the default sshd_config shipped with
S# OpenSSH is to specify options with their default value where
# possible, but leave them commented.  Uncommented options override the
# default value.

# To modify the system-wide sshd configuration, create a  *.conf  file under
#  /etc/ssh/sshd_config.d/  which will be automatically included below
Include /etc/ssh/sshd_config.d/*.conf

# If you want to change the port on a SELinux system, you have to tell
# SELinux about this change.
# semanage port -a -t ssh_port_t -p tcp #PORTNUMBER
#
Port 22
#AddressFamily any
#ListenAddress 0.0.0.0
#ListenAddress ::
```

- sudo vim /etc/ssh/sshd_config
- #port 22 -> port 22 (주석제거)

- cat /etc/ssh/sshd_config

Virtual Box SSH Installation


```
[seokhyun@localhost ~]$ service sshd start
Redirecting to /bin/systemctl start sshd.service
[seokhyun@localhost ~]$ service sshd status
Redirecting to /bin/systemctl status sshd.service
● sshd.service - OpenSSH server daemon
     Loaded: loaded (/usr/lib/systemd/system/sshd.service; enabled; preset: enabled)
     Active: active (running) since Fri 2024-08-09 03:35:26 KST; 15min ago
       Docs: man:sshd(8)
             man:sshd_config(5)
   Main PID: 877 (sshd)
      Tasks: 1 (limit: 23008)
     Memory: 2.8M
        CPU: 28ms
     CGroup: /system.slice/sshd.service
             └─877 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Aug 09 03:35:26 localhost.localdomain systemd[1]: Starting OpenSSH server daemon...
Aug 09 03:35:26 localhost.localdomain sshd[877]: Server listening on 0.0.0.0 port 22.
Aug 09 03:35:26 localhost.localdomain sshd[877]: Server listening on :: port 22.
Aug 09 03:35:26 localhost.localdomain systemd[1]: Started OpenSSH server daemon.
```

- service sshd start
- service sshd status

SSH Installation Trouble Shooting


```
[seokhyun@localhost ~]$ service sshd start
Redirecting to /bin/systemctl start sshd.service
Job for sshd.service failed because the control process exited with error code.
See "systemctl status sshd.service" and "journalctl -xeu sshd.service" for details.
```

```
[seokhyun@localhost ~]$ journalctl -xeu sshd.service
    A start job for unit sshd.service has finished with a failure.

    The job identifier is 5224 and the job result is failed.
Aug 11 19:15:41 localhost.localdomain systemd[1]: Stopped OpenSSH server daemon.
    Subject: A stop job for unit sshd.service has finished
    Defined-By: systemd
    Support: https://access.redhat.com/support

    A stop job for unit sshd.service has finished.

    The job identifier is 5330 and the job result is done.
Aug 11 19:18:04 localhost.localdomain systemd[1]: Starting OpenSSH server daemon...
    Subject: A start job for unit sshd.service has begun execution
    Defined-By: systemd
    Support: https://access.redhat.com/support

    A start job for unit sshd.service has begun execution.

    The job identifier is 6046.
Aug 11 19:18:04 localhost.localdomain sshd[3787]: Server listening on 0.0.0.0 port 22.
Aug 11 19:18:04 localhost.localdomain sshd[3787]: Server listening on :: port 22.
Aug 11 19:18:04 localhost.localdomain systemd[1]: Started OpenSSH server daemon.
    Subject: A start job for unit sshd.service has finished successfully
    Defined-By: systemd
    Support: https://access.redhat.com/support

    A start job for unit sshd.service has finished successfully.

    The job identifier is 6046.
```

- service sshd start
- 에러가 발생할 수 있음

- journalctl –xeu ssh.service
  - 시스템 로그 조회 가능
  - -x : 로그 메시지에 대한 설명 출력
  - -e : 가장 최근 로그 출력
  - -u [system unit name] : 특정 서비스 로그만 출력

SSH Installation Trouble Shooting


```
[seokhyun@localhost ~]$ firewall-cmd --permanent --zone=public --add-port=22/tcp
Warning: ALREADY_ENABLED: 22:tcp
success
```

- 방화벽에 port number 허용
  - firewall-cmd –permanent—zone=public –add-port=[port number]/tcp

```
[seokhyun@localhost ~]$ firewall-cmd --reload
success
[seokhyun@localhost ~]$ systemctl restart sshd.service
```

- 방화벽 재시작
  - firewall-cmd –reload

```
[seokhyun@localhost ~]$ netstat -tulpn |grep LISTEN
(Not all processes could be identified, non-owned process info
 will not be shown, you would have to be root to see it all.)
tcp        0      0 0.0.0.0:22              0.0.0.0:*               LISTEN      -
tcp        0      0 127.0.0.1:631           0.0.0.0:*               LISTEN      -
tcp6       0      0 ::1:22                  :::*                    LISTEN      -
tcp6       0      0 ::1:631                 :::*                    LISTEN      -
```

- Port number 허용 확인
  - Netstat –tulpn |grep LISTEN
  - sudo semanage port –l |grep ssh

```
[seokhyun@localhost ~]$ sudo semanage port -l | grep ssh
ssh_port_t                     tcp      22
```

SSH Installation Trouble Shooting


```
[seokhyun@localhost ~]$ cat /etc/selinux/config

# This file controls the state of SELinux on the system.
# SELINUX= can take one of these three values:
#     enforcing - SELinux security policy is enforced.
#     permissive - SELinux prints warnings instead of enforcing.
#     disabled - No SELinux policy is loaded.
# See also:
# https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/9/html/using_selinux/changing-selinux-states-
-selinux#changing-selinux-modes-at-boot-time_changing-selinux-states-and-modes
#
# NOTE: Up to RHEL 8 release included, SELINUX=disabled would also
# fully disable SELinux during boot. If you need a system with SELinux
# fully disabled instead of SELinux running with no policy loaded, you
# need to pass selinux=0 to the kernel command line. You can use grubby
# to persistently set the bootloader to boot with selinux=0:
#
#    grubby --update-kernel ALL --args selinux=0
#
# To revert back to SELinux enabled:
#
#    grubby --update-kernel ALL --remove-args selinux
#
SELINUX=disabled
# SELINUXTYPE= can take one of these three values:
```

- /etc/selinux/config 확인
- 보안정책 비활성화
- SELINUX = enforcing

-> SELINUX = disabled

CMD Test


