

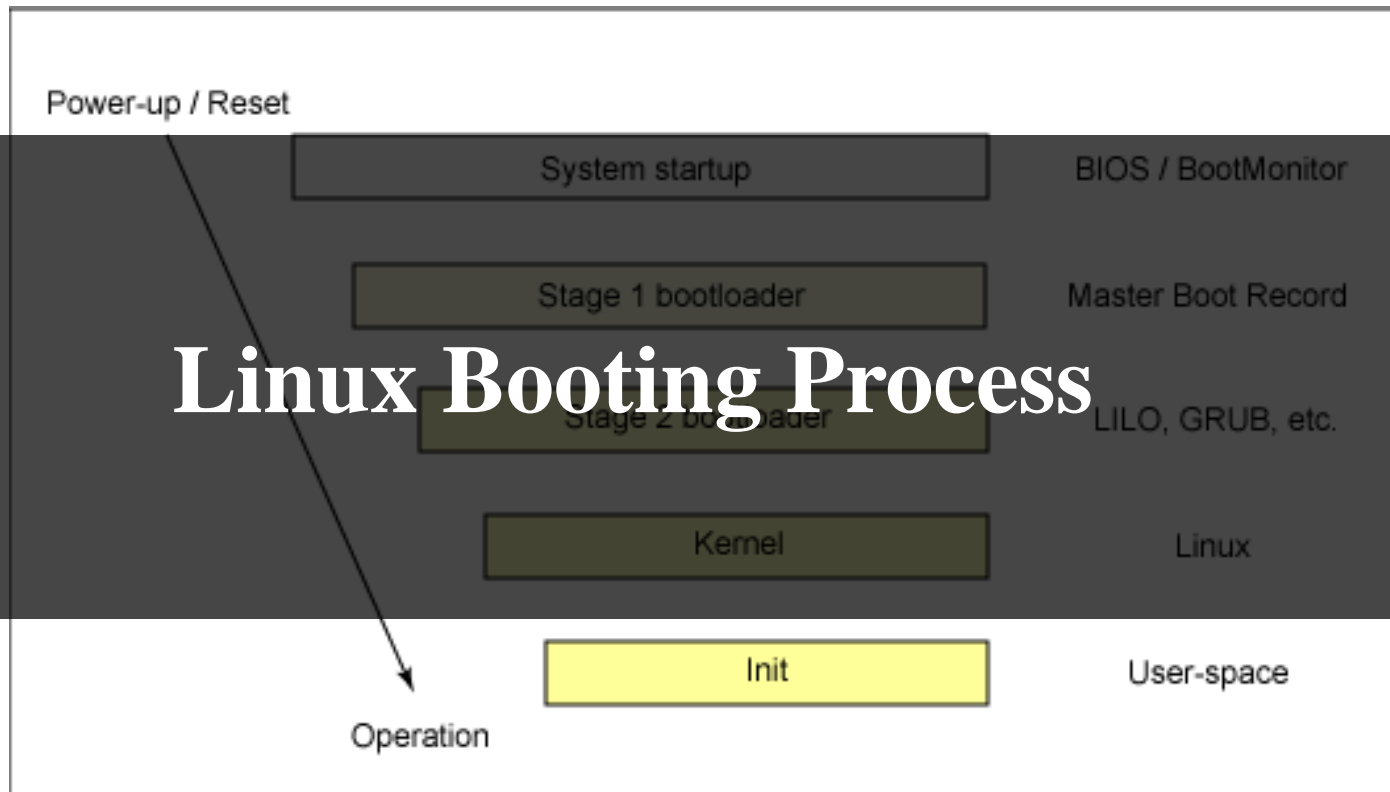


Chapter 11

Linux Administration

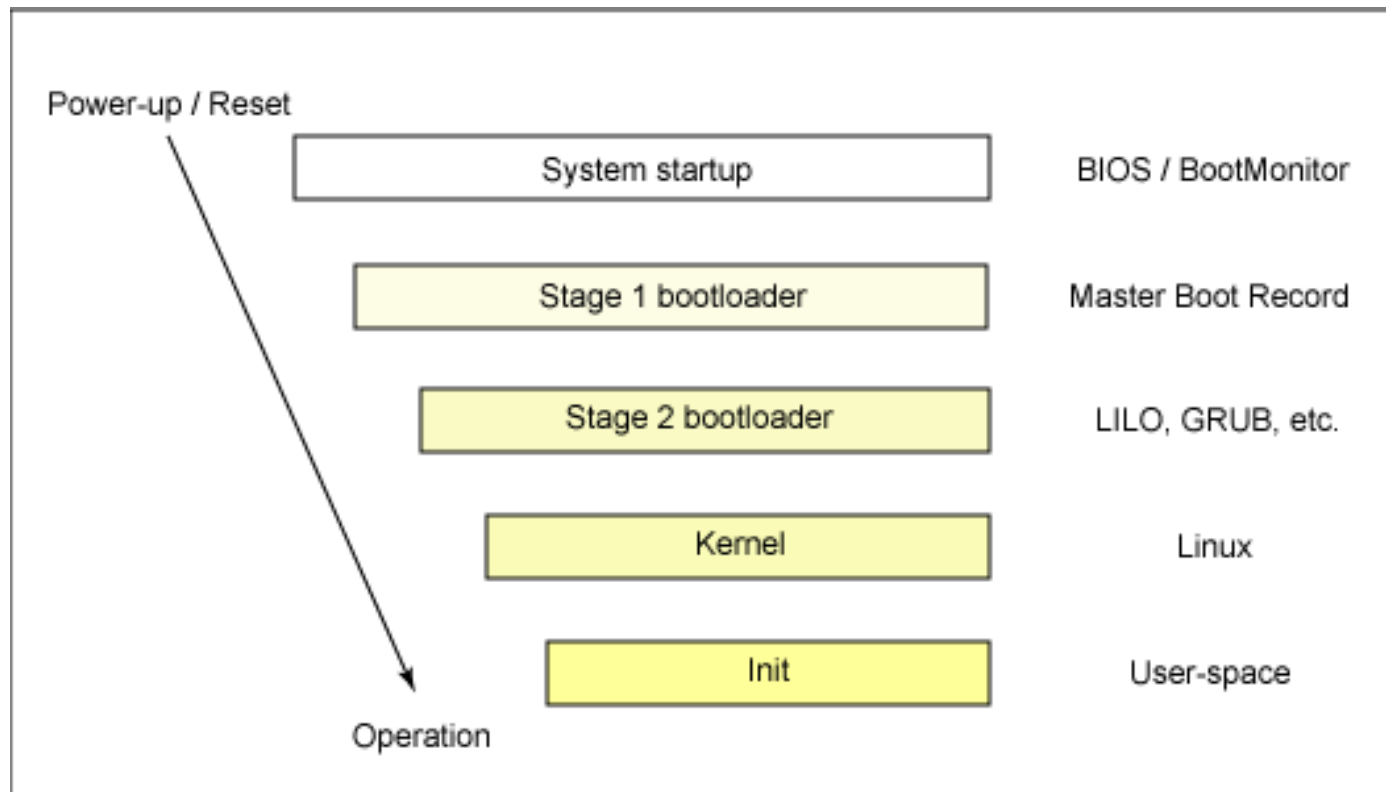
Open Source SW Development
CSE22300

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 bootable devices**
5. **Load and execute boot sector from 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

