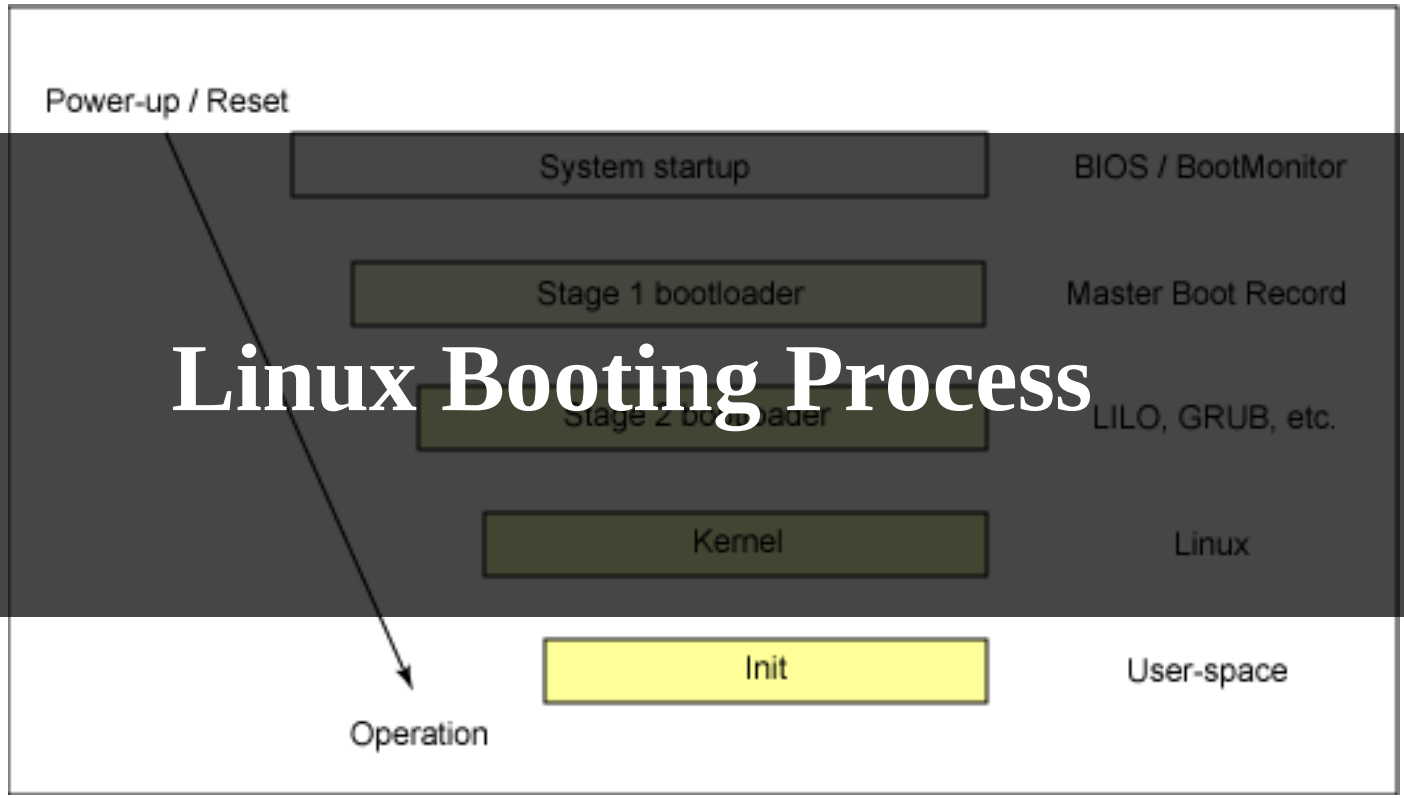
Chapter 11
Linux Administration

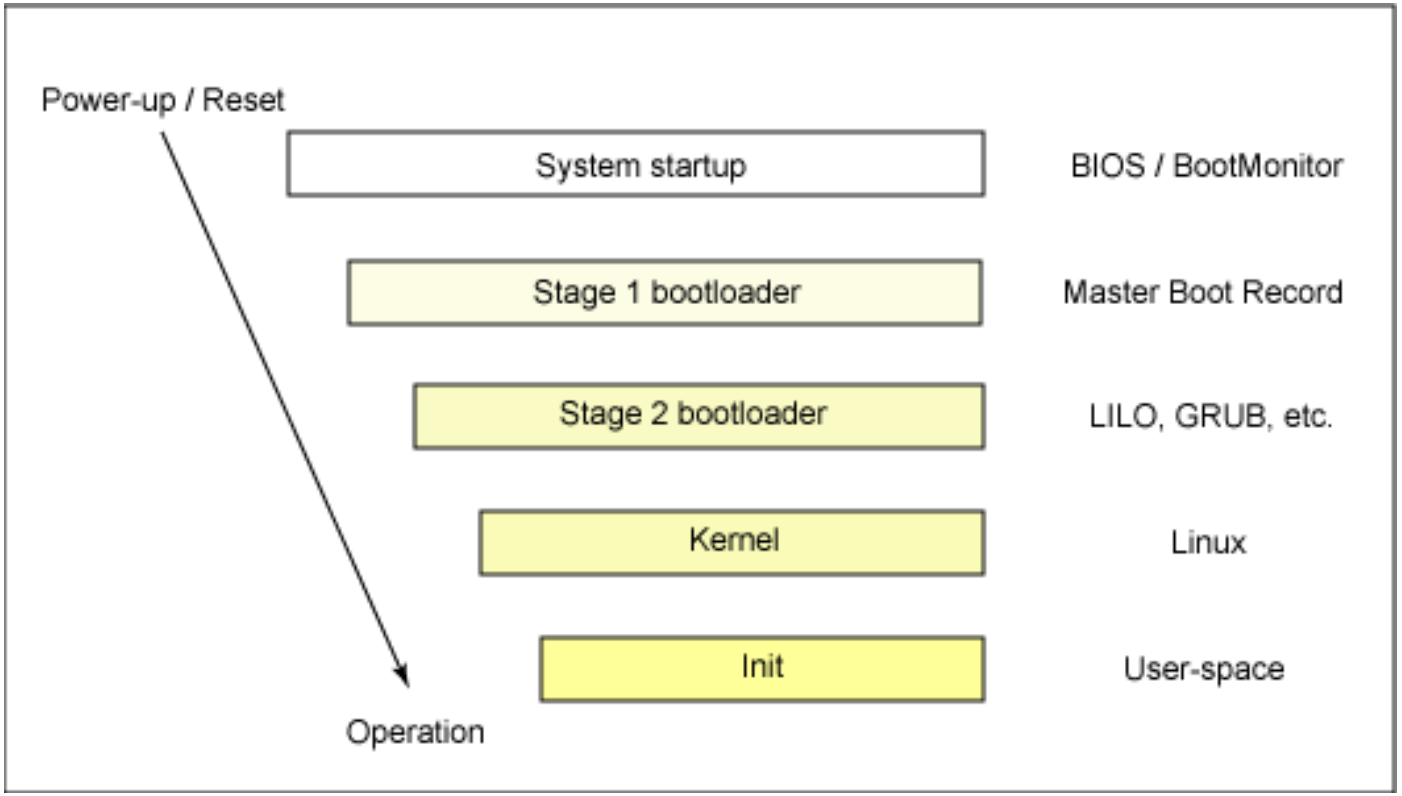
Open Source SW Development
CSE22300

Linux Booting Process



Booting Process

- **Booting is a bootstrapping process that starts operating systems when the user turns on a computer system**



Booting Sequence

1. **Turn on**
2. **CPU jump to address of BIOS (0xFFFF0)**
3. **BIOS runs POST (Power-On Self Test)**
4. **Find bootale devices**
5. **Loads and execute boot sector form MBR**
6. **Load OS**

BIOS

- **Code program embedded on a chip**
- **Software code run by a computer when first powered on**
- **The primary function of BIOS**
  - **recognizes and controls various devices that make up the computer.**

BIOS on board

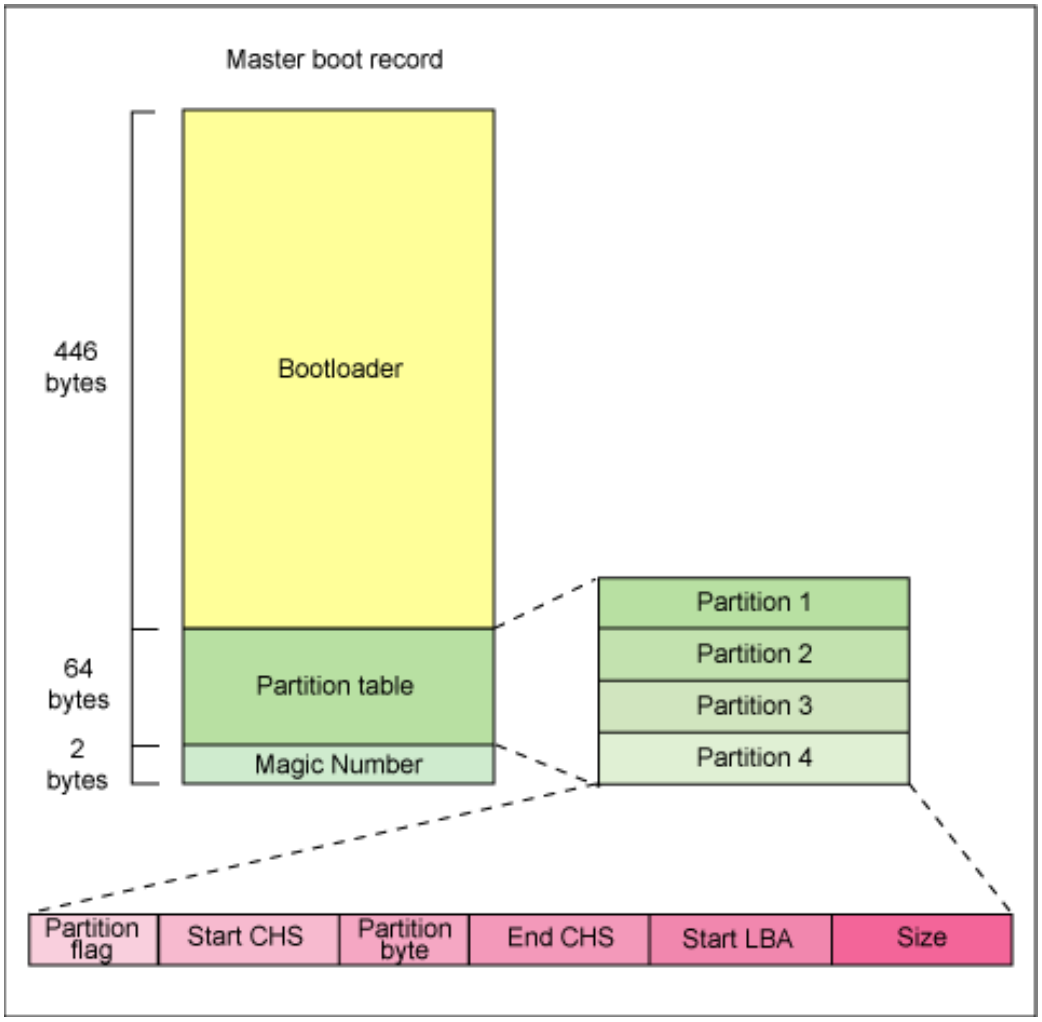
BIOS on screen

MBR

- **Located in the first sector (512 Byte) on the disk**
  - **sector 1 of cylinder 0, head 0**

- **OS is booted from a hard disk, where the Master Boot Record (MBR) contains the primary boot loader**
- **After the MBR is loaded into RAM, the BIOS yields control to it.**

MBR


Master boot record
446 bytes
Bootloader
64 bytes
Partition table
2 bytes
Magic Number
Partition 1
Partition 2
Partition 3
Partition 4
Partition flag
Start CHS
Partition byte
End CHS
Start LBA
Size

MBR

- **The first 446 bytes**
  - **The primary boot loader**
  - **Contains both executable code and error message text**
- **The next sixty-four bytes**
  - **the partition table**
  - **Contains a record for each of four partitions**

- **The MBR ends with two bytes that are defined as the magic number (0xAA55)**
  - **Validation check of the MBR**

Bootloader

- **Called the kernel loader**
  - **The task at this stage is to load the Linux kernel**

- **Optional, initial RAM disk**
- **GRUB and LILO are the most popular Linux boot loader.**

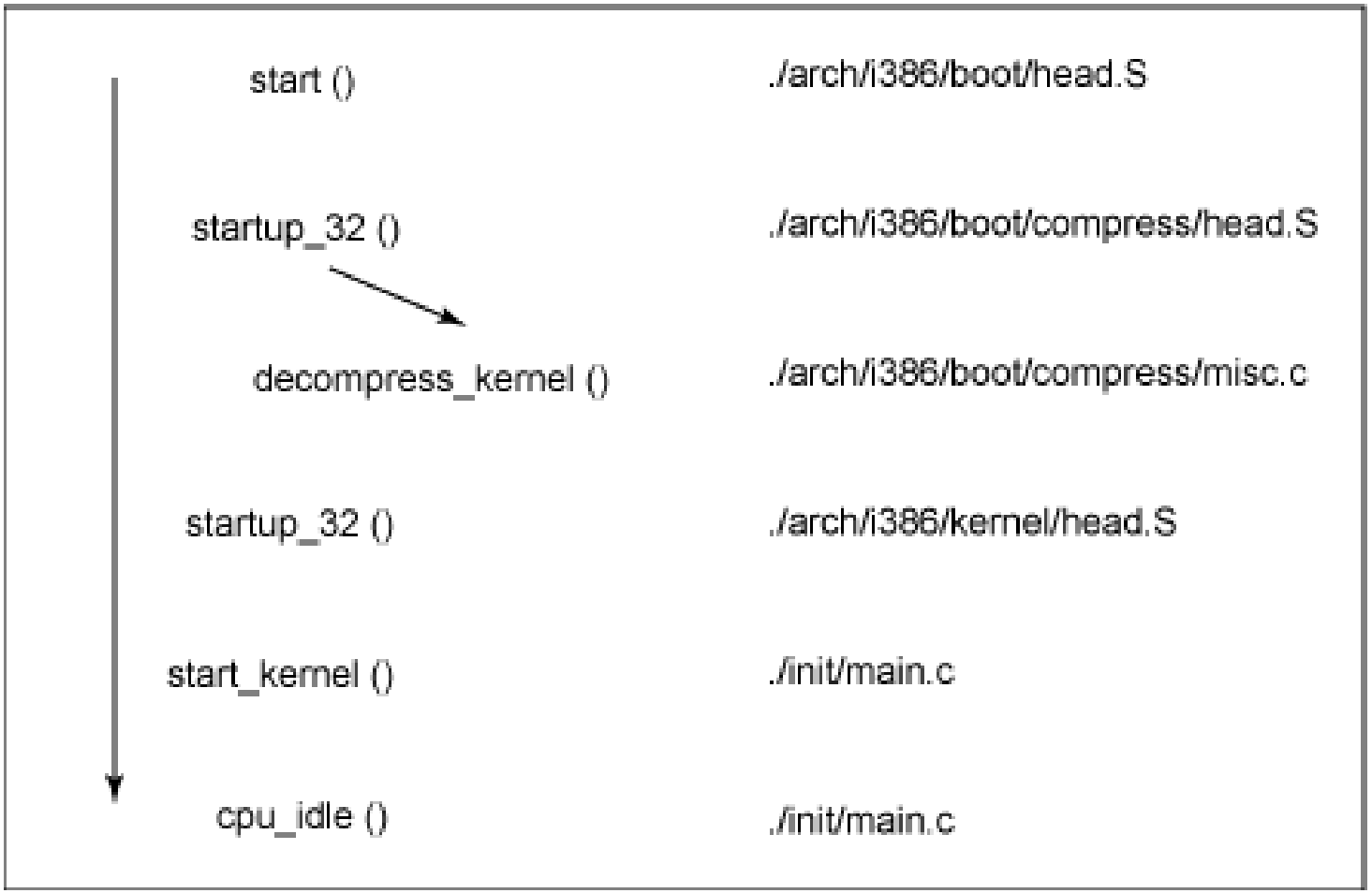
GRUB: GRand Unified Bootloader

- **GRUB is an operating system independent boot loader**
- **A multiboot software packet from GNU**
- **Flexible command line interface**
- **File system access**
- **Support multiple executable format**
- **Support diskless system**
- **Download OS from network**
- **Etc.**