```
[seokhyun@localhost ~]$ ssh seokhyun@172.23.[redacted] -p 10621
seokhyun@172.23.[redacted]'s password:
Activate the web console with: systemctl enable --now cockpit.socket

Last login: Fri Aug  9 03:57:38 2024 from [redacted]
[seokhyun@localhost ~]$ ls
Desktop  Documents  Downloads  Music  Pictures  Public  Templates  Videos
```

```
[seokhyun@localhost ~]$ exit
logout
Connection to 172.23.14.241 closed.
```

- ssh userID@접속IP -p 포트번호

Ex) ssh seokhyun@172.23.xxx.xxx –p 10621

SSH Port Number


```
[seokhyun@localhost ~]$ sudo semanage port -l | grep ssh
ssh_port_t                     tcp      22
[seokhyun@localhost ~]$ sudo semanage port -a -t ssh_port_t -p tcp 8080
Port tcp/8080 already defined, modifying instead
[seokhyun@localhost ~]$ sudo semanage port -l | grep ssh
ssh_port_t                     tcp      8080, 22
```

- ssh가 사용하고 있는 port 확인
  - sudo semanage port –l | grep ssh
- ssh에 port number 추가하기
  - sudo semanage port –a –t ssh_port_t –p tcp [port number]

```
[seokhyun@localhost ~]$ sudo semanage port -d -t 8080 -p tcp 8080
[seokhyun@localhost ~]$ sudo semanage port -l | grep ssh
ssh_port_t                     tcp      22
```

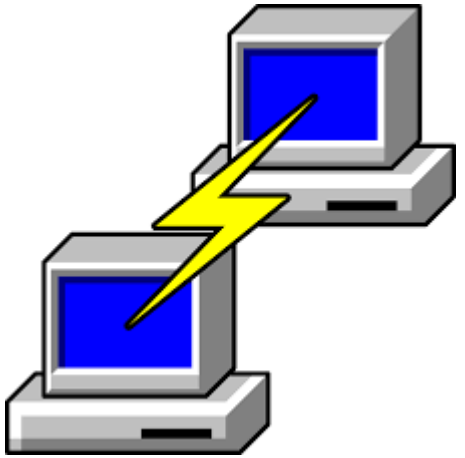
- ssh가 사용하는 port 삭제
  - sudo semanage port –d –t [port number] –p tcp [port number]

Putty

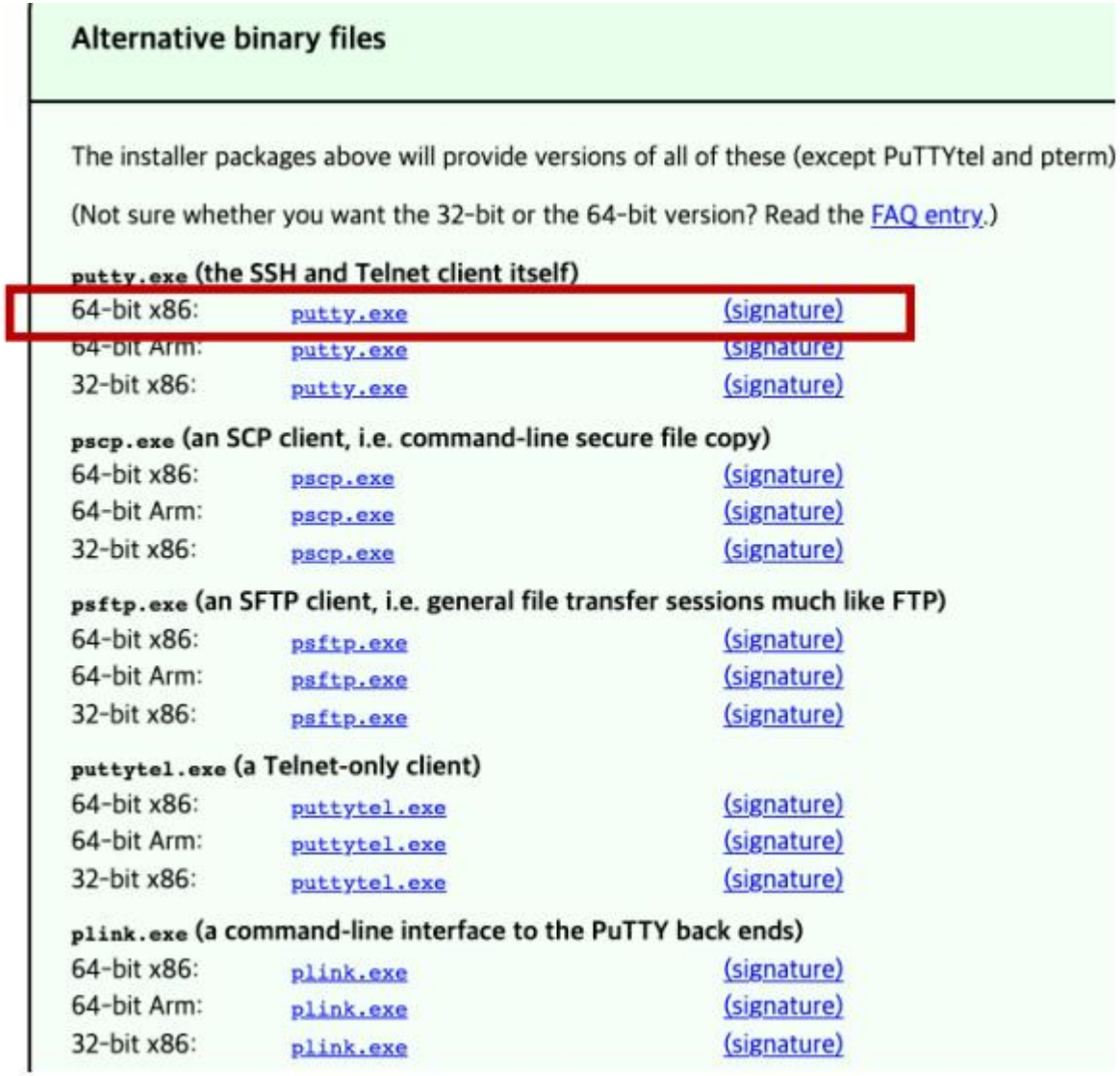