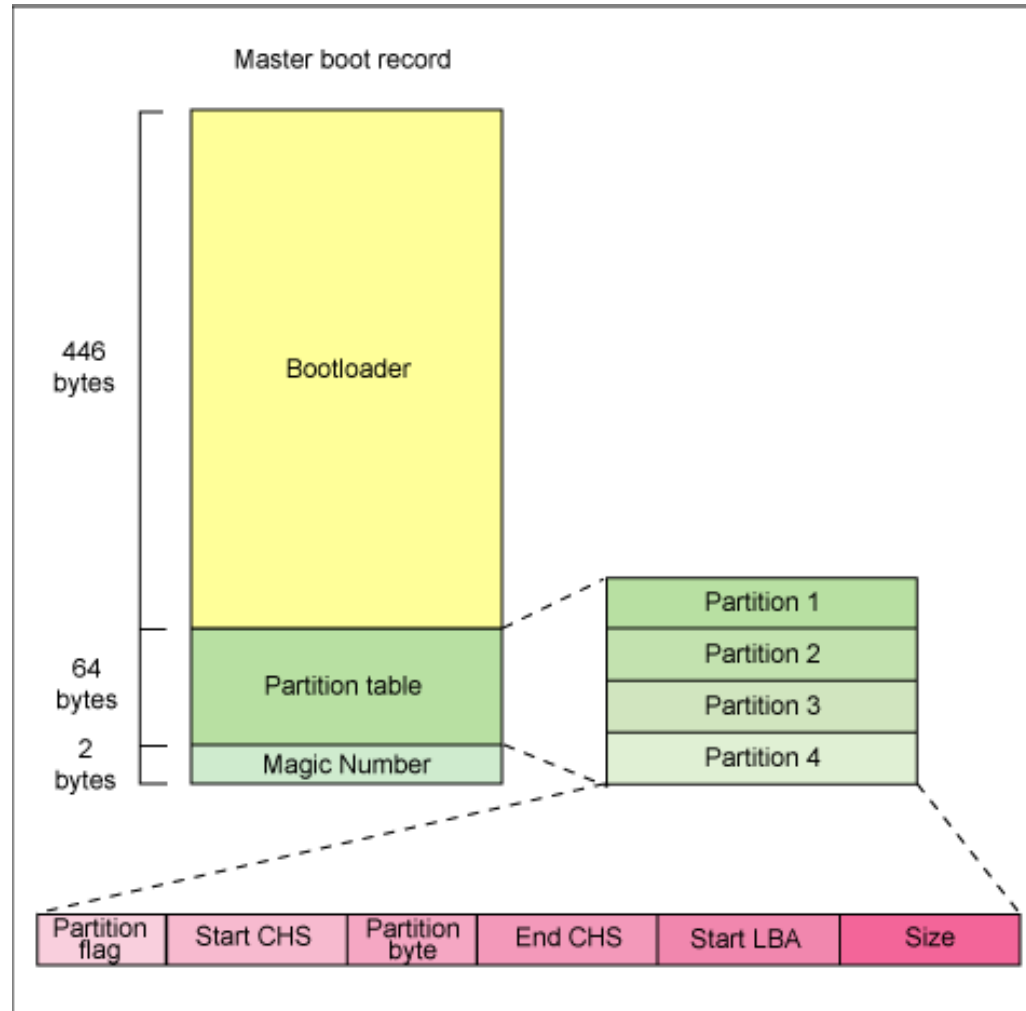


BIOS on screen

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



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.**

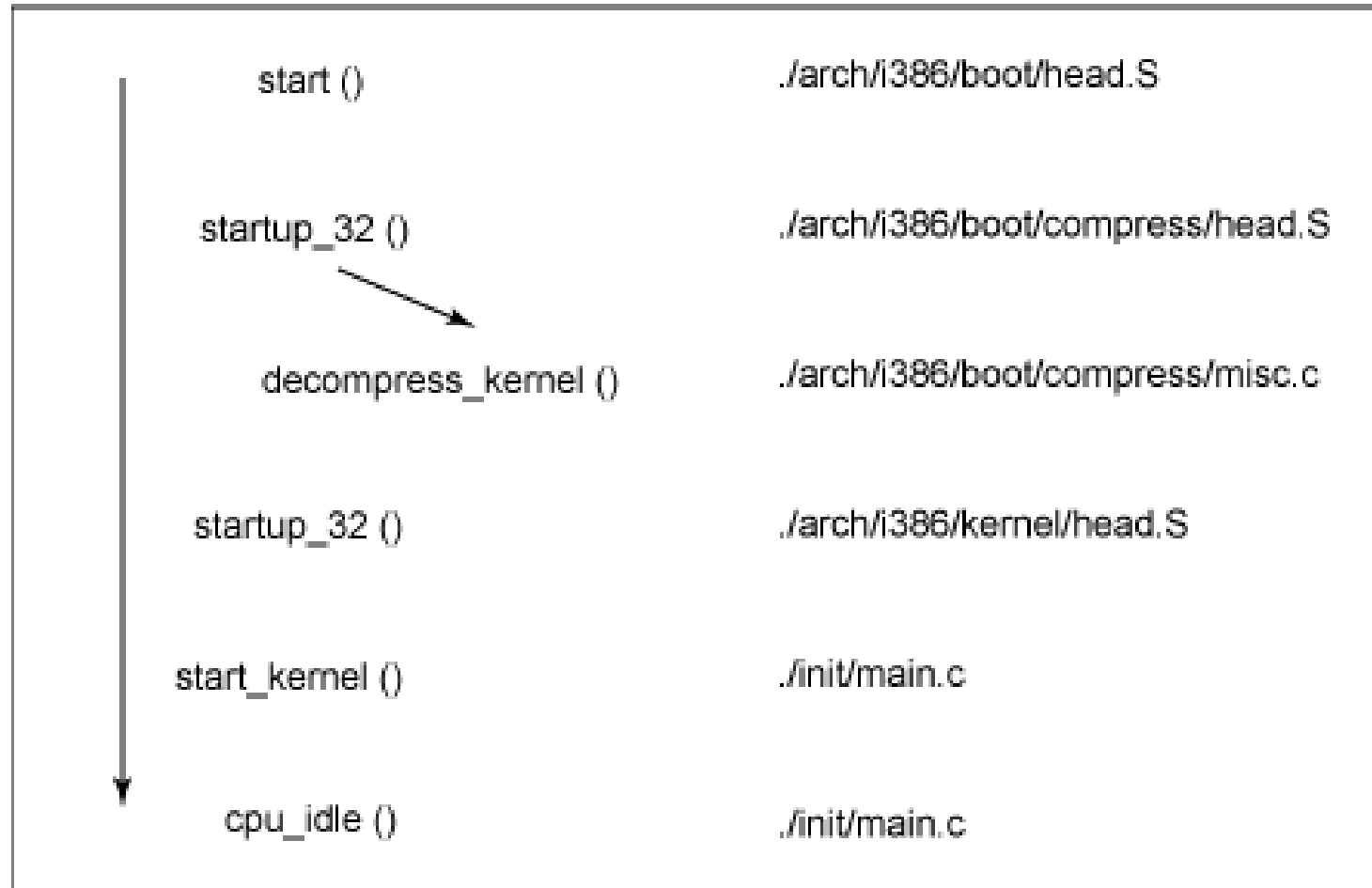
GRUB: GRand Unified Bootloader

- **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**

The slide features a dark gray horizontal band across the middle. Within this band, there are several overlapping, semi-transparent icons of people in various shades of blue, green, and black. The text "User management" is centered in white, serif font over these icons.