Kernel Image

- **Kernel**
  - **Always store on memory until computer is tern off**
- **Kernel image**
  - **Not an executable kernel, but a compress kernel image**
- **zImage**
  - **size less than 512 KB**
- **bzImage**
  - **size greater than 512 KB**

Start Up of Linux Kernel



Init process

- **The First Thing**
  - **the kernel does is to execute init program**
- **Init**
  - **the root/parent of all processes executing on Linux**
  - **init starts is a script /etc/rc.d/rc.sysinit**
- **Based on the appropriate run-level, scripts are executed to start various processes to run the system and make it functional**

The Linux Init Processes

- **The init process**
  - **Identified by process id "1“**
  - **responsible for starting system processes as defined in the /etc/inittab file**
  - **On ubuntu, init process refer to /etc/init directory**

- **Init typically will start multiple instances of "getty" which waits for console logins which spawn one's user shell process**

- **Upon shutdown, init controls the sequence and processes for shutdown**

Run-level

- **Run-level**
  - **software configuration of the system which allows only a selected group of processes to exist**

- **The processes spawned by init for each of these runlevels are defined configuration files in the /etc/init directory**
- **Init can be in one of eight runlevels: 0-6**

Run-level

Runlevel	Scripts Directory (Red Hat/Fedora Core)	State
0	/etc/rc.d/rc0.d/	shutdown/halt system
1	/etc/rc.d/rc1.d/	Single user mode
2	/etc/rc.d/rc2.d/	Multiuser with no network services exported
3	/etc/rc.d/rc3.d/	Default text/console only start. Full multiuser
4	/etc/rc.d/rc4.d/	Reserved for local use. Also X-windows (Slackware/BSD)
5	/etc/rc.d/rc5.d/	XDM X-windows GUI mode (Redhat/System V)
6	/etc/rc.d/rc6.d/	Reboot

- **rc#.d files are the scripts for a given run level that run during boot and shutdown**
- **The scripts are found in the directory /etc/rc.d/rc#.d/ where the symbol # represents the run level**

Init.d

- **Daemon is a background process**
- **init.d is a directory that admin can start/stop individual demons by changing on it**
  - **/etc/rc.d/init.d/ (Red Hat/Fedora)**
  - **/etc/init.d/ (Debian, Ubuntu)**

- **Admin can issuing the command and either the start, stop, status, restart or reload option**

- **i.e. to stop the web server:**
  - **cd /etc/init.d/**
  - **httpd stop**

User management

The Superuser

- **Superuser**
  - **Issue any command, access any file, and perform every function**
  - **a.k.a. root**
  - **Technically, can change to anything**
  - **User and group number 0**

- **Must limit use of root**
  - **Inexperienced users can cause serious harm**
  - **Use of root for non-privileged tasks unnecessary and can be open to attack**
  - **Security and privacy violations – root can look at anyone's files**
- **Limit what root can do remotely**
- **Ensure a strong password**

Creating a New User Account

- **Manual**
  - **Add an entry in /etc/passwd and /etc/shadow file**
  - **Use next uid and suitable gid**

- **Command**
  - **Use useradd or adduser command to create a new user**
  - **useradd –g <group> -d <home directory> -c <comment> -s <shell> login-name**
  - **groupadd to create a new group (groupadd group-name)**

/etc/password

- **The /etc/passwd file**
  - **List of users recognized by the system**
  - **It can be extended or replaced by a directory service,**
  - **It's complete and authoritative only on standalone systems.**

- **Used at login time**
  - **The system consults /etc/passwd**
  - **Determine a user's UID and home directory, among other things**
  - **Each line in the file represents one user and contains seven fields separated by colons.**

/etc/password

- **/etc/passwd Holds user account info**
- **Included fields are:**
- **Login name**
- **User Id (uid)**
- **Group Id (gid)**
- **General Comment about the user**
- **Home Directory**
- **Shell**

/etc/password

- **/etc/passwd Holds user account info**
- **Included fields are:**
  - **Login name**
  - **User Id (uid)**
  - **Group Id (gid)**
  - **General Comment about the user**
  - **Home Directory**
  - **Shell**

- **The actual encrypted passwords are stored in /etc/shadow on Linux**

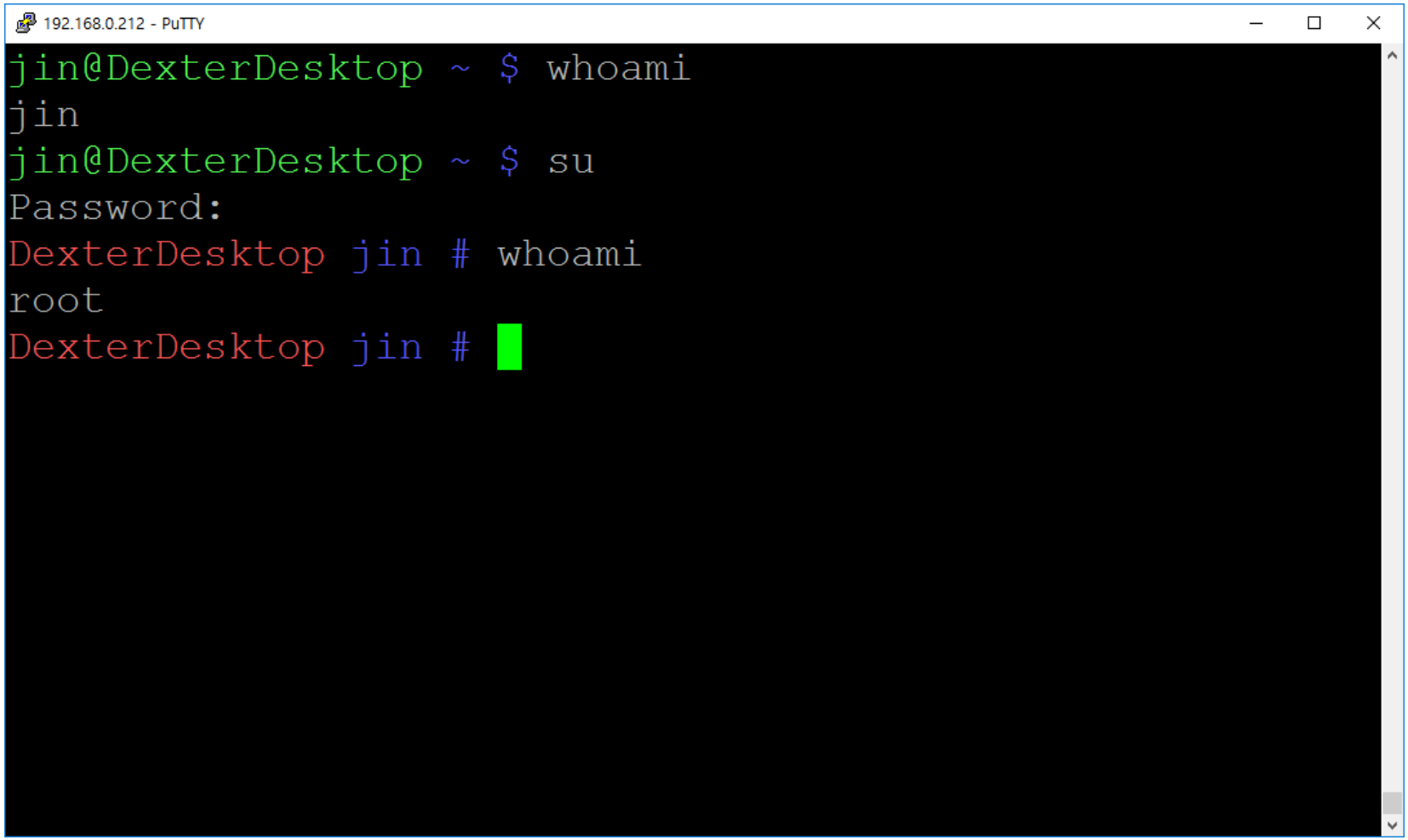
/etc/shadow

- /etc/shadow
  - Contains the encrypted password information for users' accounts
- Included fields are:
  - Login name
  - Encrypted password
  - Days since Jan 1, 1970 that password was last changed
  - Days before password may not be changed
  - Days after which password must be changed
  - Days before password is to expire that user is warned
  - Days after password expires that account is disabled
  - Days since Jan 1, 1970 that account is disabled

su

- **Short for *substitute* or *switch user***
- **Syntax: `su [options] [username]`**
  - **If `username` is omitted, `root` is assumed**
- **After issuing command, prompted for that user's password**
- **A new shell opened with the privileges of that user**
- **Once done issuing commands, must type exit**

su


192.168.0.212 - PuTTY
jin@DexterDesktop ~ $ whoami
jin
jin@DexterDesktop ~ $ su
Password:
DexterDesktop jin # whoami
root
DexterDesktop jin #

sudo

- **Allows you to issue a single command as another user**
- **`sudo [options] [-u user] command`**
  - **Again, if no user specified, root assumed**
  - **New shell opened with user's privileges**
  - **Specified command executed**

- **Must configure a user to run commands as another user when using `sudo`**
  - **Permissions stored in `/etc/sudoers`**
  - **Permissions granted to users or groups, to certain commands or all, and with or without password being required**

sudo


192.168.0.212 - PuTTY
jin@DexterDesktop ~ $ sudo su
[sudo] password for jin:
DexterDesktop jin # whoami
root
DexterDesktop jin #

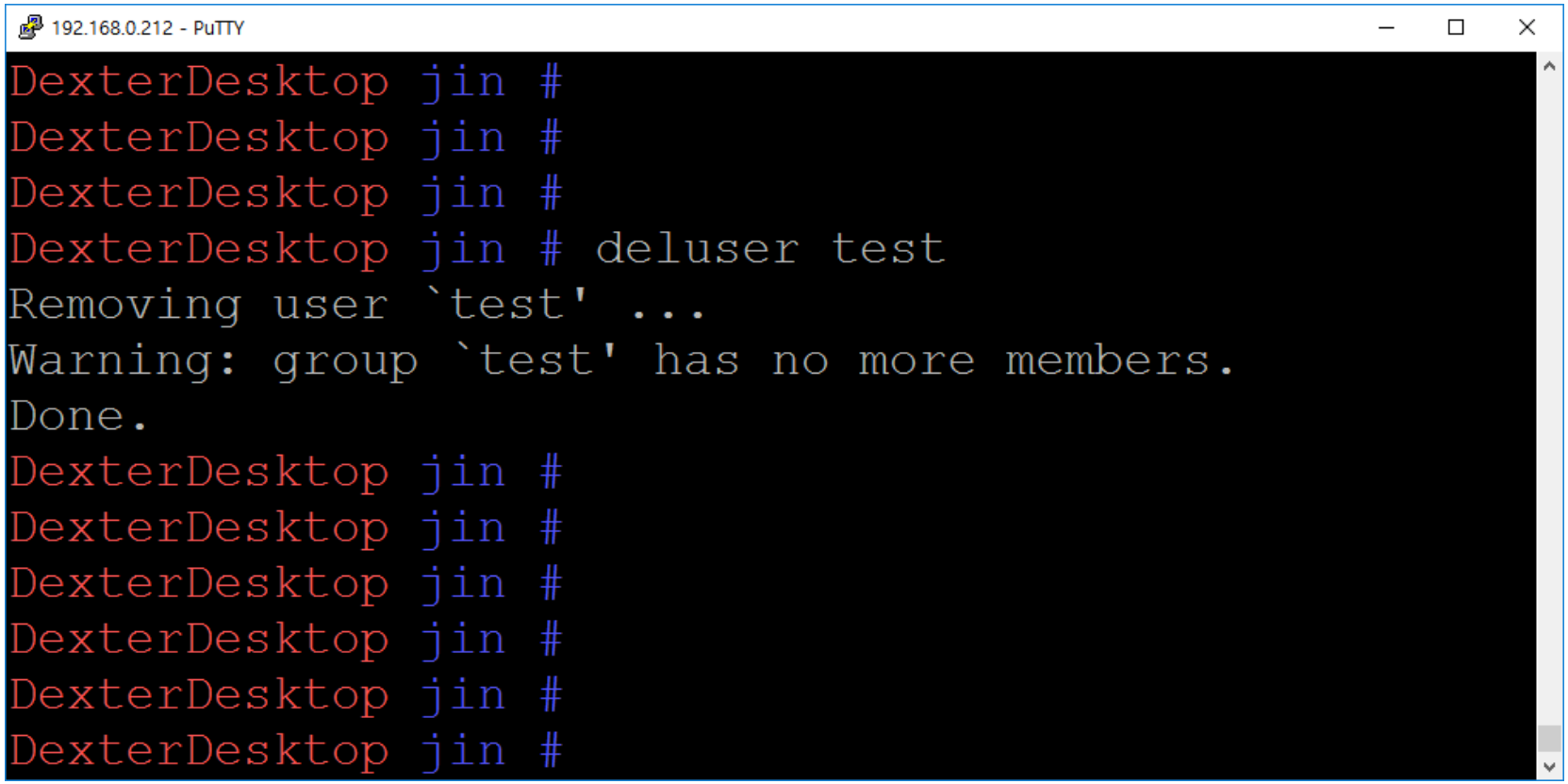
useradd / adduser

- **Create a new user or update default new user information**
  - **useradd –g <group> -s <shell> -c <comment> –d <home directory> <username>**
  - **adduser <username>**

192.168.0.212 - PuTTY
DexterDesktop jin # adduser test
Adding user `test' ...
Adding new group `test' (1001) ...
Adding new user `test' (1001) with group `test' ...
Creating home directory `/home/test' ...
Copying files from `/etc/skel' ...
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
Changing the user information for test
Enter the new value, or press ENTER for the default
Full Name []: Test
Room Number []: Test
Work Phone []: Test
Home Phone []: Test
Other []: Test
Is the information correct? [Y/n] y
DexterDesktop jin #
DexterDesktop jin #