❖ Putty

- SSH, Telnet, TCP 접속을 위한 클라이언트
- 윈도우 환경에서 리눅스 서버나 다른 원격 시스템에 접속이 가능
- 오픈 소스이며 사용이 간편하여 많이 사용되는 SSH 클라이언트 중 하나

- https://www.putty.org/



Putty



Alternative binary files

The installer packages above will provide versions of all of these (except PuTTYtel and pterm)

(Not sure whether you want the 32-bit or the 64-bit version? Read the FAQ entry.)

putty.exe (the SSH and Telnet client itself)

64-bit x86:	putty.exe	(signature)
64-bit Arm:	putty.exe	(signature)
32-bit x86:	putty.exe	(signature)

pscp.exe (an SCP client, i.e. command-line secure file copy)

64-bit x86:	pscp.exe	(signature)
64-bit Arm:	pscp.exe	(signature)
32-bit x86:	pscp.exe	(signature)

psftp.exe (an SFTP client, i.e. general file transfer sessions much like FTP)

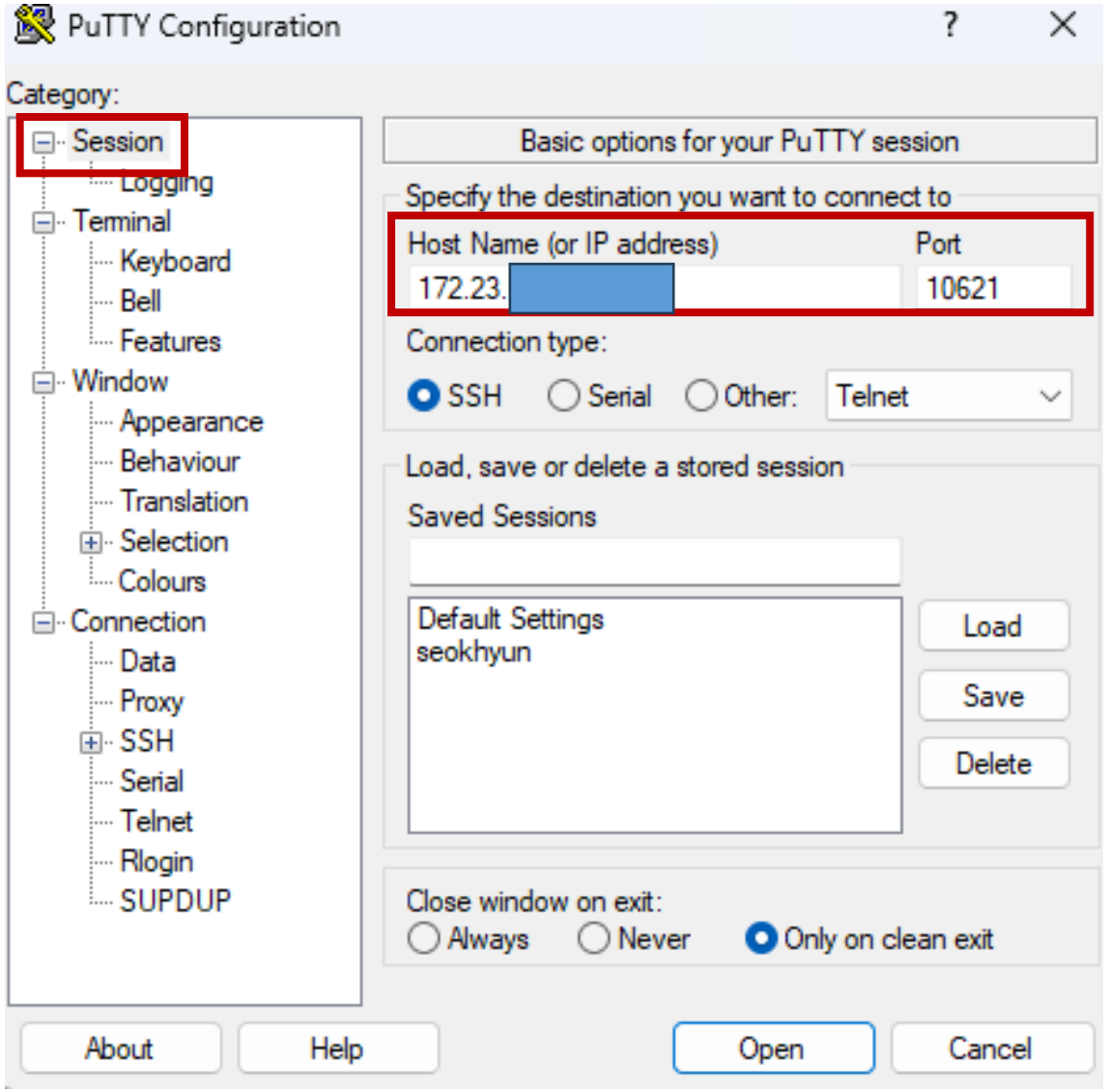
64-bit x86:	psftp.exe	(signature)
64-bit Arm:	psftp.exe	(signature)
32-bit x86:	psftp.exe	(signature)

puttytel.exe (a Telnet-only client)

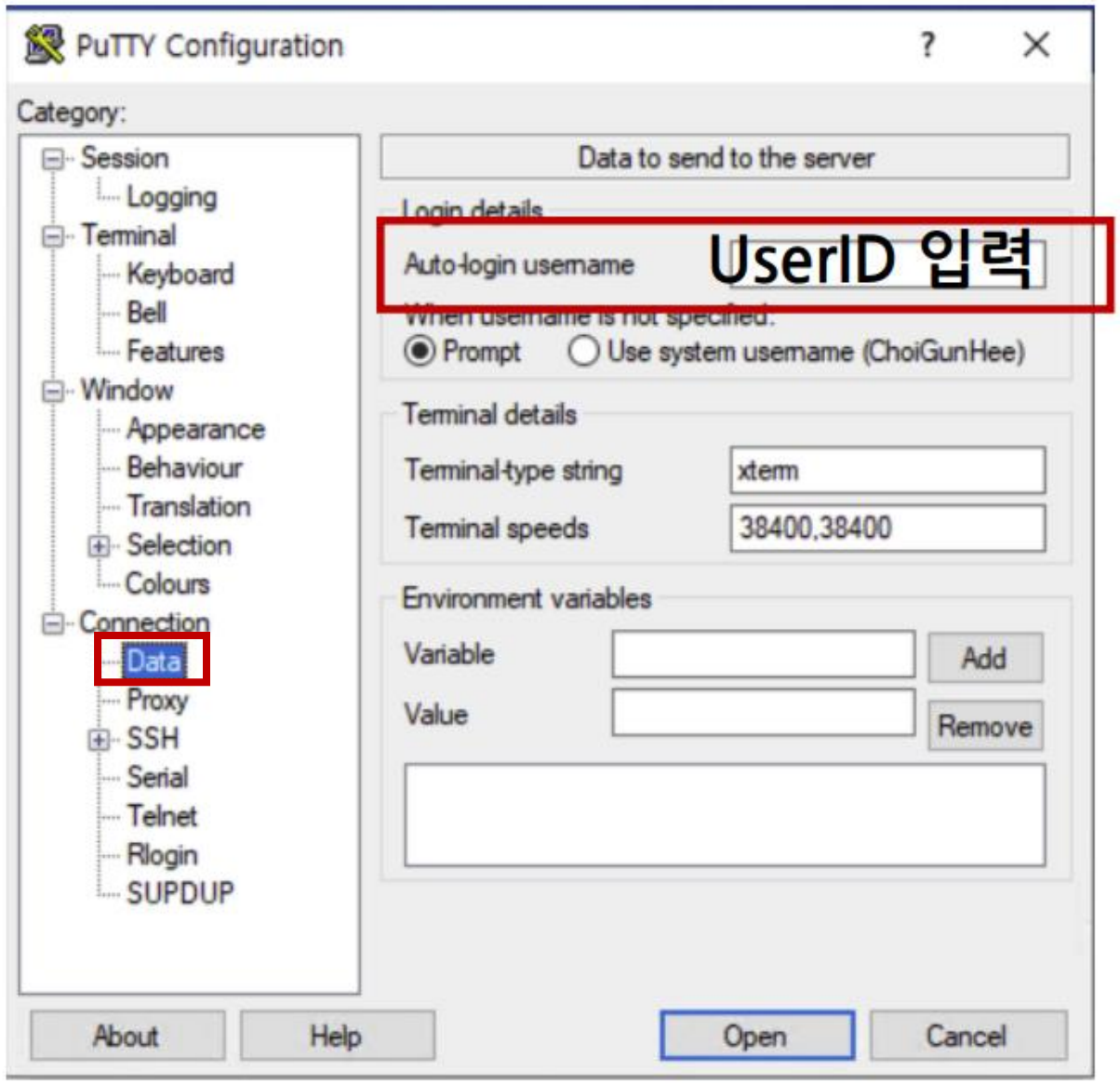
64-bit x86:	puttytel.exe	(signature)
64-bit Arm:	puttytel.exe	(signature)
32-bit x86:	puttytel.exe	(signature)

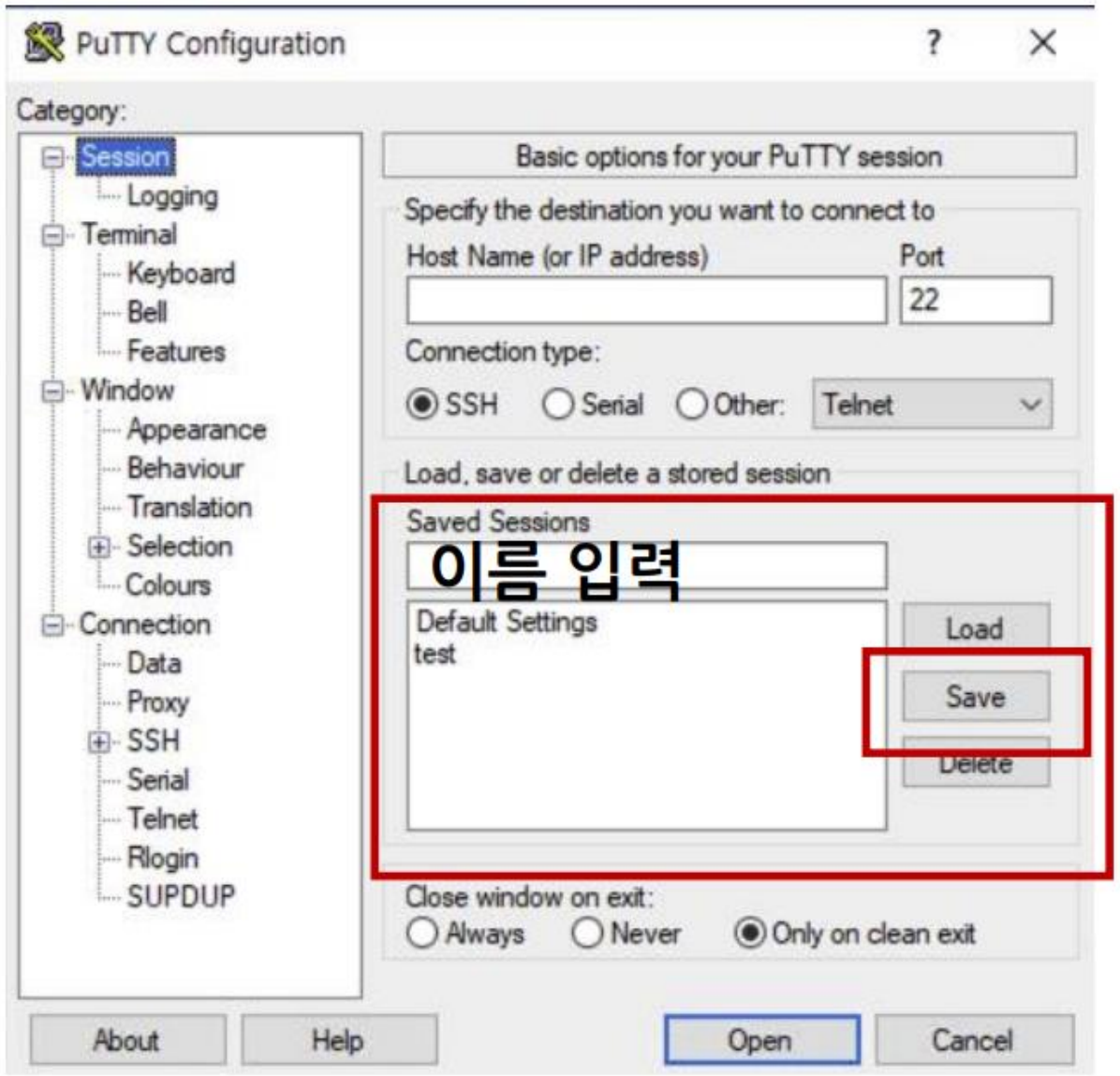
plink.exe (a command-line interface to the PuTTY back ends)

64-bit x86:	plink.exe	(signature)
64-bit Arm:	plink.exe	(signature)
32-bit x86:	plink.exe	(signature)

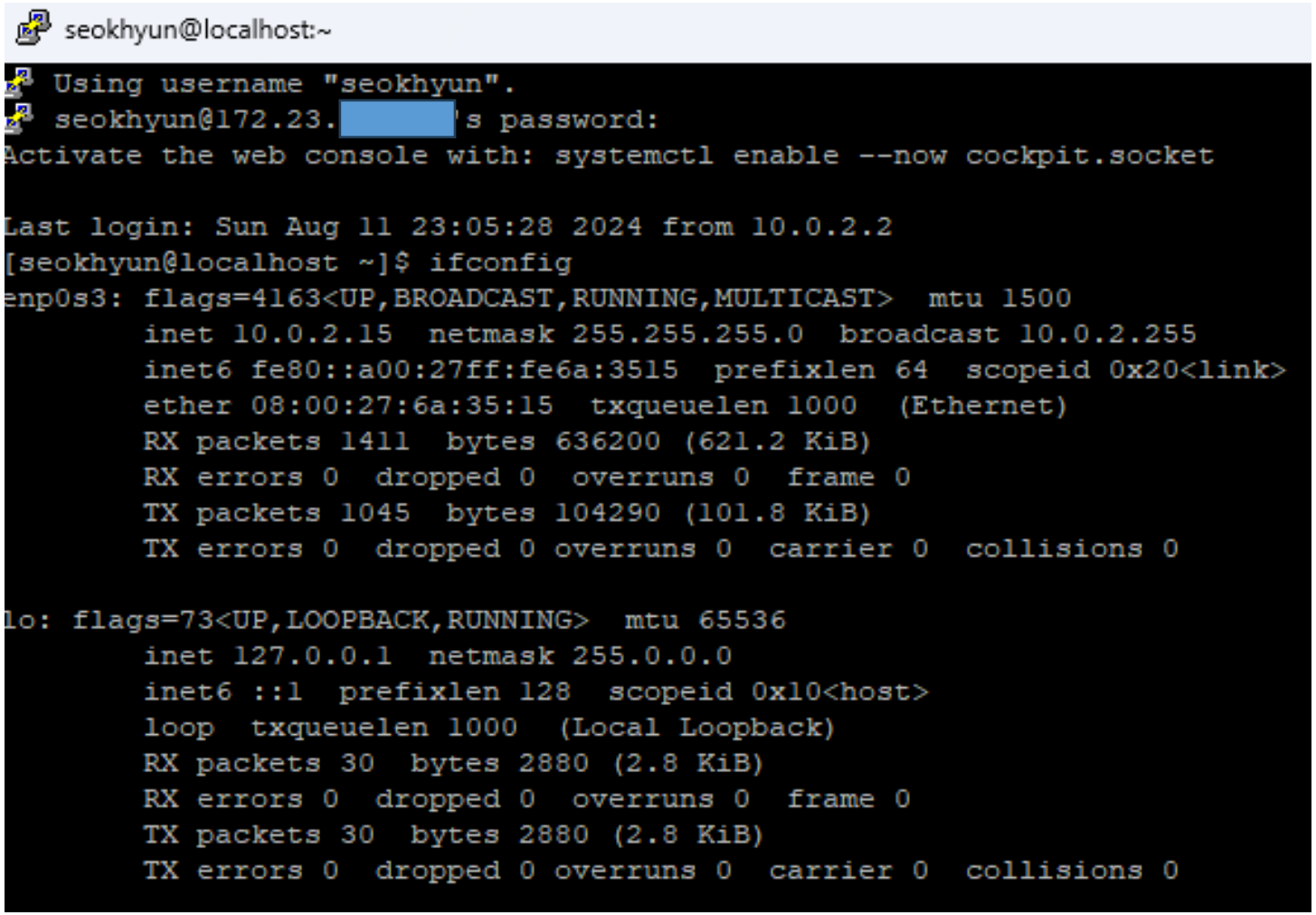