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/passwd

- **/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**

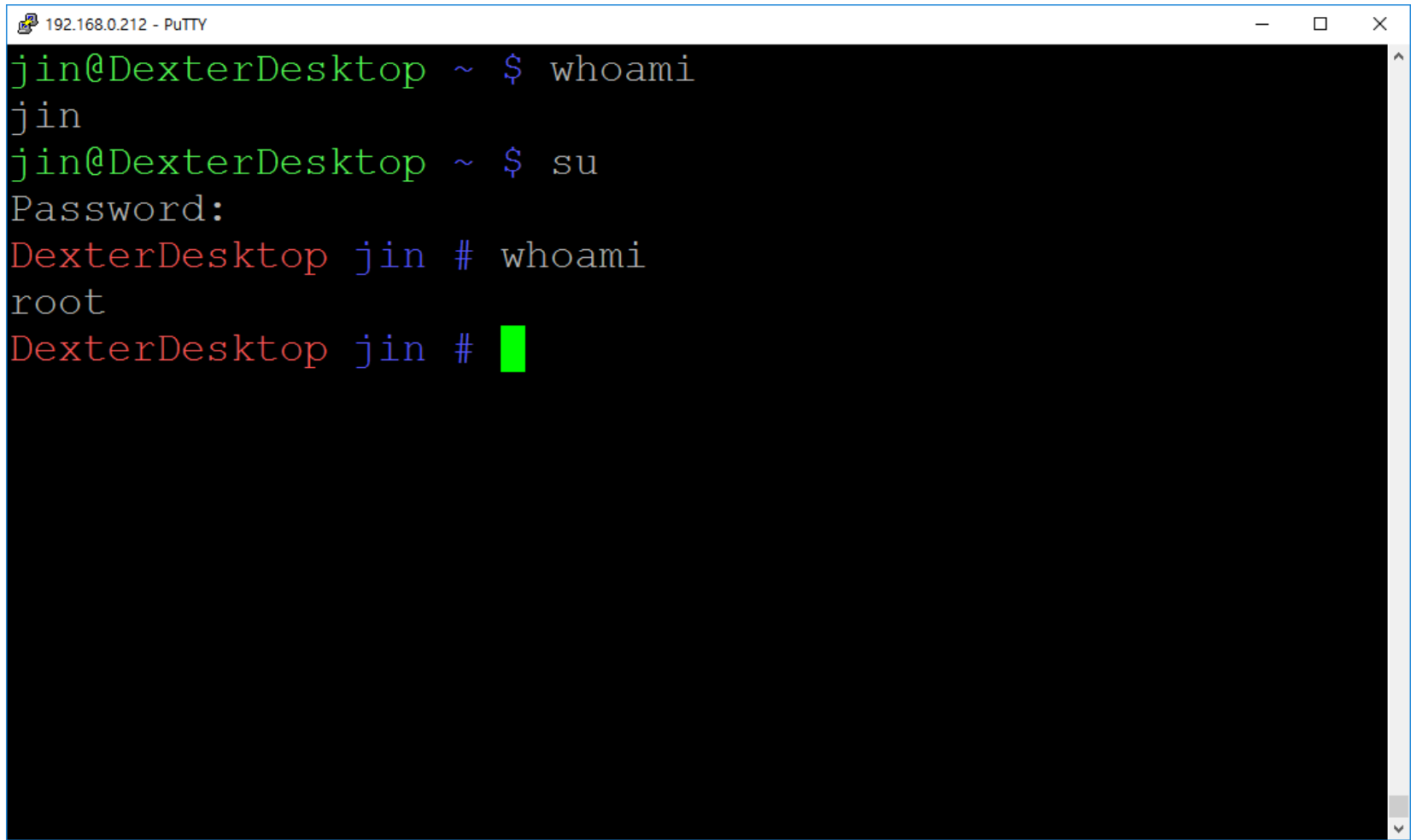
/etc/shadow

- **/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