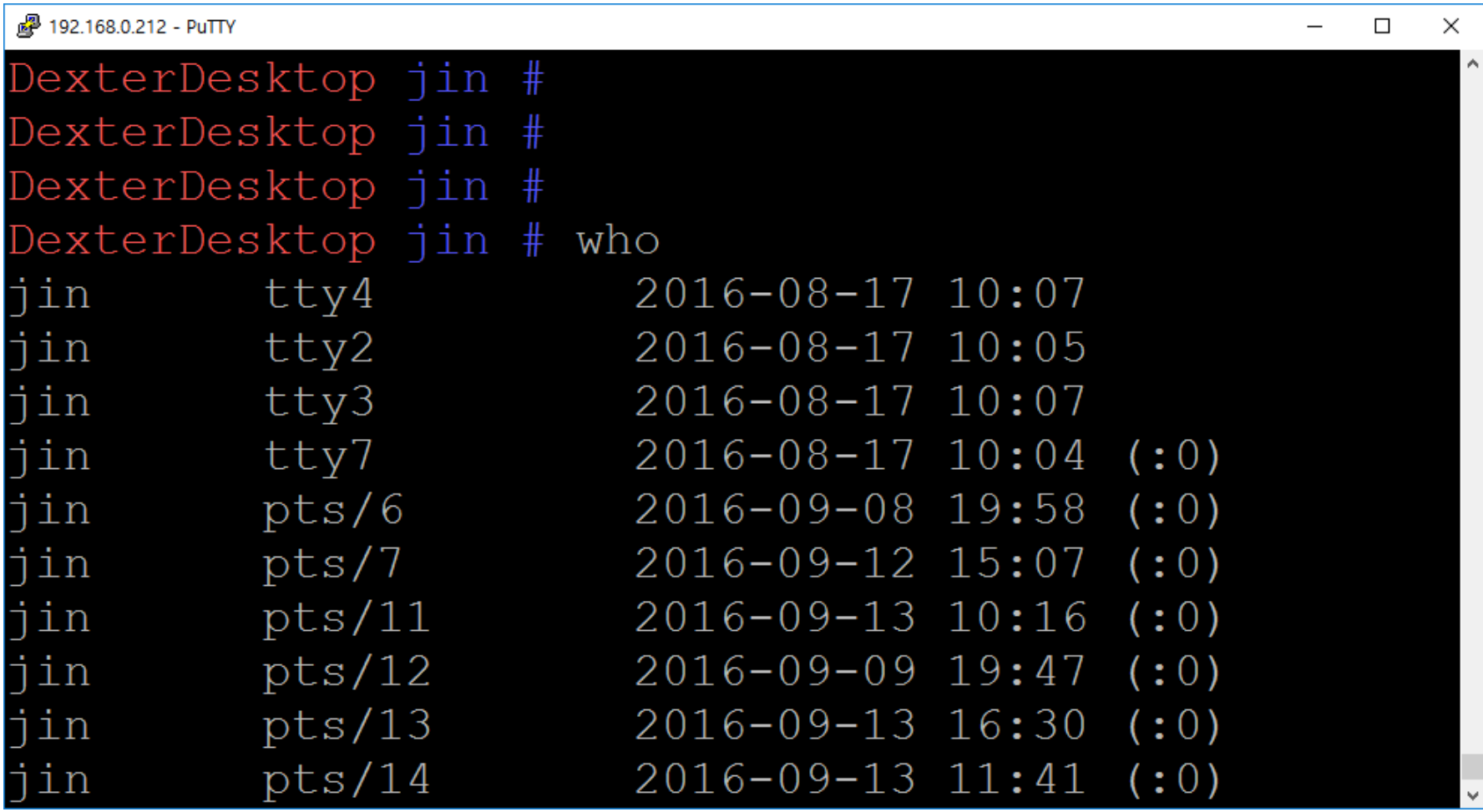
userdel / deluser

- **delete a user**
- **deluser <username>**
  - **userdel <username>**



who

- **Display the users logged in.**



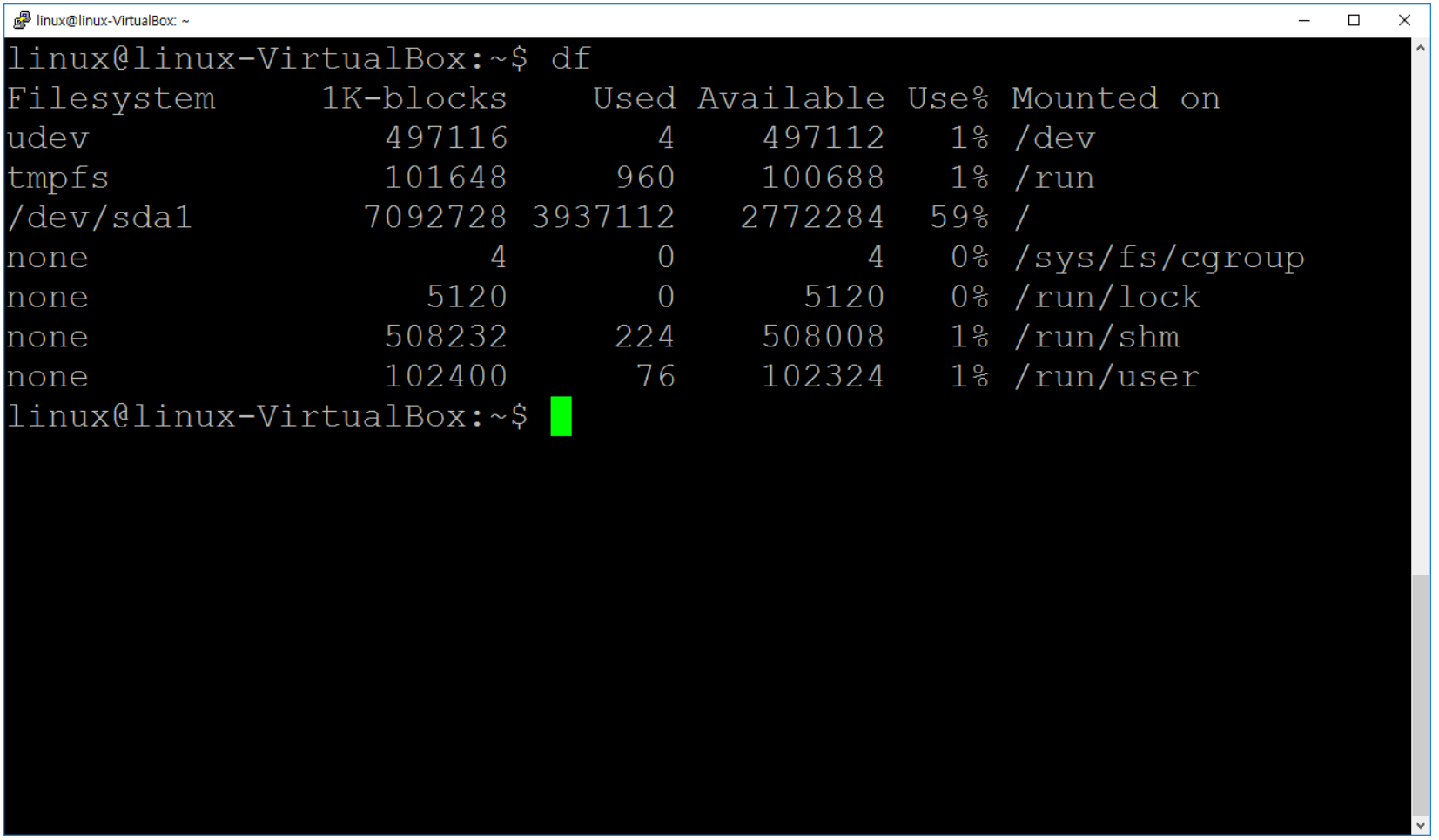
whoami

- **Print effective user id.**

Filesystem Management

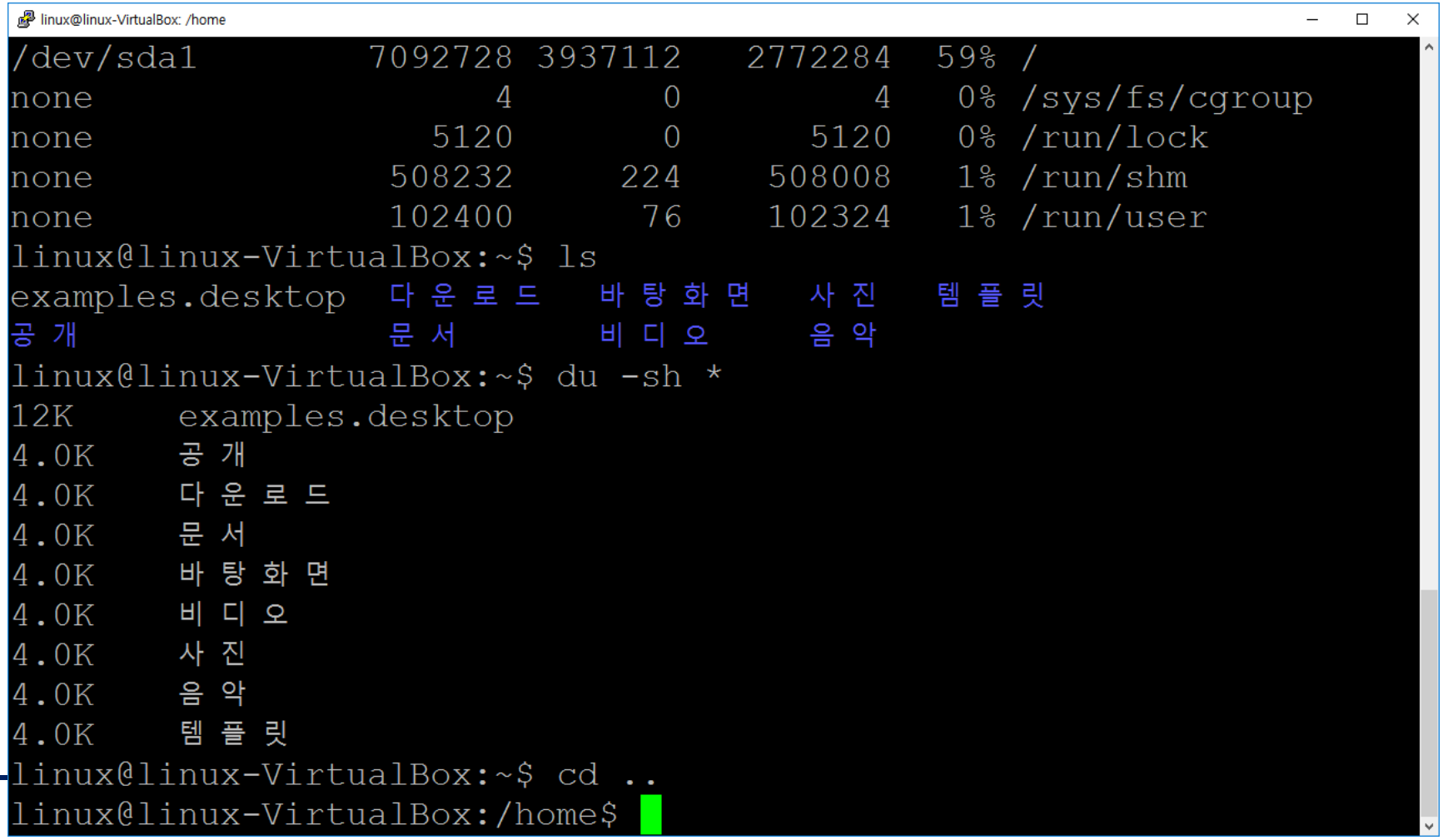
df

- **Shows the disk free space on one or more filesystems**



du

- **Shows how much disk space a directory and all its files contain**

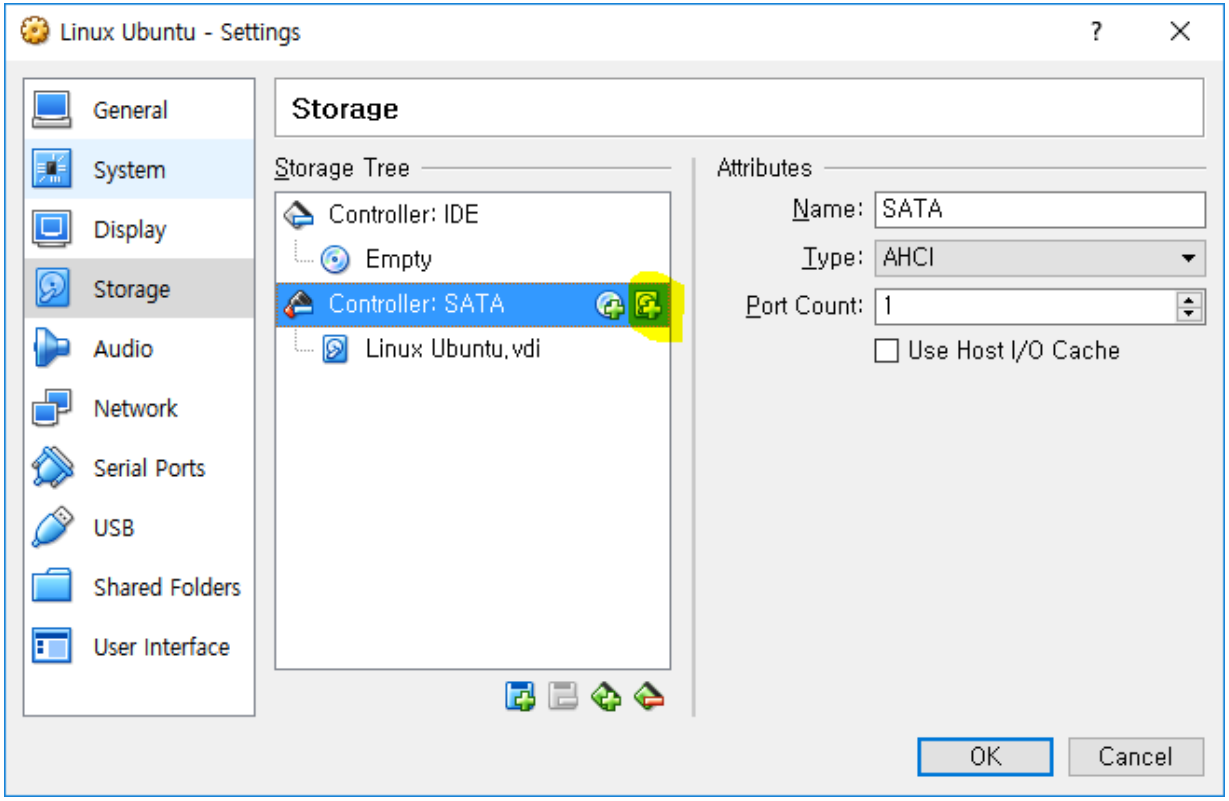


Mounting File Systems

- **General Procedure for Mounting a File System**
  - **1. Format the disk drive.**
  - **2. Partition the disk drive.**
  - **3. mkfs the partition.**
  - **4. Create a mount point for the file system.**
  - **5. Mount the file system.**