Putty


PuTTY Configuration
Category:
Session
Logging
Terminal
Keyboard
Bell
Features
Window
Appearance
Behaviour
Translation
Selection
Colours
Connection
Data
Proxy
SSH
Serial
Telnet
Rlogin
SUPDUP
Data to send to the server
Login details
Auto-login username
UserID 입력
Prompt
Use system username (ChoiGunHee)
Terminal details
Terminal-type string
xterm
Terminal speeds
38400,38400
Environment variables
Variable
Add
Value
Remove
About
Help
Open
Cancel

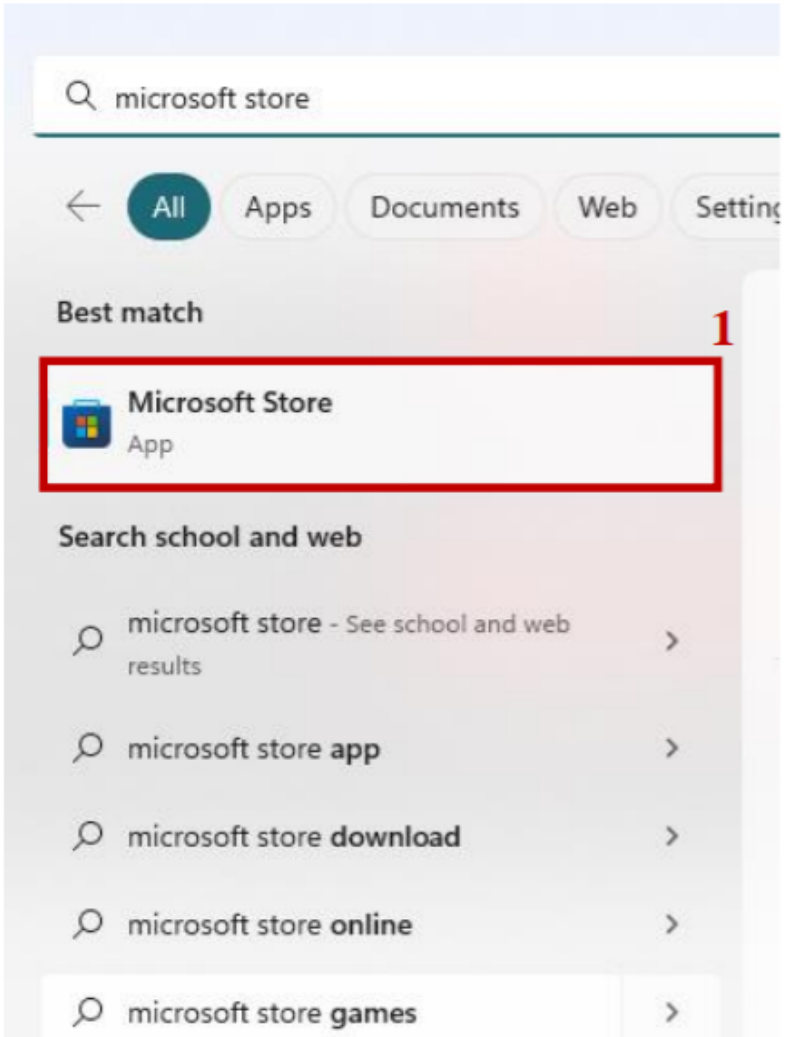

PuTTY Configuration
Category:
Session
Logging
Terminal
Keyboard
Bell
Features
Window
Appearance
Behaviour
Translation
Selection
Colours
Connection
Data
Proxy
SSH