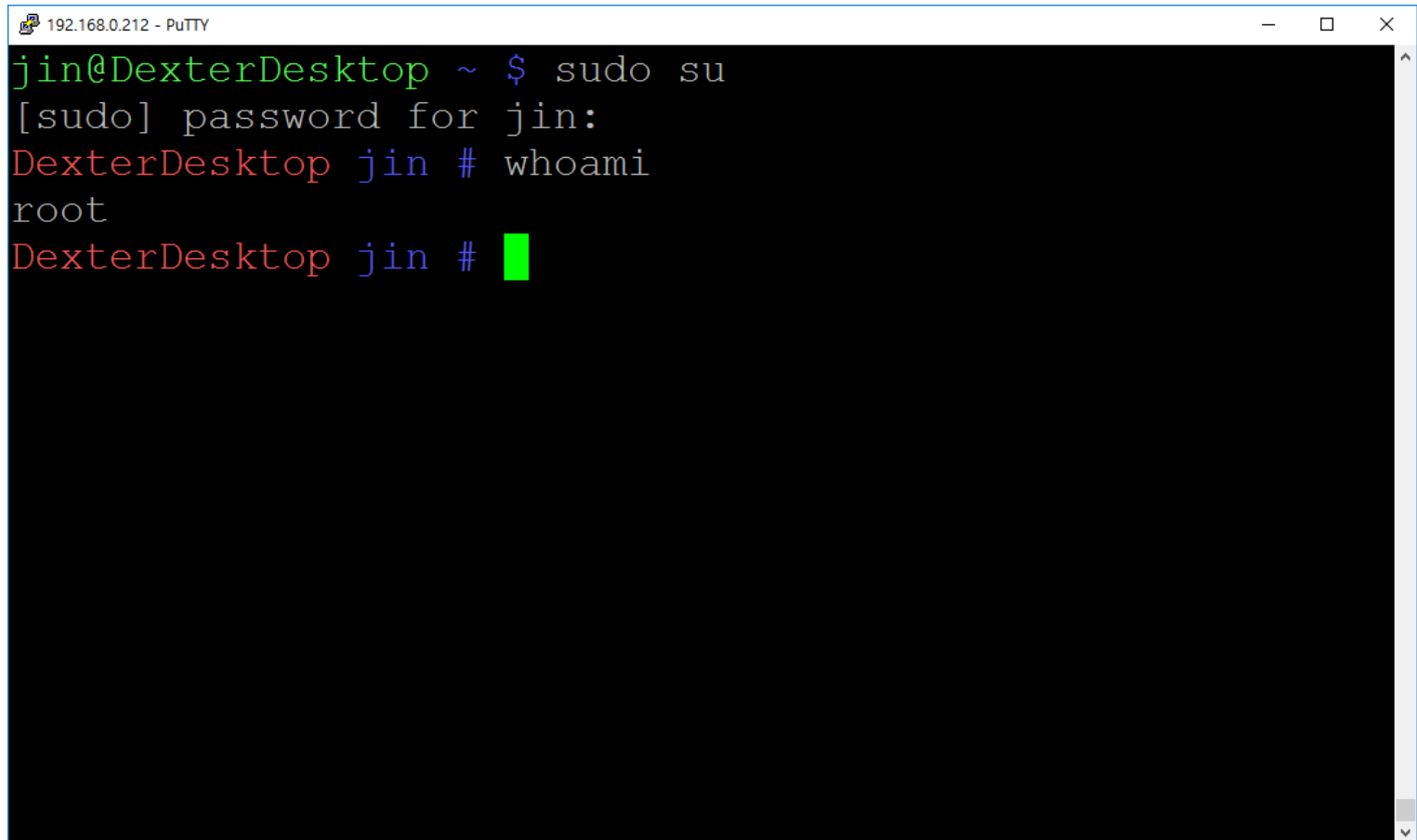


```
192.168.0.212 - PuTTY
jin@DexterDesktop ~ $ whoami
jin
jin@DexterDesktop ~ $ su
Password:
DexterDesktop jin # whoami
root
DexterDesktop jin #
```