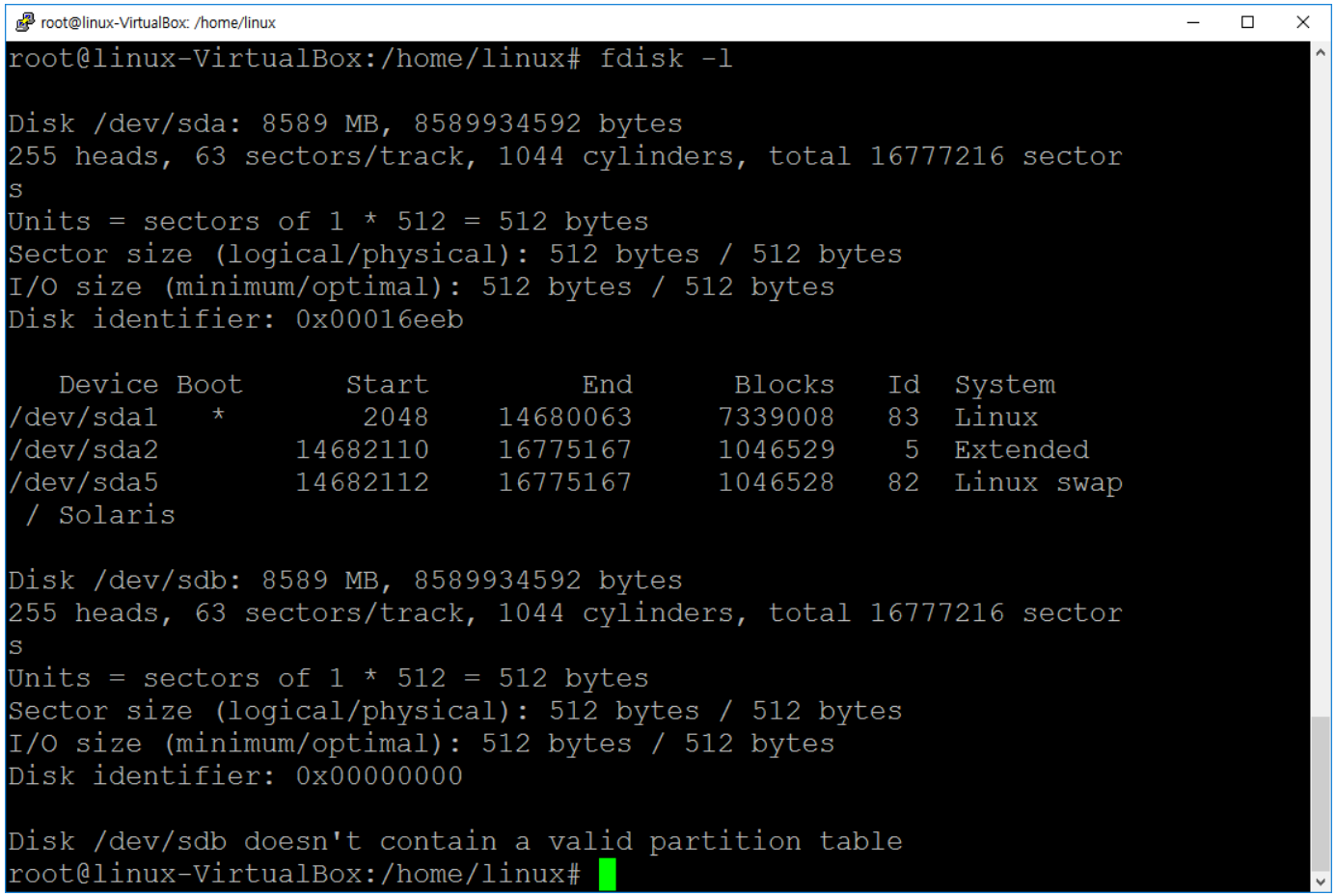
Mounting File Systems

- **Shtudown**
  - **shutdown –h now**
- **Add a new virtual disk**



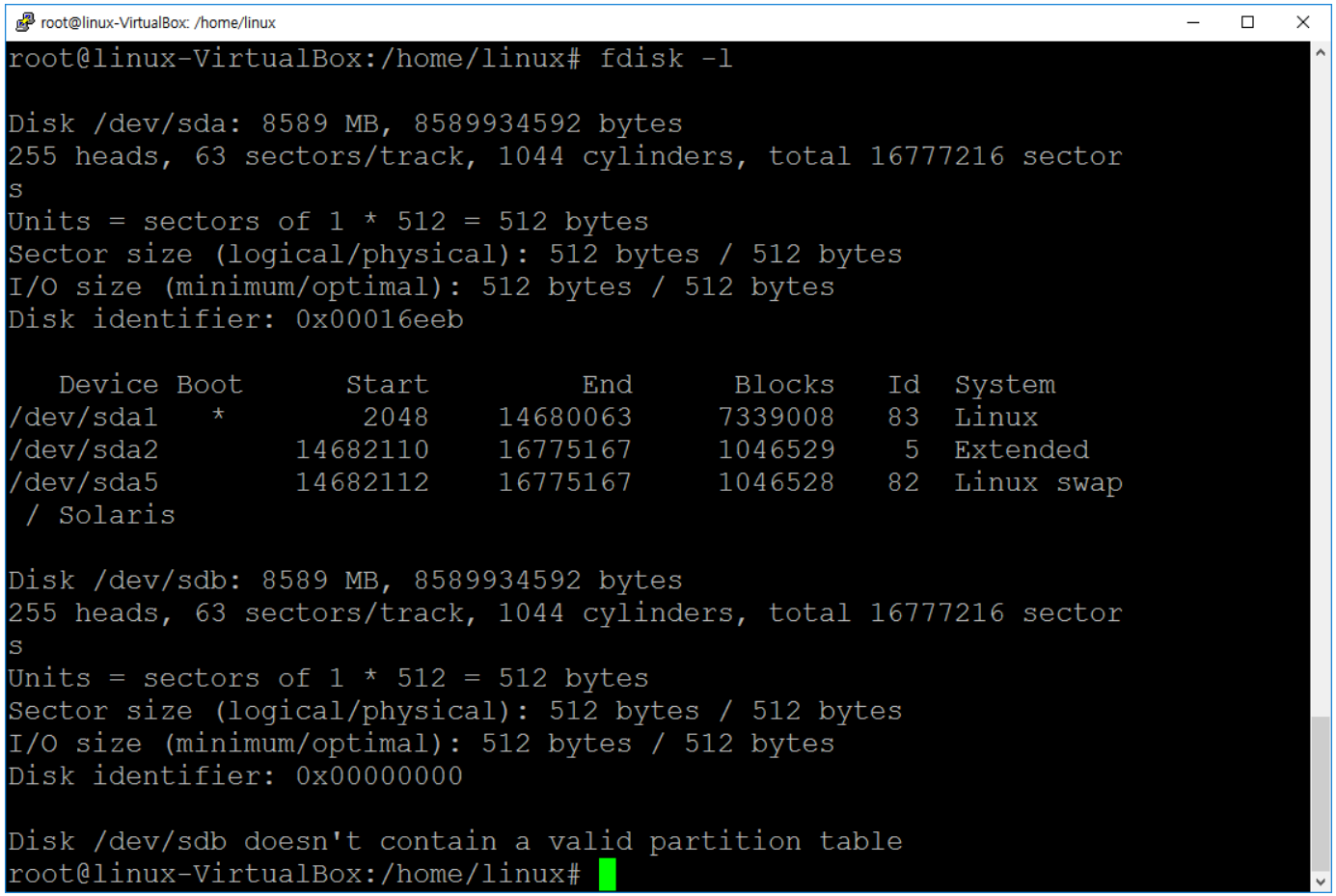
Mounting File Systems

- **List disk lists**
  - **fdisk –l**



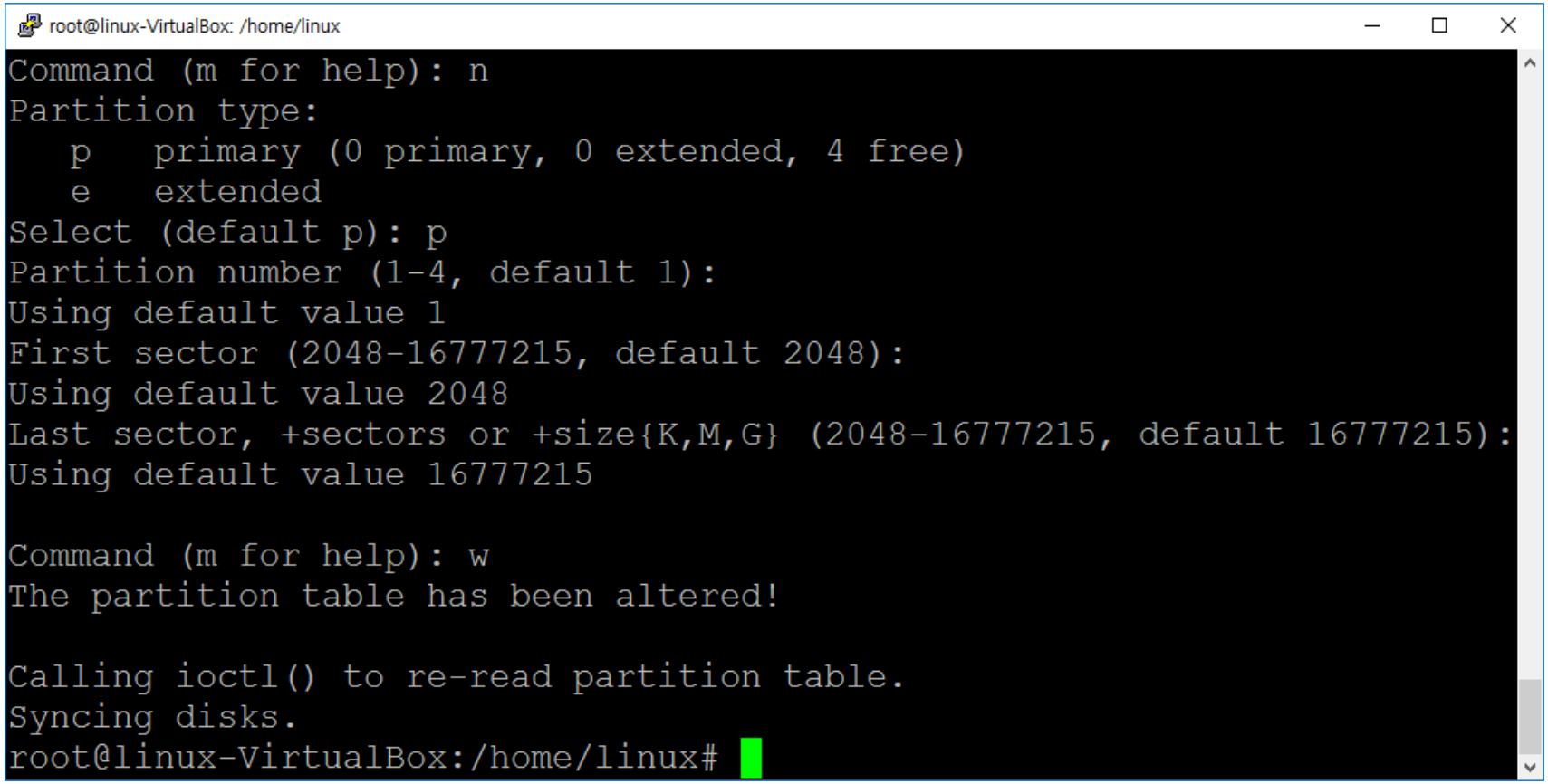
Mounting File Systems

- **List disk lists**
  - **fdisk –l**



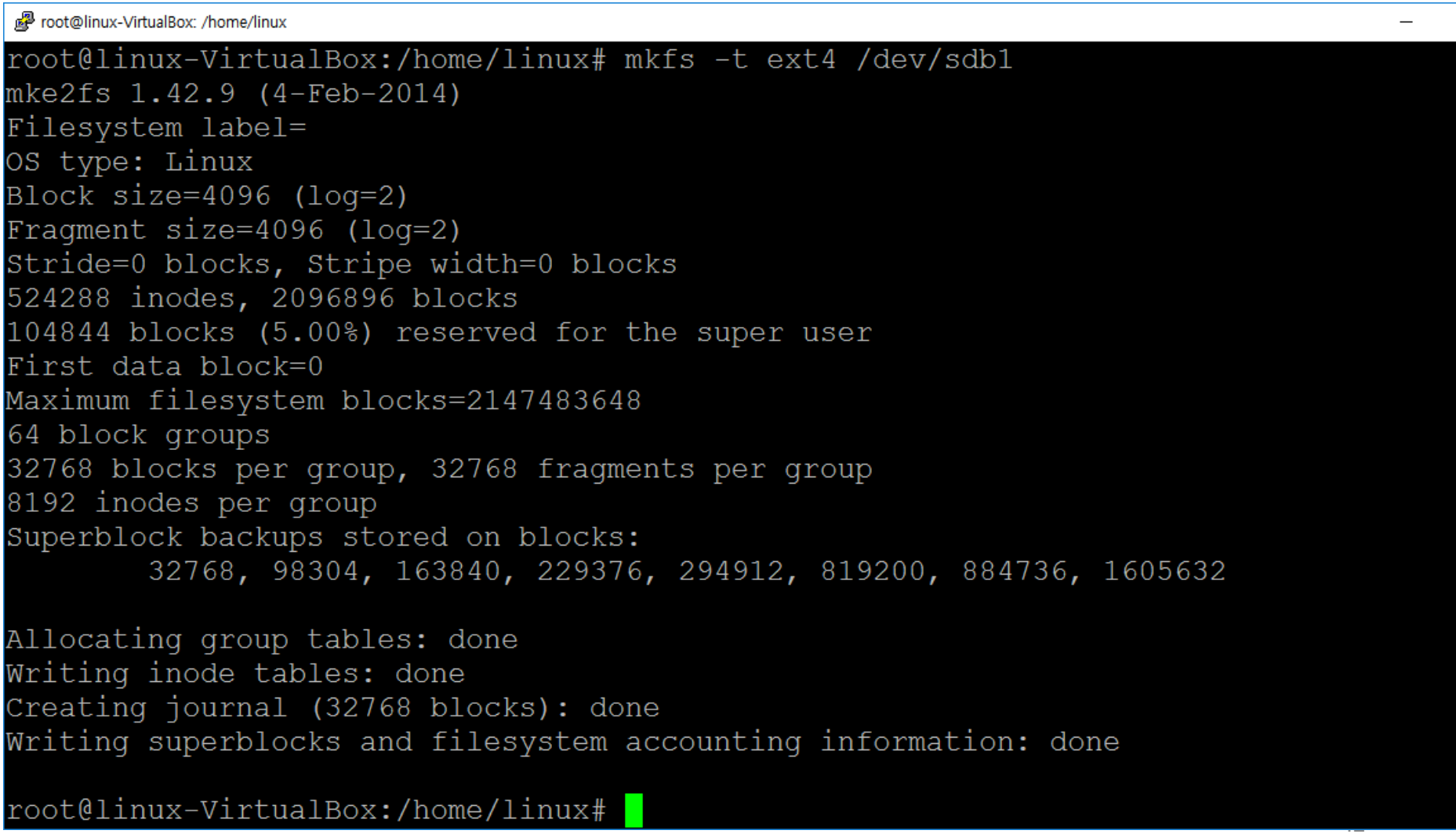
Mounting File Systems

- **Makes partitions**
  - **fdisk /dev/sdb**



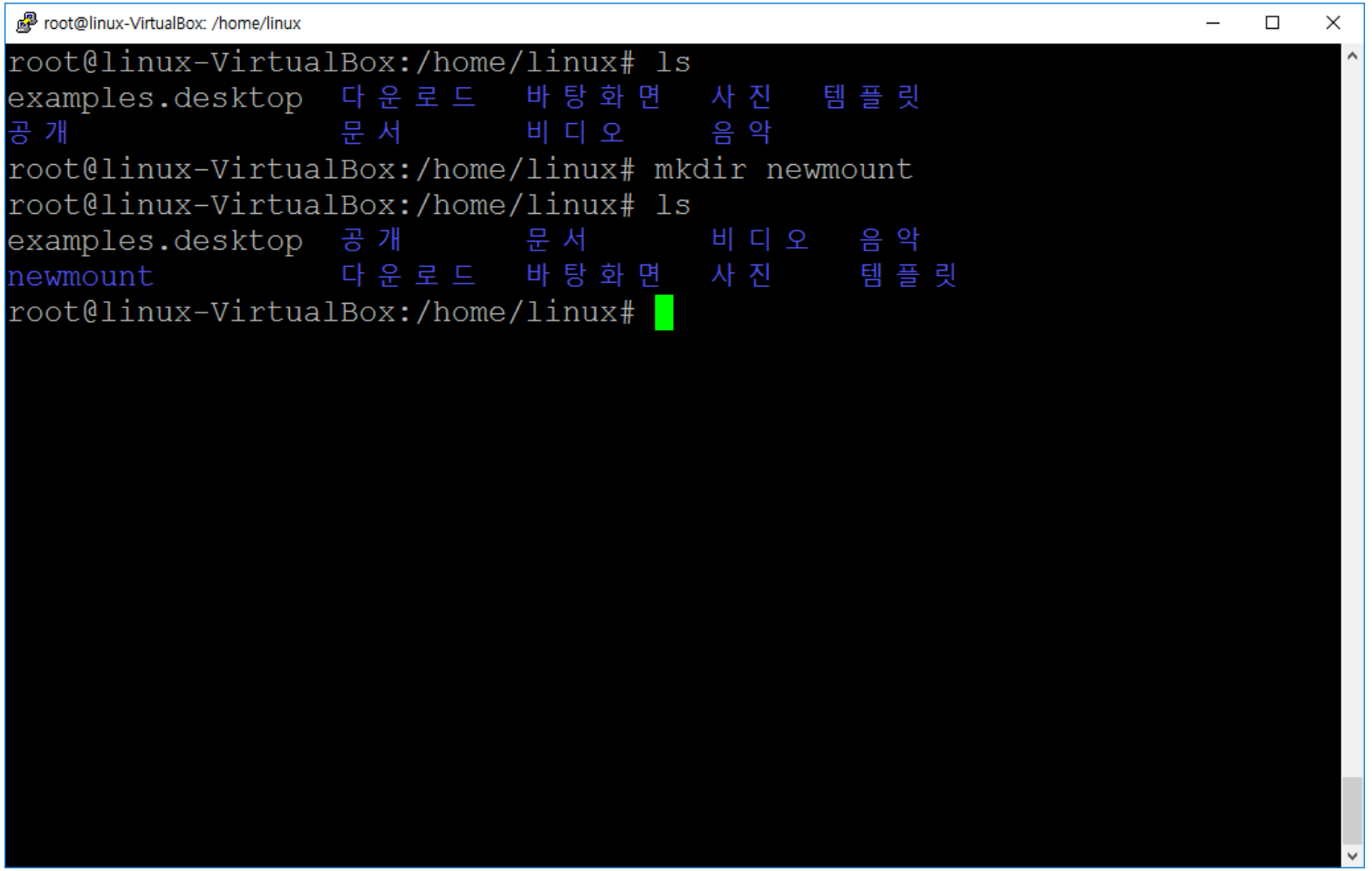
Mounting File Systems

- **mkfs –t ext4 /dev/sdb1**



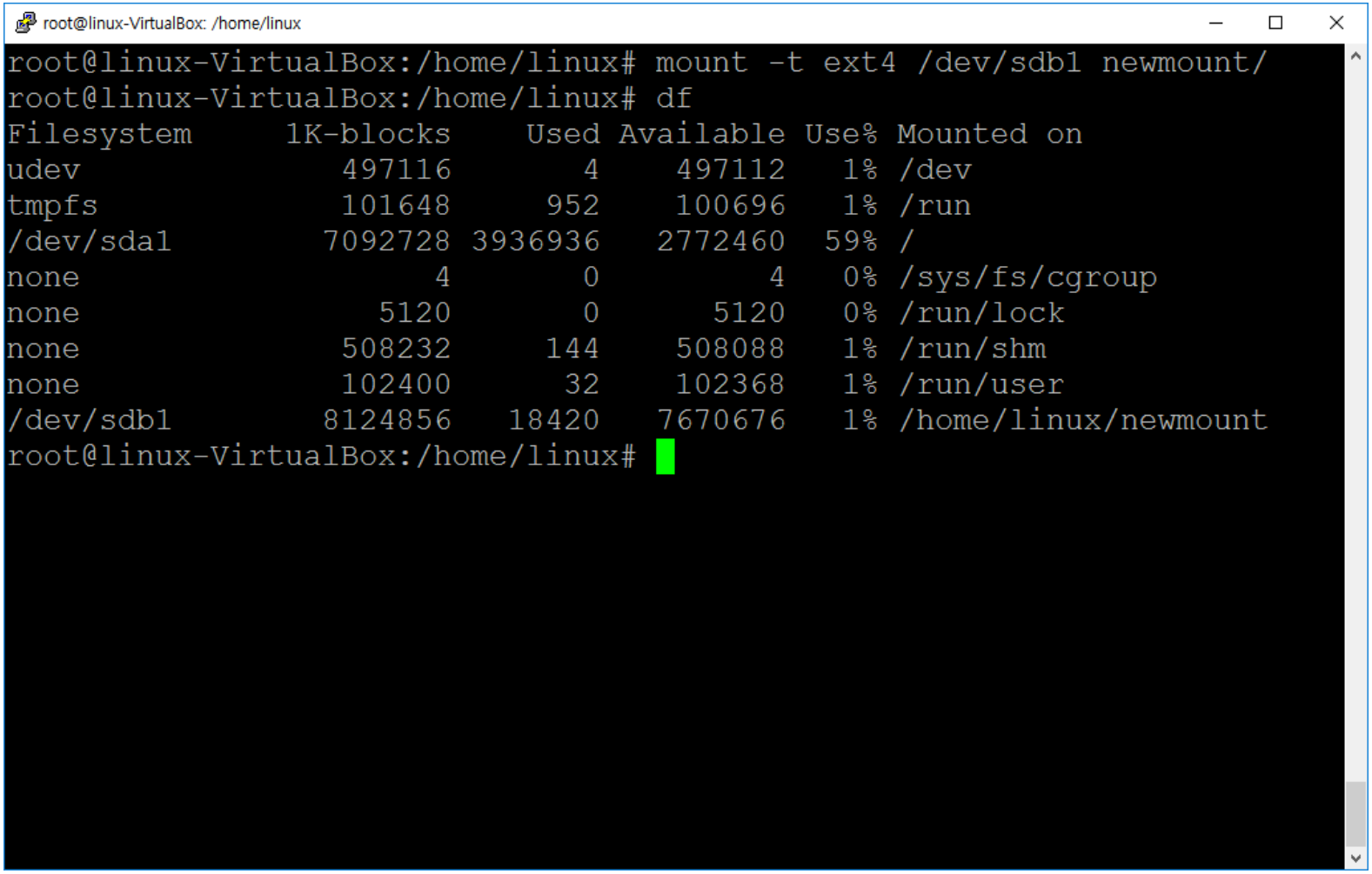
Mounting File Systems

- **Create a mounting point**



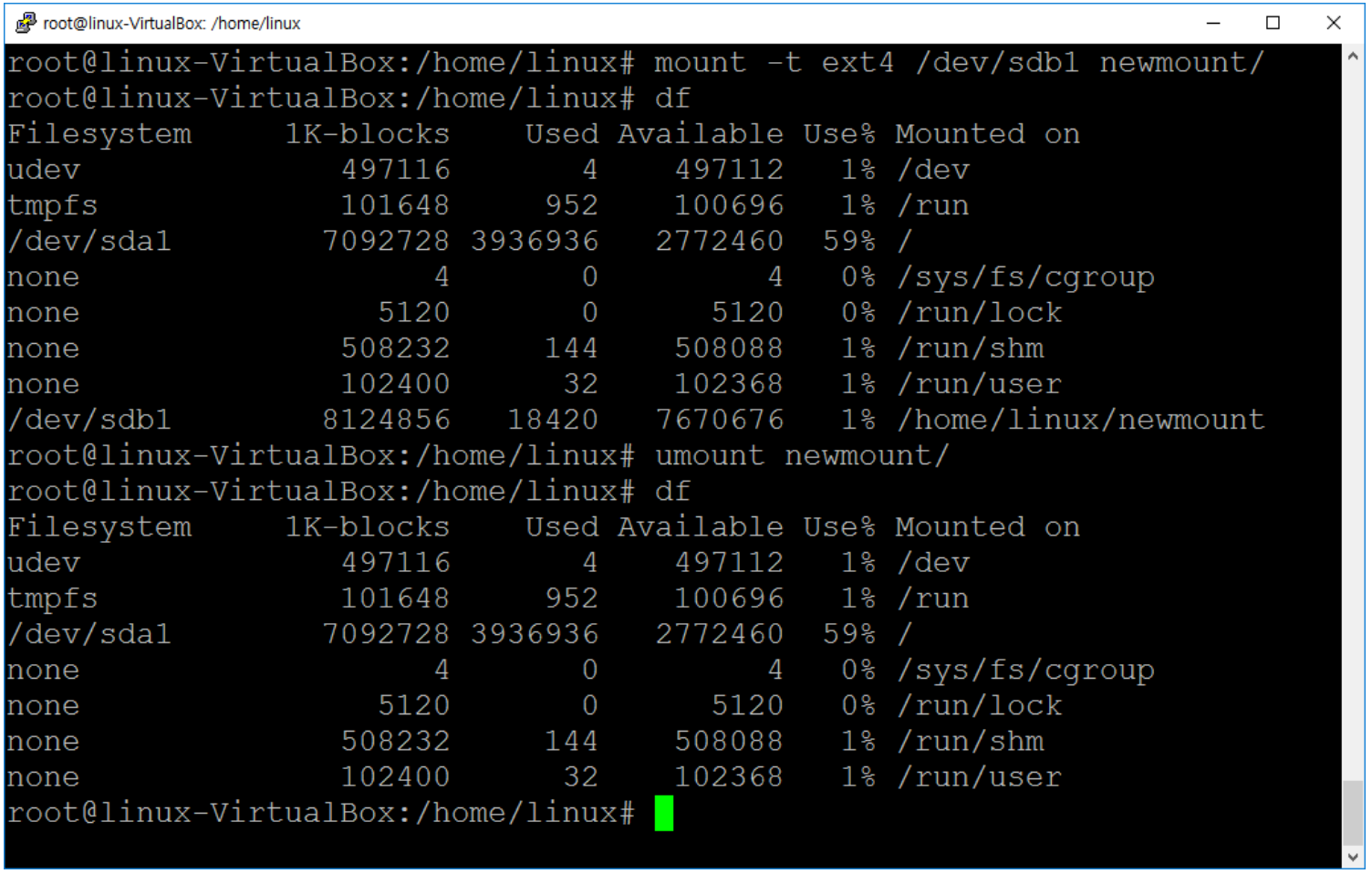
Mounting File Systems

- **mount -t ext4 /dev/sdb1 newdisk**



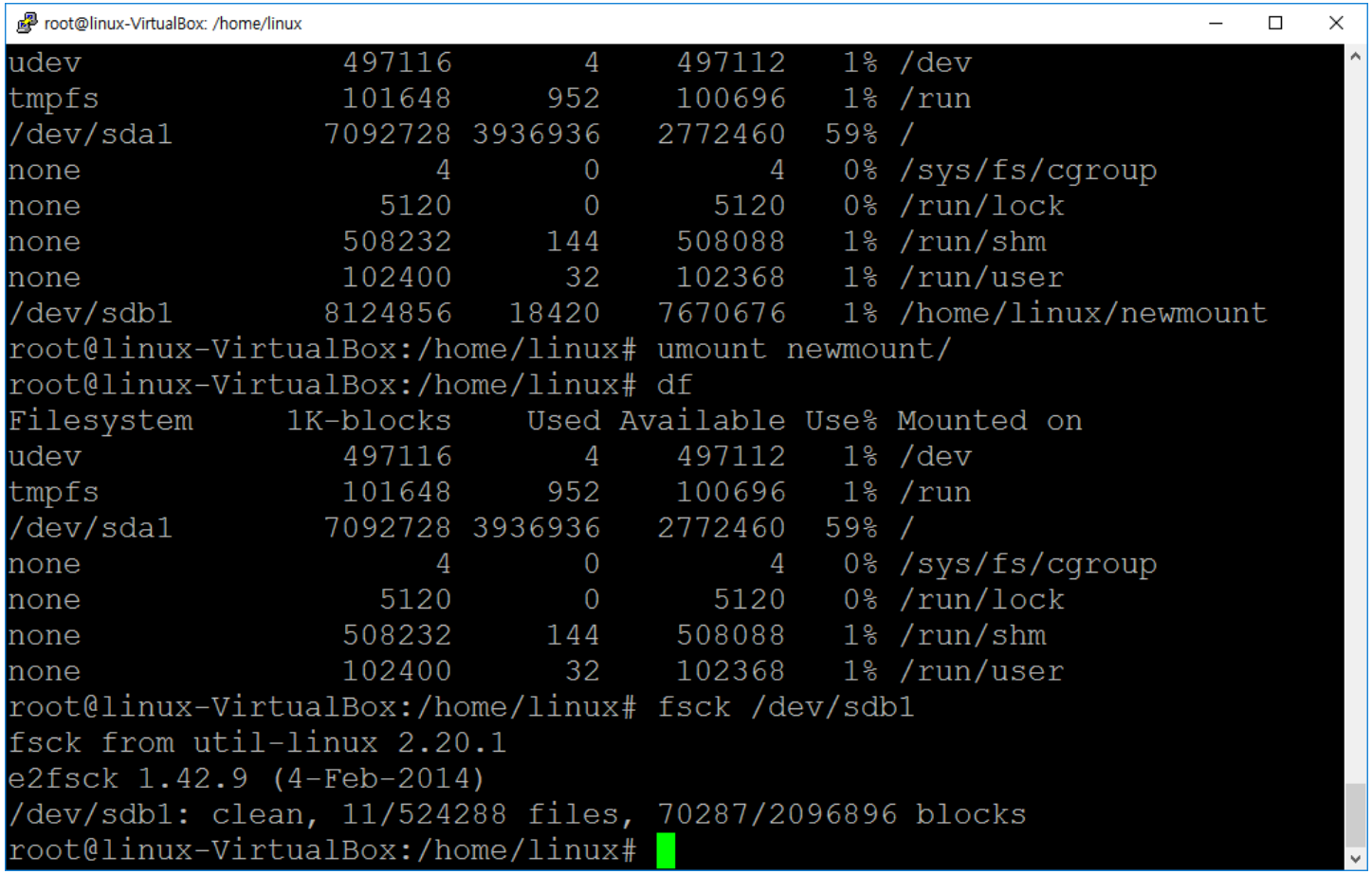
Unmounting File Systems

- **umount newdisk**



Filesystem Check