Serial
Telnet
Rlogin
SUPDUP
Basic options for your PuTTY session
Specify the destination you want to connect to
Host Name (or IP address)
Port
22
Connection type:
SSH
Serial
Other:
Telnet
Load, save or delete a stored session
Saved Sessions
이름 입력
Default Settings
test
Load
Save
Delete
Close window on exit:
Always
Never
Only on clean exit
About
Help
Open
Cancel

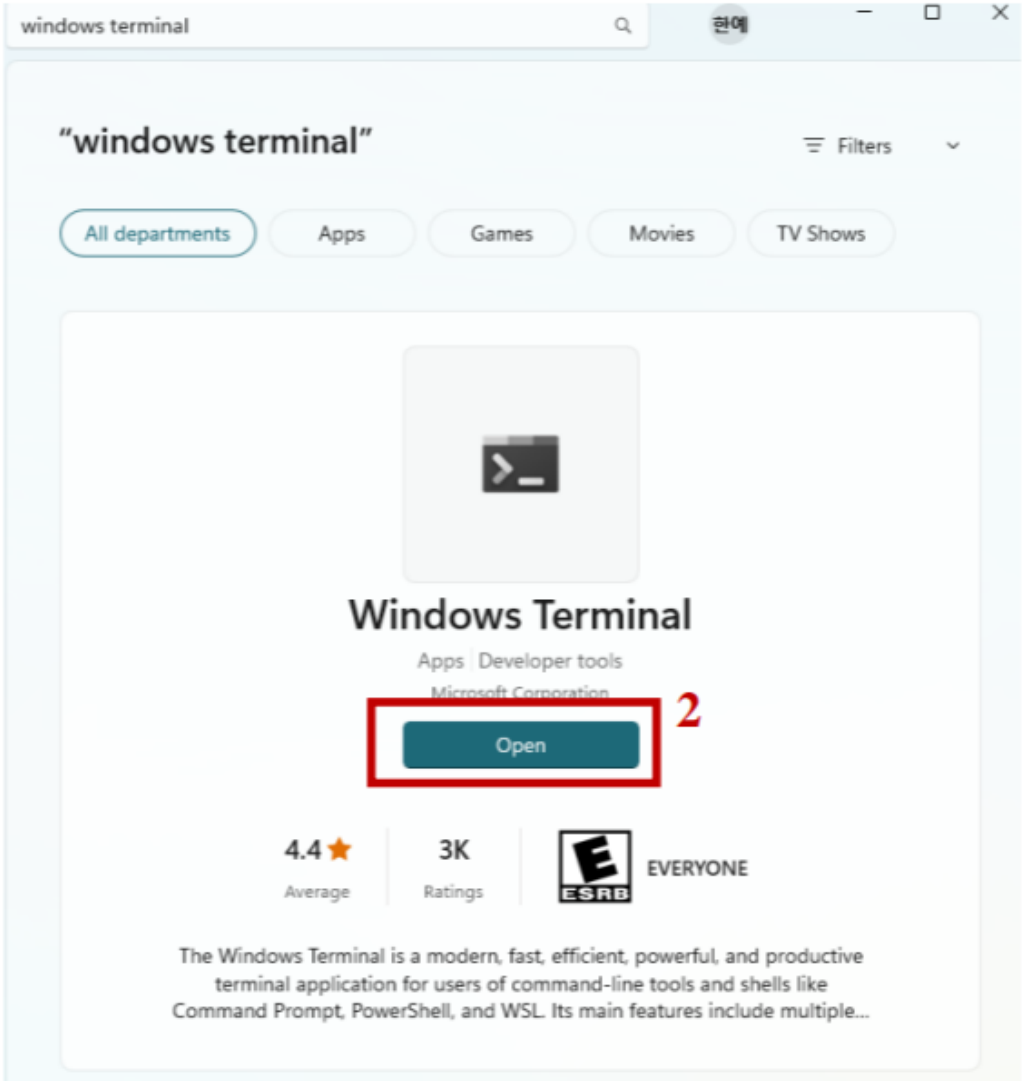
Putty

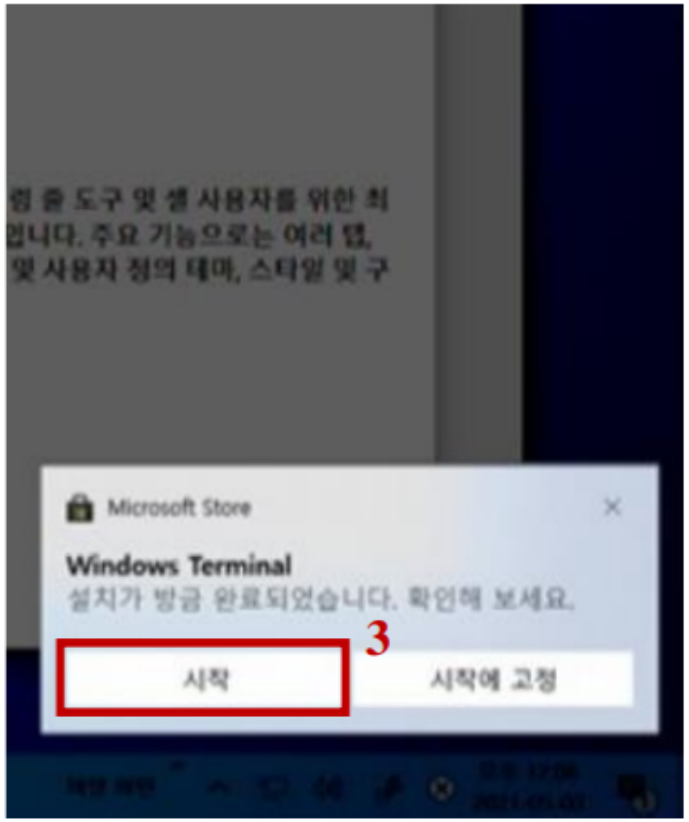


- Password 입력
- 정상적으로 접속이 되었는지 확인을 위해 ip정보 확인

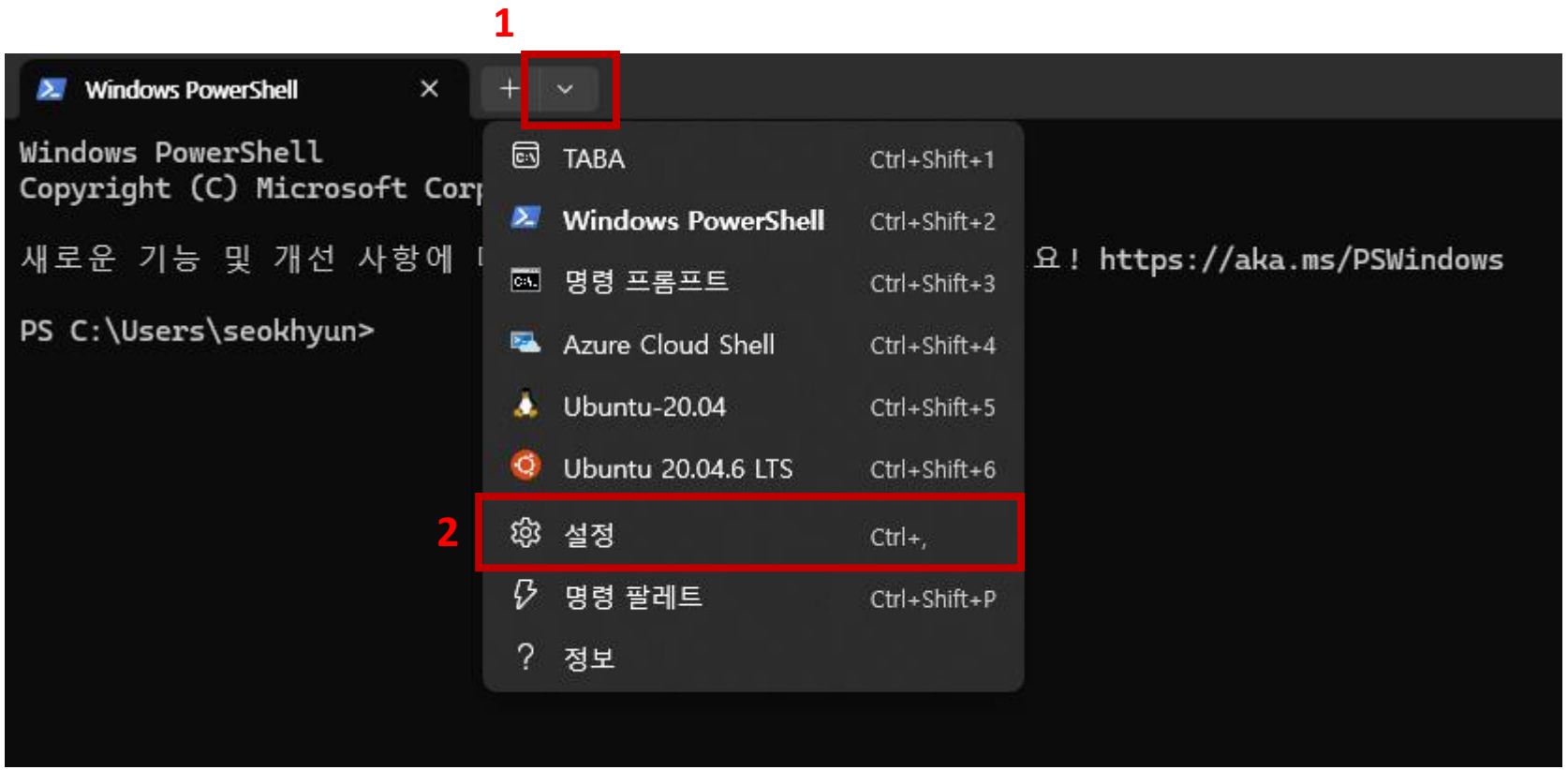
Window Terminal Installation

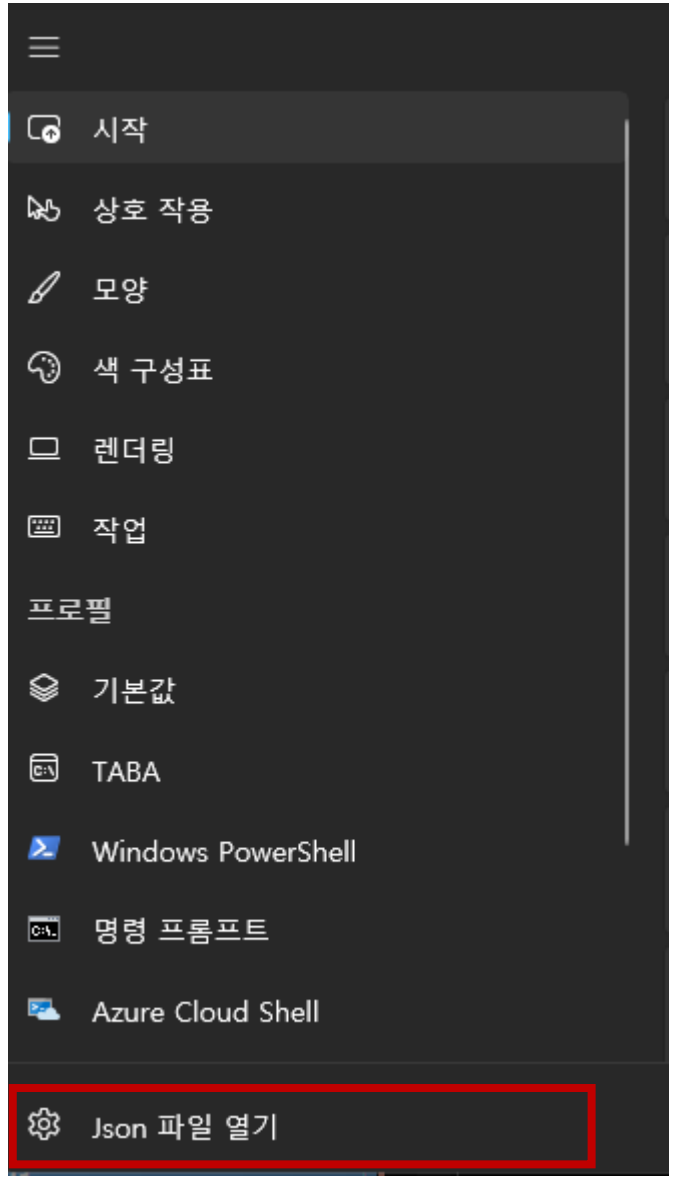






Window Terminal 설정





Window Terminal 설정