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



A terminal window titled "192.168.0.212 - PuTTY" with standard window controls. The terminal shows a user named 'jin' at a host named 'DexterDesktop' in the directory '~'. The user enters the command 'sudo su'. The system prompts for a password: '[sudo] password for jin:'. After the password is entered, the prompt changes to 'DexterDesktop jin #'. The user then enters the command 'whoami', and the output is 'root'. Finally, the prompt returns to 'DexterDesktop jin #' with a green cursor.

```
jin@DexterDesktop ~ $ sudo su
[sudo] password for jin:
DexterDesktop jin # whoami
root
DexterDesktop jin #
```

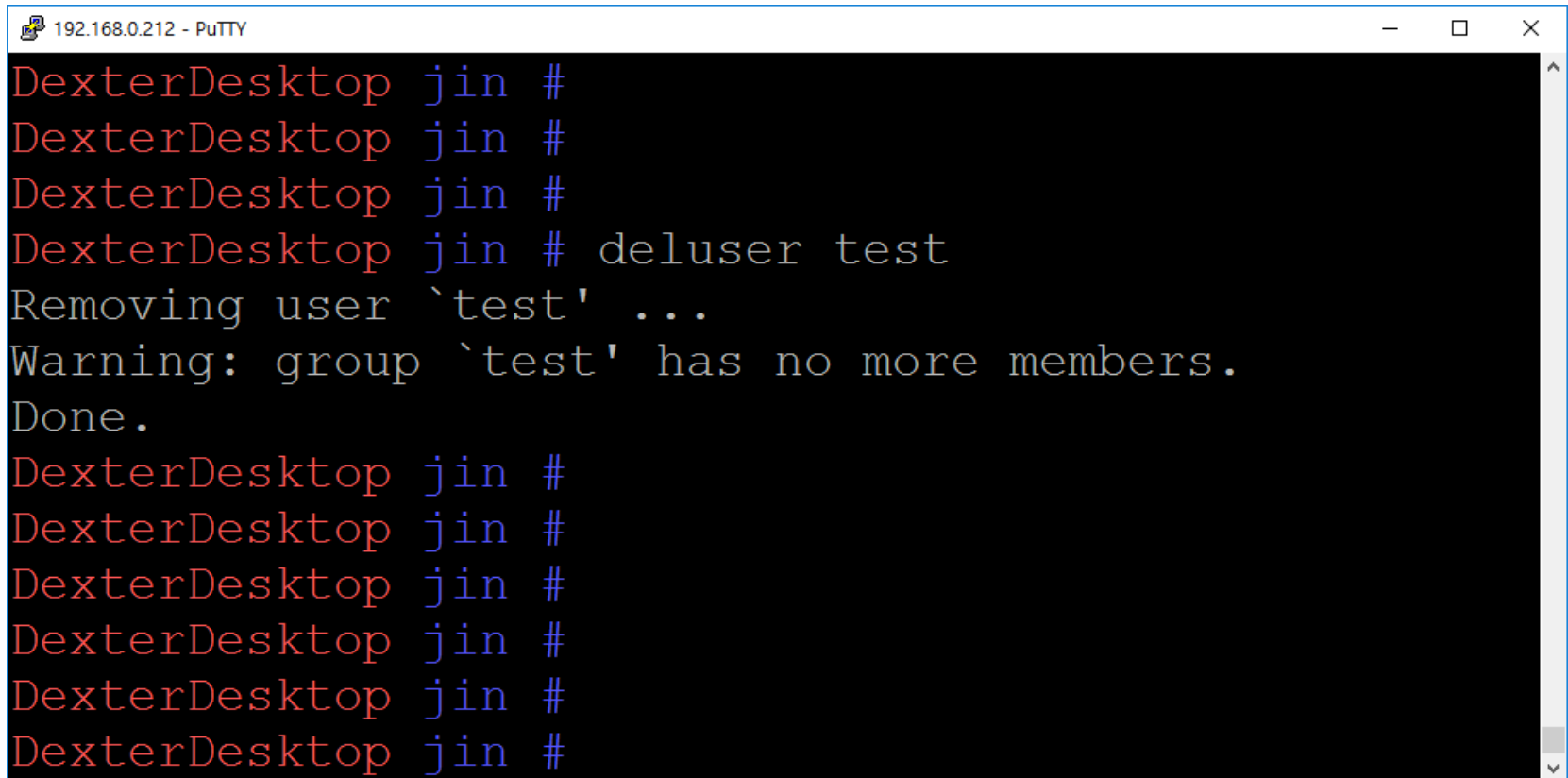
useradd / adduser

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

```
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

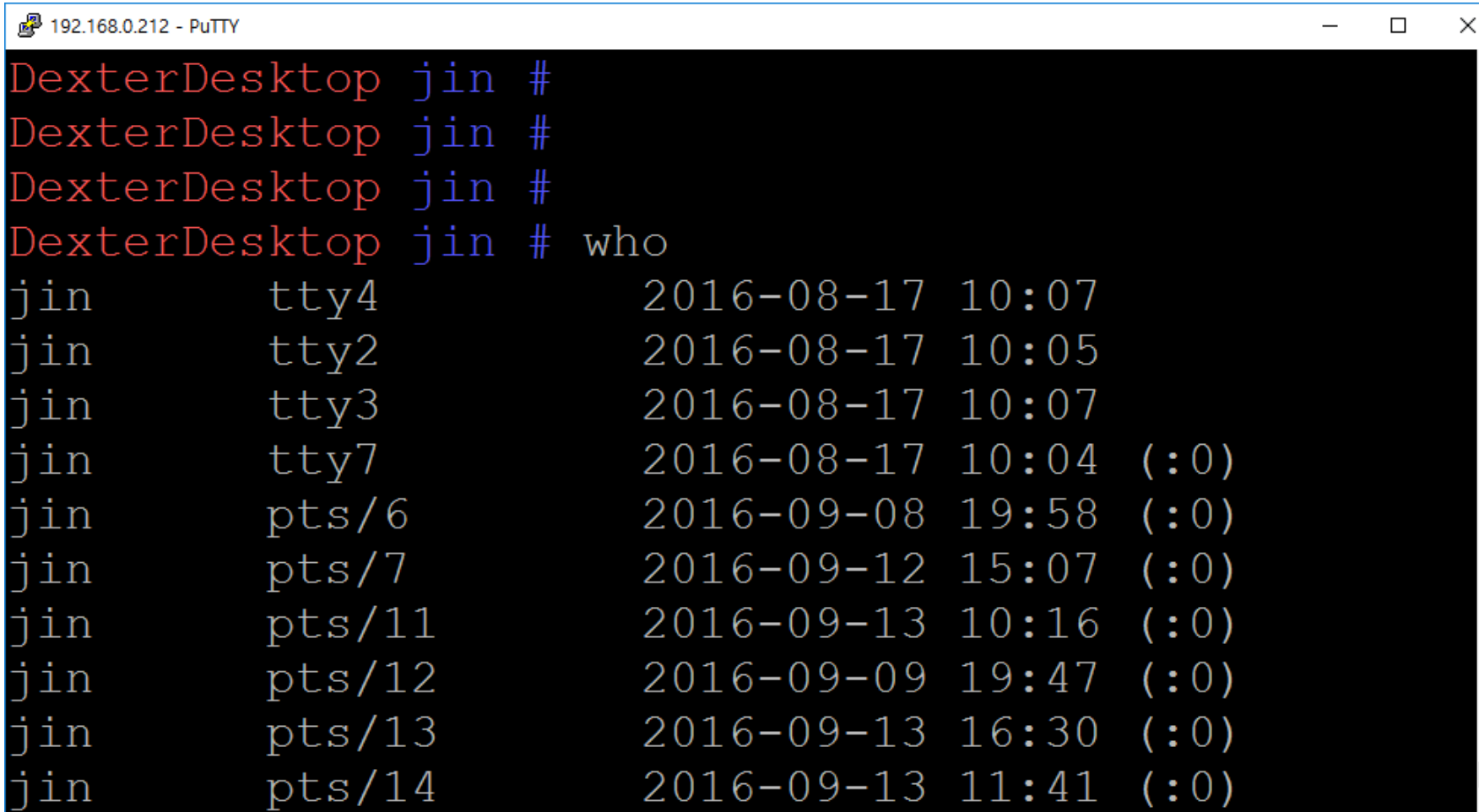
- delete a user
- **deluser** <username>
 - **userdel** <username>