- **fsck**
  - **Filesystem check. Must not be run on a mounted file system**




Linux Ubuntu [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
우분투 소프트웨어 센터
En 14:57
모든 프로그램
설치함
기록
진행
개발자 추천 프로그램
개발자가 추천하는 프로그램입니다
Install Linux Softwares
개발자 도구
게임
과학 및 공학
교육
그래픽
글꼴
보조 프로그램
시스템
오피스
음악과 비디오
인터넷
접근성
책& 잡지
새 프로그램
기타
KUIViewer
개발자 도구
자유
이북2cw
음악과 비디오
자유
지팩스 팩시밀리 프로그램
오피스
자유
KMail Import Wizard
보조 프로그램
자유
youker-assistant
그림 및 편집
자유
QJackRcd
음악과 비디오
자유
Jaxe
오피스
자유
Nautilus Compare Exte...
테마 및 트윅
자유
GFM
보조 프로그램
자유
사용자 맞춤 추천
추천 기능 사용하기
Right Control

Software Package

- **Package File**
  - **Bundle all the executable and data files into a single file**
- **Different formats and different control files**
  - **Where the rest of the files should be placed**
  - **The permissions they should have**
  - **A list of prerequisite packages that are required for the package to function correctly**

Package Type

- **RPM**
  - **RedHat Package Manager (RPM) files**
  - **Redhat, and Fedora Linux**

- **DEB**
  - **Debian Package format**
  - **Debian and Ubuntu Linux**

Package Type

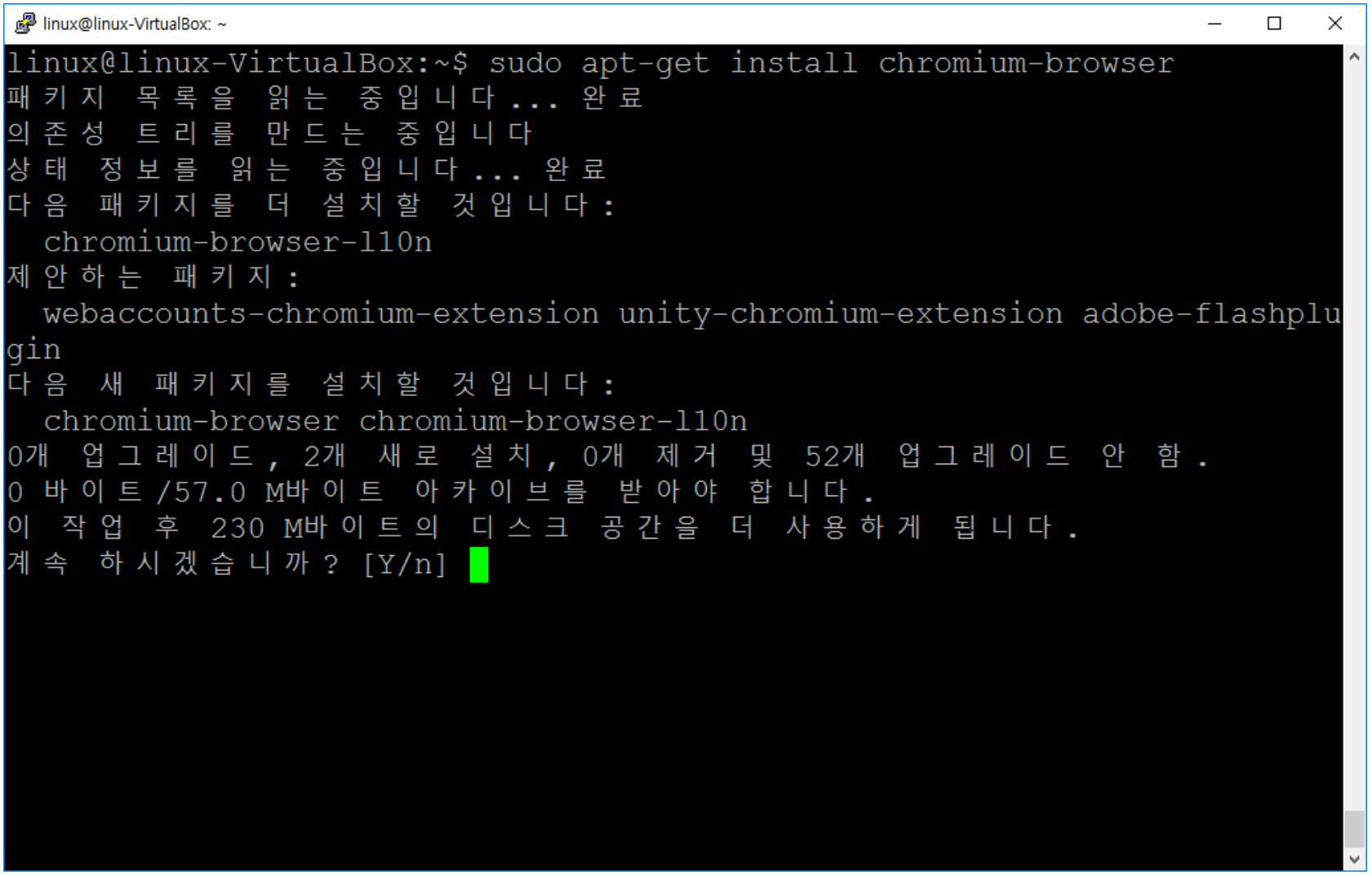
- **RPM**
  - **RedHat Package Manager (RPM) files**
  - **Redhat, and Fedora Linux**

- **DEB**
  - **Debian Package format**
  - **Debian and Ubuntu Linux**

APT (Advanced Packaging Tool)

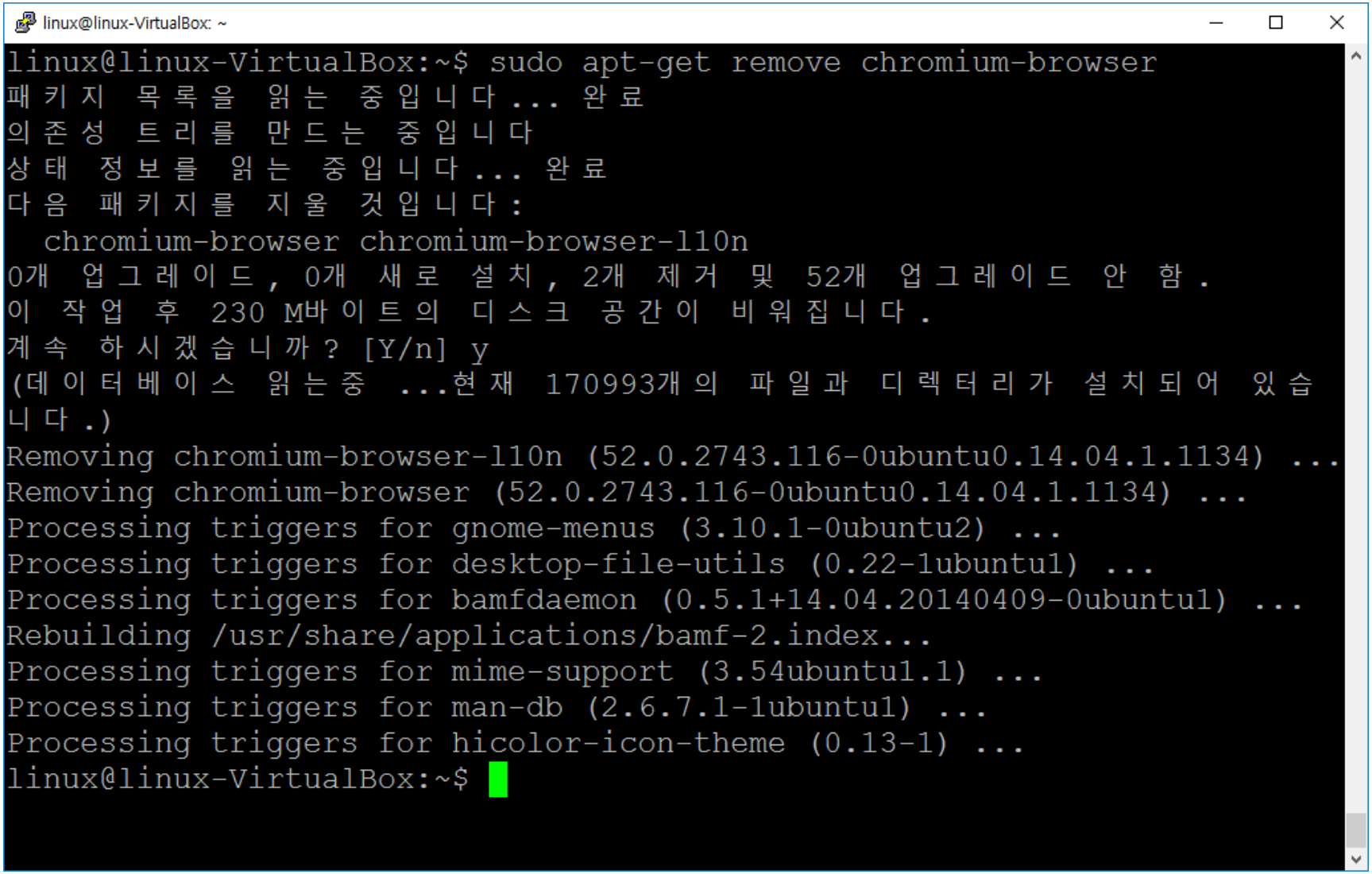
- **Install a Package**
  - **sudo apt-get install <package list>**
- **Remove a Package**
  - **sudo apt-get remove <package list>**
- **Update the Package Index**
  - **sudo apt-get update**
- **Upgrade Packages**
  - **sudo apt-get upgrade**

APT (Advanced Packaging Tool)

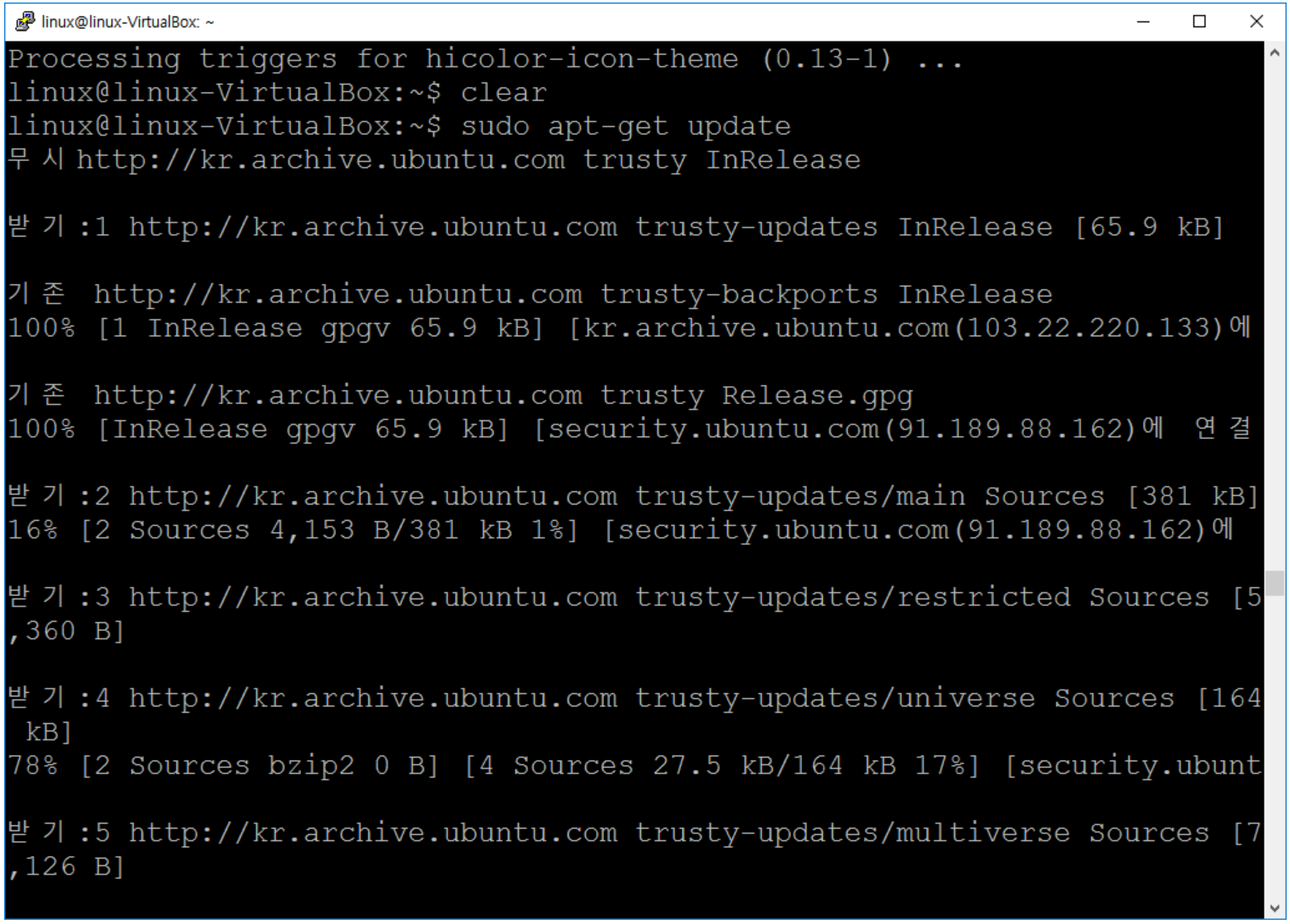


APT (Advanced Packaging Tool)