```
PS C:\Users\seokhyun> [guid]::NewGuid()

Guid
----
514611bc-8b02-4abc-ade9-
```

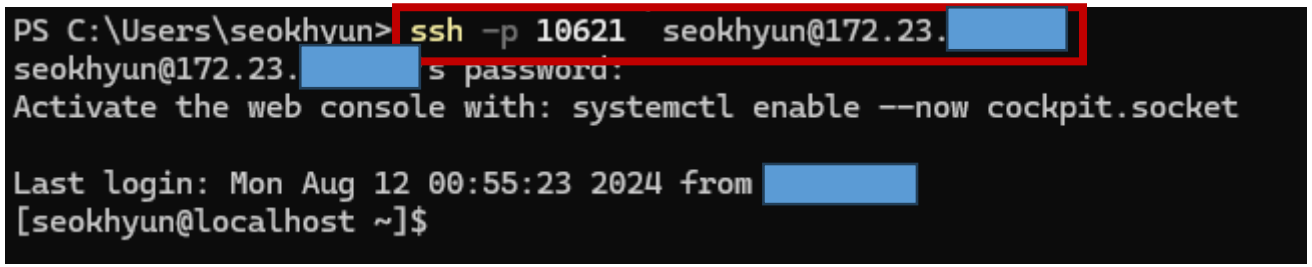
- Window powershell
  - [guid]::Newguid()

```
"profiles":
{
    "defaults": {},
    "list":
    [
        {
            "guid" : "{514611bc-8b02-4abc-ade9-
            "hidden" : false,
            "name" : "TABA",
            "suppressApplicationTitle": true,
            "commandline": "ssh seokhyun@172.23
            "cursorShape": "filledBox",
            "colorScheme": "Tango Dark"
        },
```

- commandline
  - 프로필에서 사용되는 실행 파일
  - ex) ssh seokhyun@172.23.xxx.xxx
- Name
  - 메뉴에 표시될 프로필 이름
  - 시작 시 셸에 전달할 제목으로 사용

Window Terminal로 접속

- Window powershell
  - ssh name@IP address
  - ex) ssh seokhyun@172.23.xxx.xxx
  - 기본적으로 22번 포트는 사용하지 않기 때문에 접속이 불가



- ssh –p [port number] commdline
  - ex) ssh –p 10621 seokhyun@172.23.xxx.xxx
- 윈도우에서도 ssh를 이용해 접속 가능