```
192.168.0.212 - PuTTY
DexterDesktop jin #
DexterDesktop jin #
DexterDesktop jin #
DexterDesktop jin # deluser test
Removing user `test' ...
Warning: group `test' has no more members.
Done.
DexterDesktop jin #
DexterDesktop jin #
DexterDesktop jin #
DexterDesktop jin #
DexterDesktop jin #
DexterDesktop jin #
```

who

- Display the users logged in.

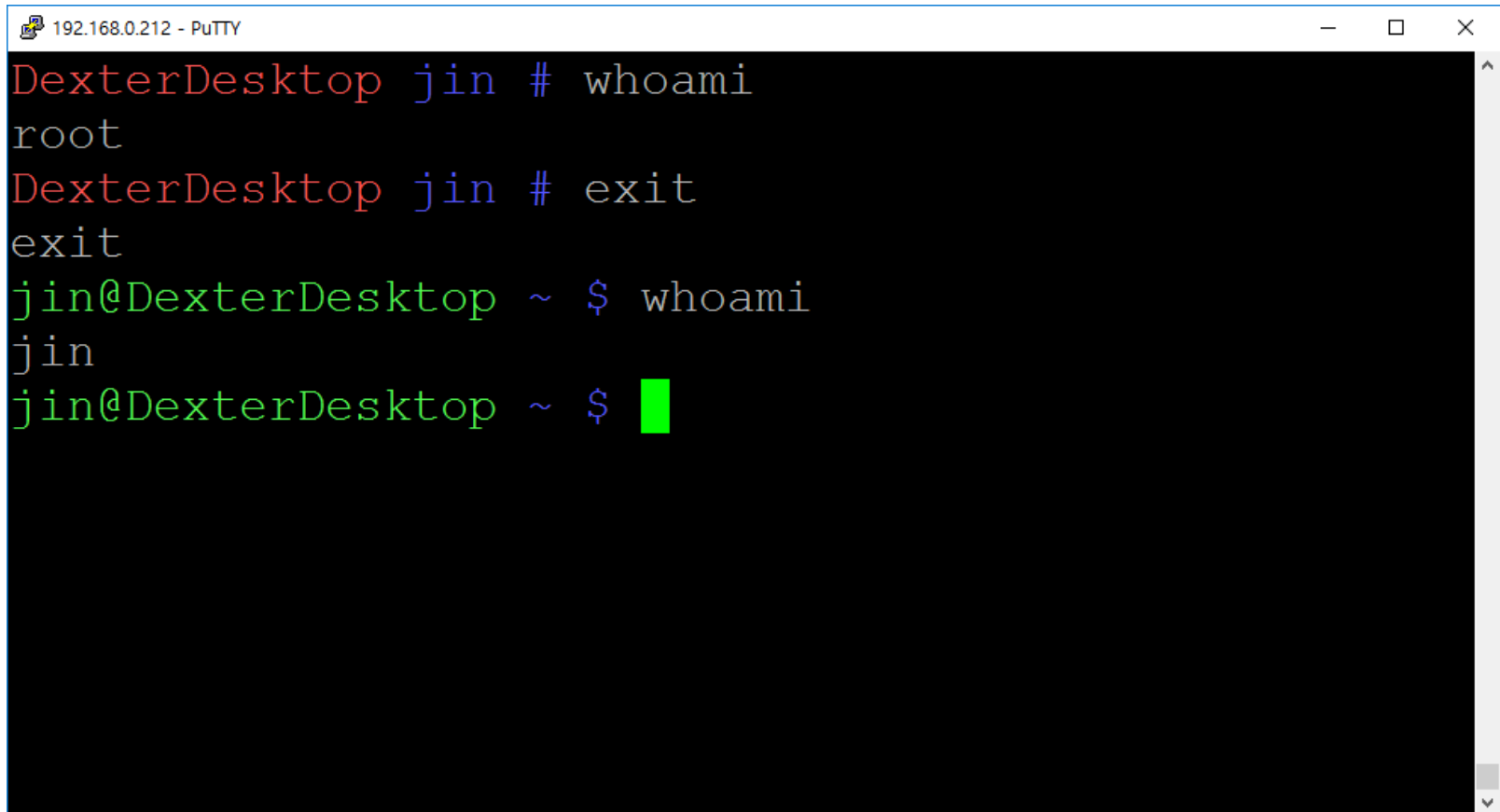


The screenshot shows a PuTTY terminal window titled "192.168.0.212 - PuTTY". The terminal output shows the prompt "DexterDesktop jin #" repeated four times, followed by the command "who". The output of the "who" command is a list of logged-in users, their terminals, login dates, and times. The output is as follows:

```
DexterDesktop jin #  
DexterDesktop jin #  
DexterDesktop jin #  
DexterDesktop jin # who  
jin          tty4          2016-08-17  10:07  
jin          tty2          2016-08-17  10:05  
jin          tty3          2016-08-17  10:07  
jin          tty7          2016-08-17  10:04  (:0)  
jin          pts/6         2016-09-08  19:58  (:0)  
jin          pts/7         2016-09-12  15:07  (:0)  
jin          pts/11        2016-09-13  10:16  (:0)  
jin          pts/12        2016-09-09  19:47  (:0)  
jin          pts/13        2016-09-13  16:30  (:0)  
jin          pts/14        2016-09-13  11:41  (:0)
```


whoami

- **Print effective user id.**



A screenshot of a PuTTY terminal window titled "192.168.0.212 - PuTTY". The terminal shows a sequence of commands and their outputs. The prompt is "DexterDesktop jin #". The first command is "whoami", which outputs "root". The second command is "exit", which outputs "exit". The third command is "whoami", which outputs "jin". The fourth command is "whoami", which outputs "jin". The terminal window has a black background with white text. The prompt "DexterDesktop jin #" is in red. The command "whoami" is in blue. The output "root" is in white. The output "exit" is in white. The output "jin" is in green. The prompt "jin@DexterDesktop ~ \$" is in green. The command "whoami" is in blue. The output "jin" is in green. The prompt "jin@DexterDesktop ~ \$" is in green. The command "whoami" is in blue. The output "jin" is in green. The terminal window has a scrollbar on the right side.