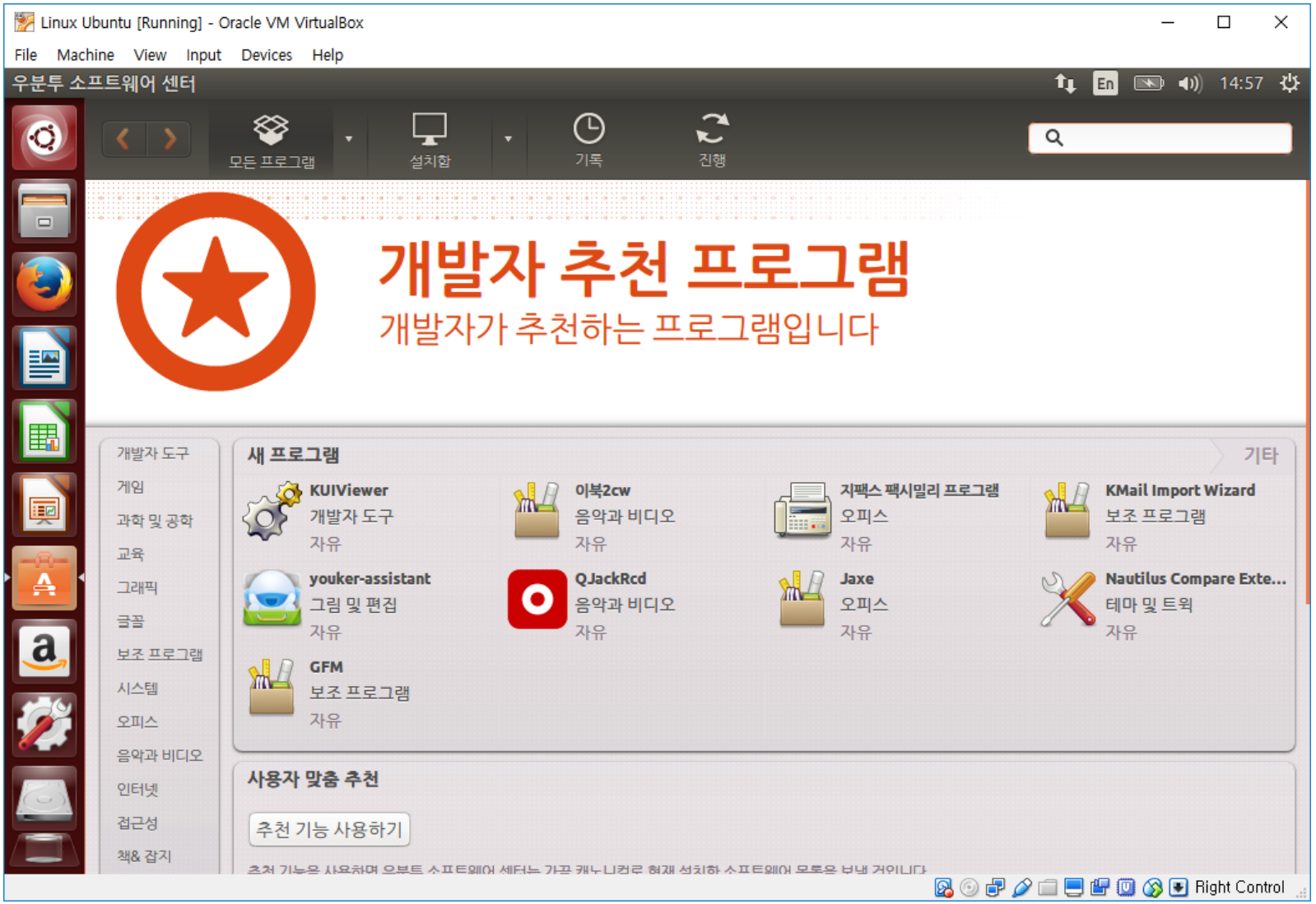
APT (Advanced Packaging Tool)



APT (Advanced Packaging Tool)



Ubuntu Software Center



SSH

SSH

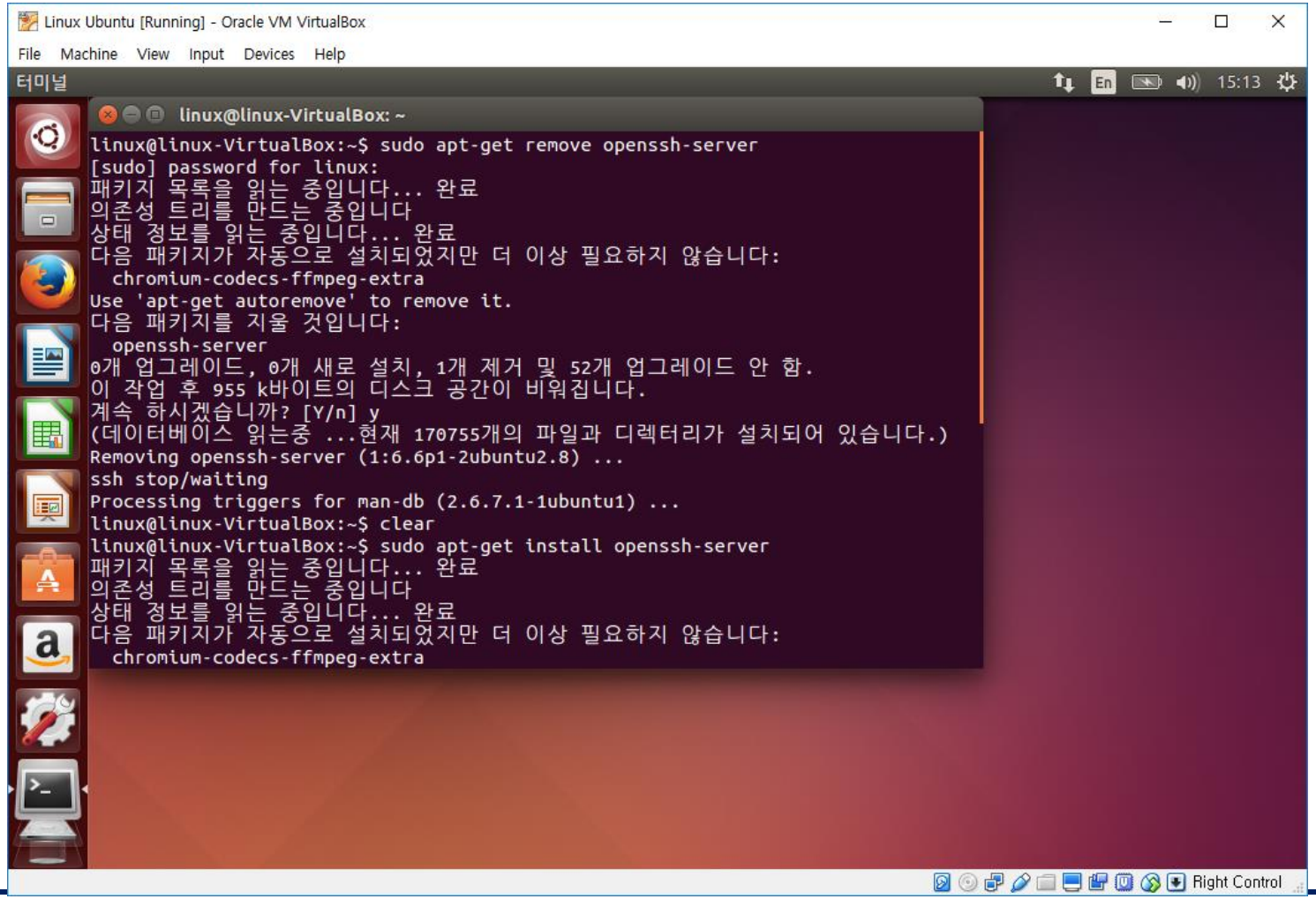
- **Secure Shell**
- **Supports secure remote logins, secure remote command execution, secure file transfers**
- **Has a client server architecture – SSH server program and client program**

Features

- **Privacy**
  - **via strong end-to-end encryption- DES, IDEA, Blowfish**
- **Integrity**
  - **via 32 bit Cyclic Redundancy Check (CRC-32)**
- **Authentication**
  - **server via server's host key, client usually via password or public key**
- **Authorization**
  - **controlled at a server wide level or per account basis**
- **Forwarding**
  - **encapsulating another TCP based service such as Telnet within an SSH session**

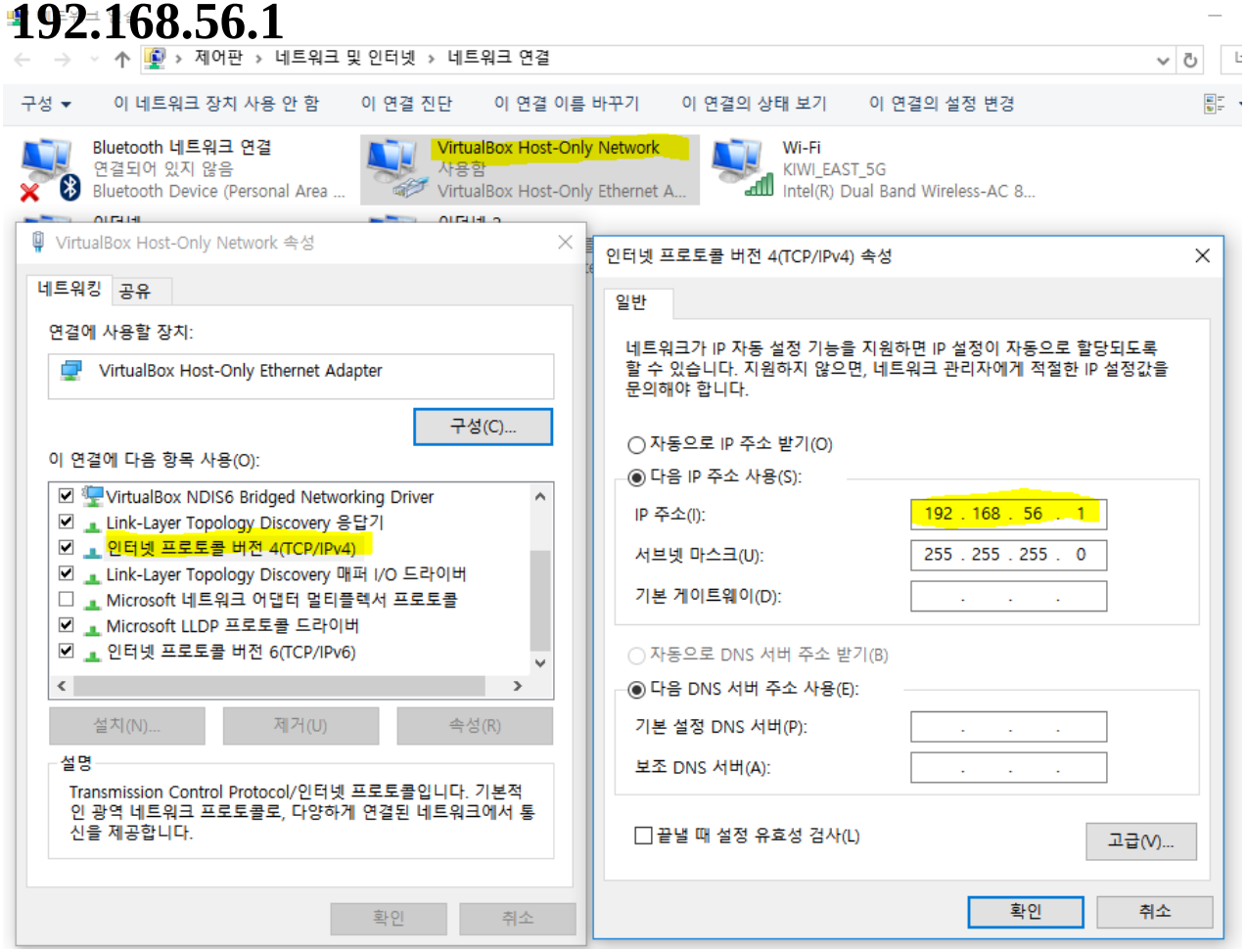
Install SSH Server

- **sudo apt-get install openssh-server**



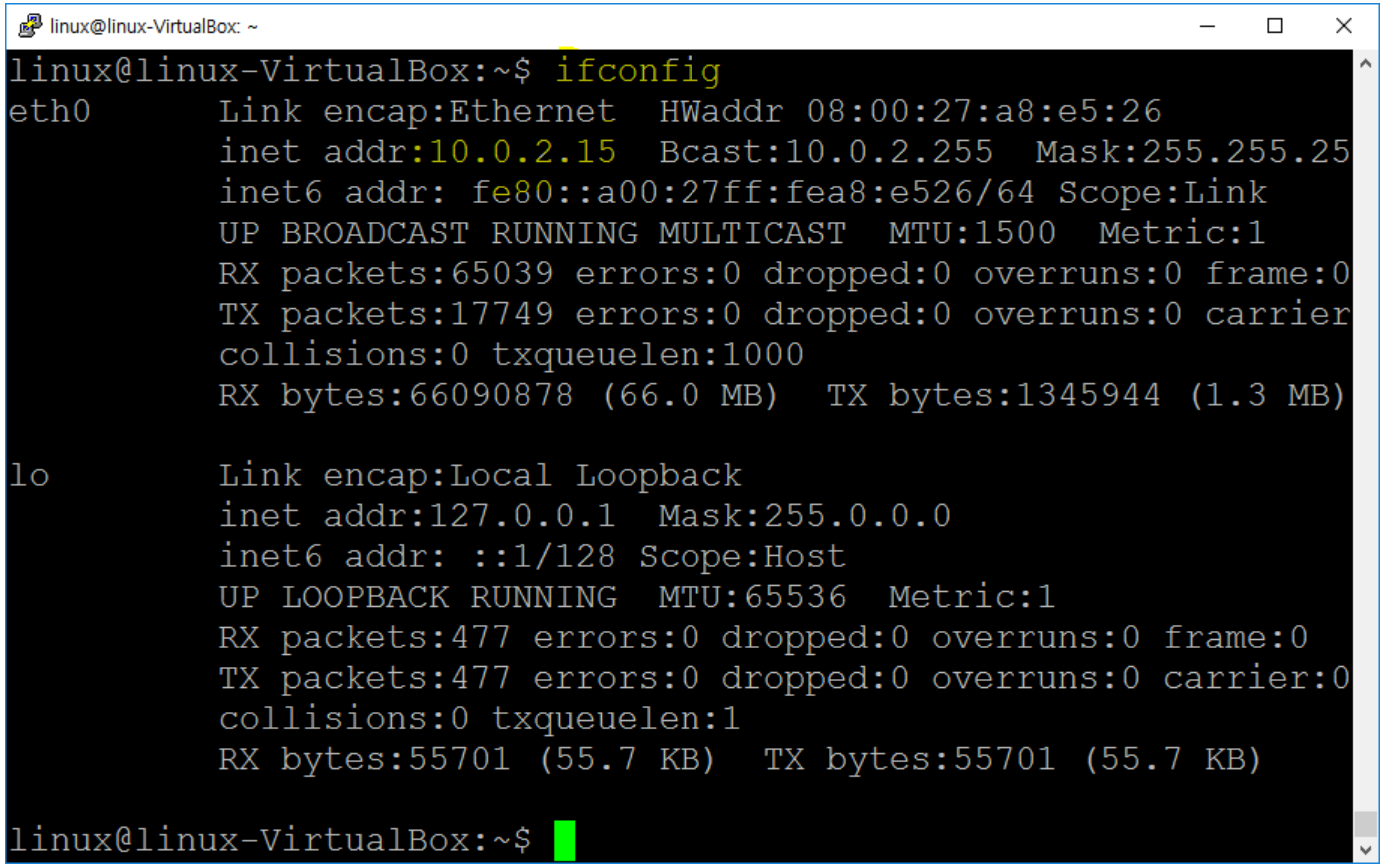
Configuring Virtualbox for SSH

- **IP of VirtualBox Host-Only Network**
  - **192.168.56.1**



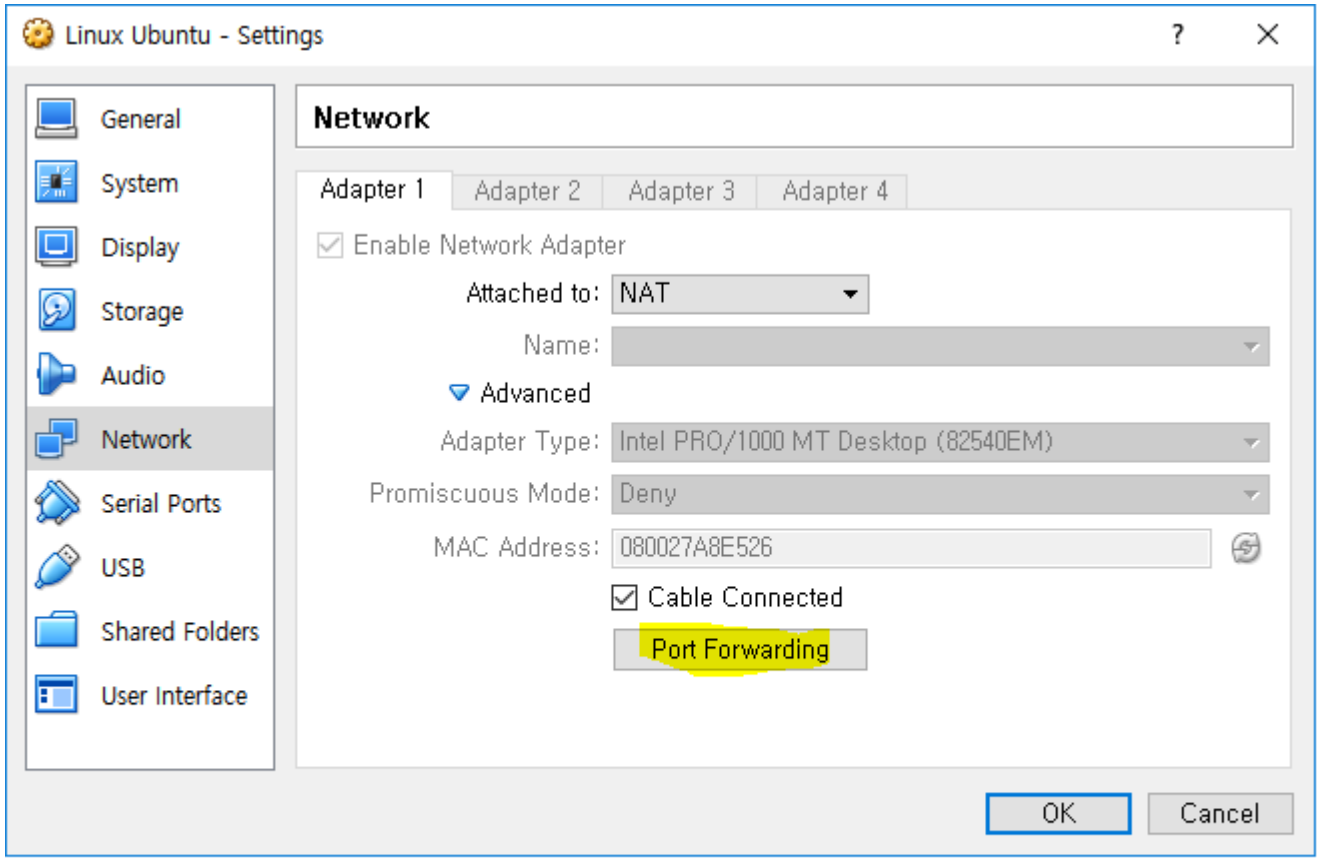
Configuring Virtualbox for SSH

- **IP of Linux with ifconfig**
  - **10.0.2.15**



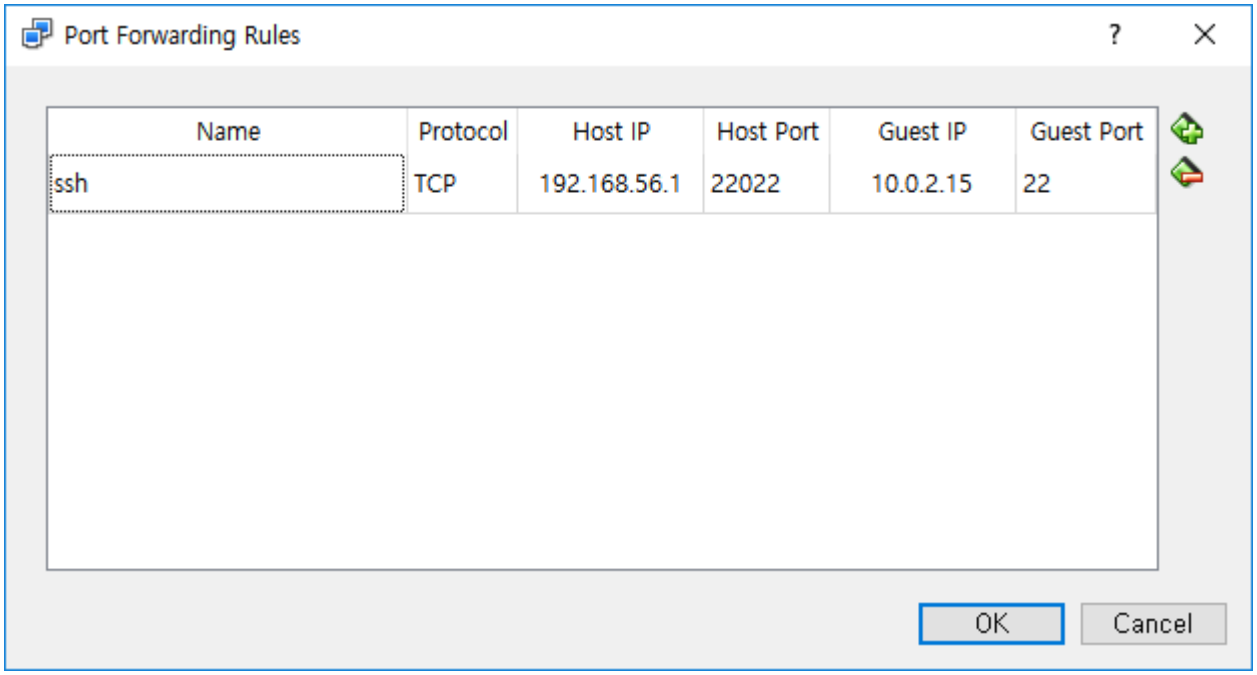
Configuring Virtualbox for SSH

- **Device → Network → Network Settings → Advanced**



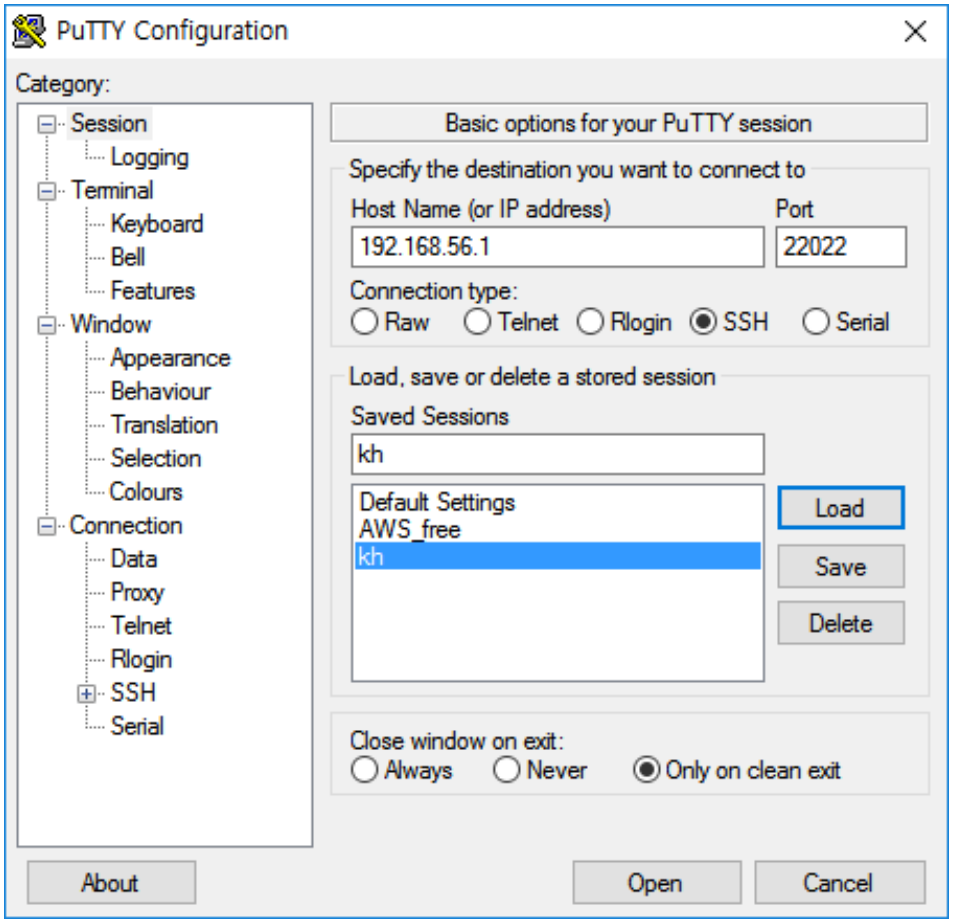
Configuring Virtualbox for SSH

- **Name : ssh**
- **Host IP : IP of VirtualBox Host-only Network (192.168.56.1)**
- **Host Port : 22022**
- **Guest IP : IP of Linux (10.0.2.15)**
- **Guest Port : 22**

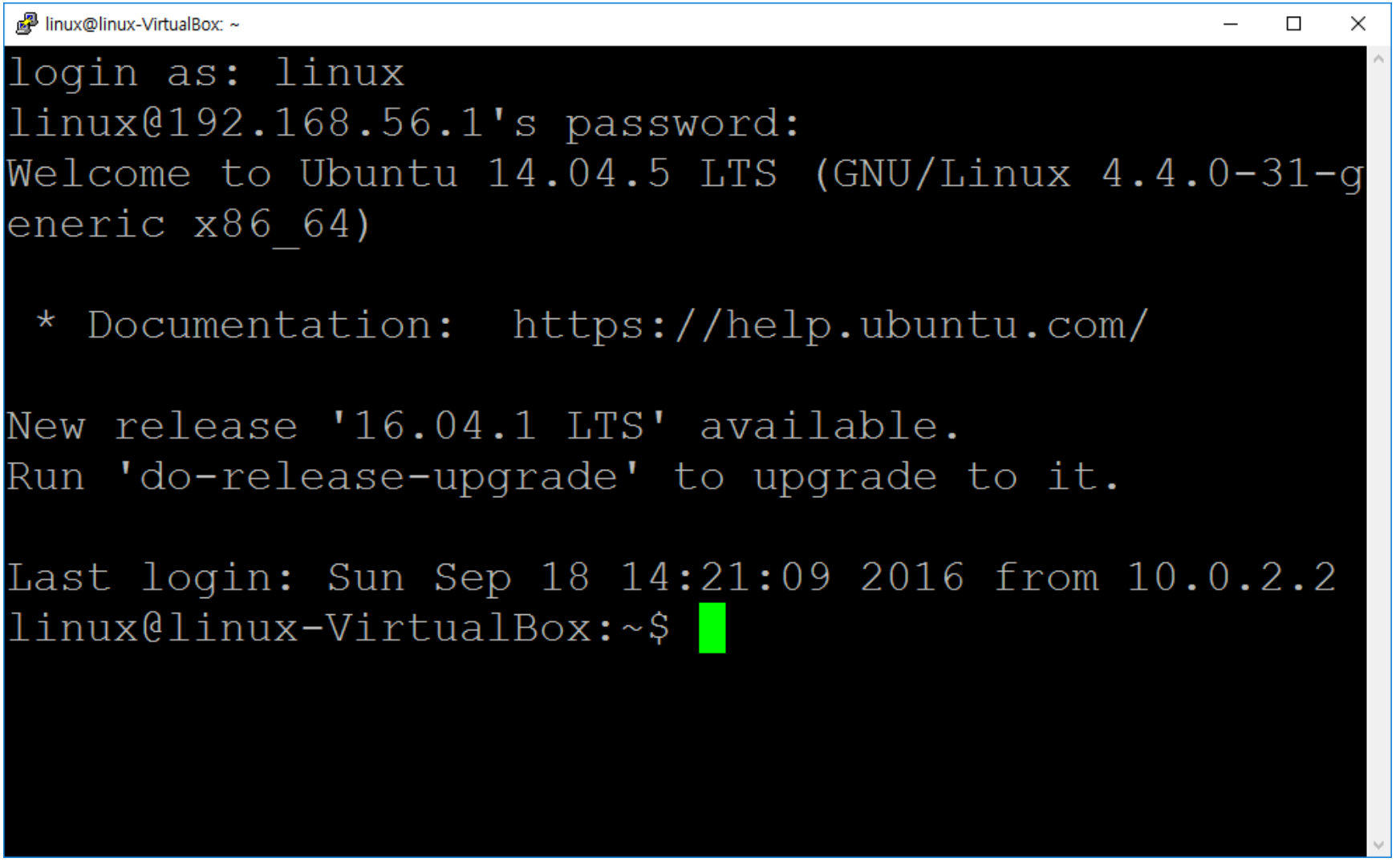


Putty

- **SSH clinet**
  - **https://the.earth.li/~sgtatham/putty/latest/x86/putty.exe**
- **Host Name**
  - **IP of Virtualbox Host-only Network**
  - **192.168.56.1**
- **Port**
  - **22022**



Connect


linux@linux-VirtualBox: ~
login as: linux
linux@192.168.56.1's password:
Welcome to Ubuntu 14.04.5 LTS (GNU/Linux 4.4.0-31-g
eneric x86_64)
* Documentation: https://help.ubuntu.com/
New release '16.04.1 LTS' available.
Run 'do-release-upgrade' to upgrade to it.
Last login: Sun Sep 18 14:21:09 2016 from 10.0.2.2
linux@linux-VirtualBox:~$