```
192.168.0.212 - PuTTY
DexterDesktop jin # whoami
root
DexterDesktop jin # exit
exit
jin@DexterDesktop ~ $ whoami
jin
jin@DexterDesktop ~ $
```



Filesystem Management

df

- Shows the disk free space on one or more filesystems

```
linux@linux-VirtualBox: ~  
linux@linux-VirtualBox:~$ df  
Filesystem      1K-blocks    Used Available Use% Mounted on  
udev            497116         4    497112   1% /dev  
tmpfs           101648        960    100688   1% /run  
/dev/sda1       7092728 3937112    2772284  59% /  
none              4            0          4   0% /sys/fs/cgroup  
none             5120            0         5120   0% /run/lock  
none            508232        224    508008   1% /run/shm  
none            102400         76    102324   1% /run/user  
linux@linux-VirtualBox:~$
```

du

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

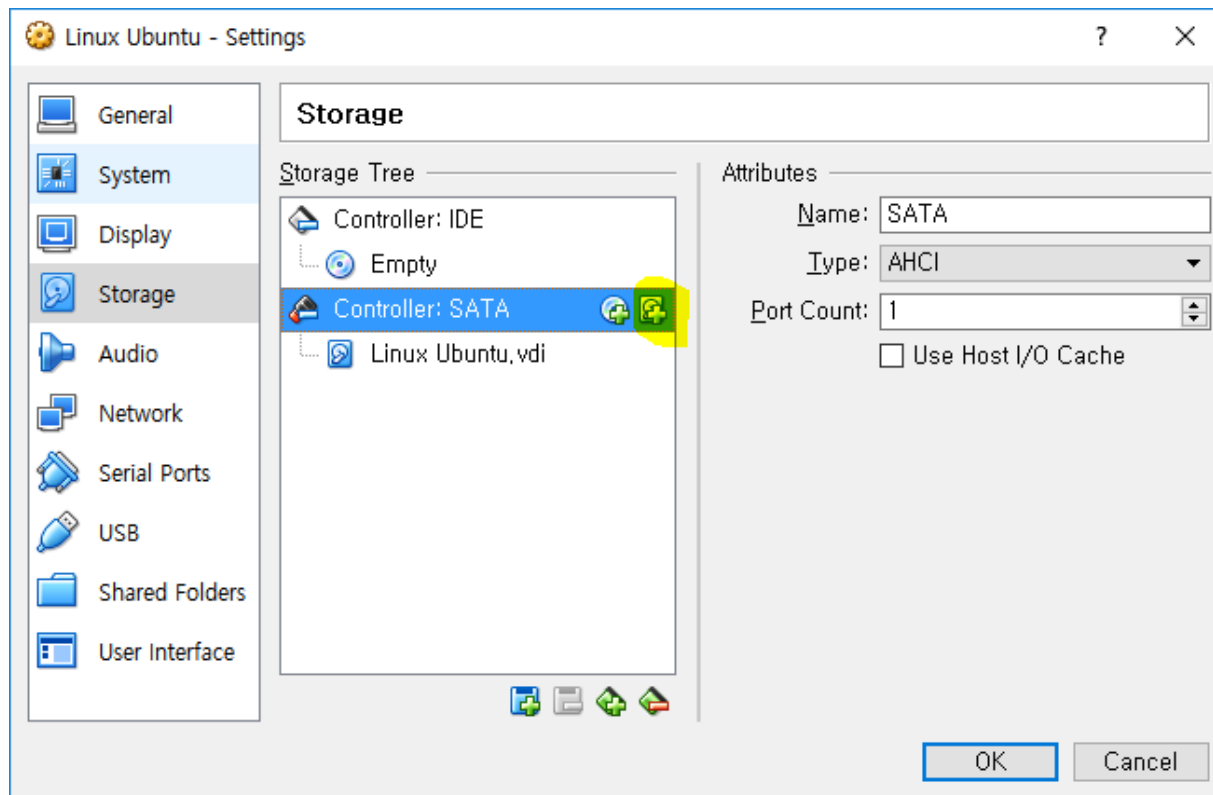
```
linux@linux-VirtualBox: ~/home
/dev/sda1      7092728 3937112    2772284    59% /
none           4         0          4         0% /sys/fs/cgroup
none          5120      0         5120      0% /run/lock
none          508232    224       508008    1% /run/shm
none          102400    76        102324    1% /run/user
linux@linux-VirtualBox:~$ ls
examples.desktop  다운로드  바탕 화면  사진  템플릿
공개              문서      비디오     음악
linux@linux-VirtualBox:~$ du -sh *
12K    examples.desktop
4.0K   공개
4.0K   다운로드
4.0K   문서
4.0K   바탕 화면
4.0K   비디오
4.0K   사진
4.0K   음악
4.0K   템플릿
linux@linux-VirtualBox:~$ cd ..
linux@linux-VirtualBox: /home$
```

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

```
root@linux-VirtualBox: /home/linux
root@linux-VirtualBox:/home/linux# fdisk -l

Disk /dev/sda: 8589 MB, 8589934592 bytes
255 heads, 63 sectors/track, 1044 cylinders, total 16777216 sector
s
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x00016eeb

   Device Boot      Start         End      Blocks   Id  System
/dev/sda1    *        2048     14680063     7339008    83   Linux
/dev/sda2                14682110     16775167     1046529     5   Extended
/dev/sda5                14682112     16775167     1046528    82   Linux swap
 / Solaris

Disk /dev/sdb: 8589 MB, 8589934592 bytes
255 heads, 63 sectors/track, 1044 cylinders, total 16777216 sector
s
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x00000000

Disk /dev/sdb doesn't contain a valid partition table
root@linux-VirtualBox:/home/linux#
```

Mounting File Systems

- List disk lists
 - fdisk -l

```
root@linux-VirtualBox: /home/linux
root@linux-VirtualBox:/home/linux# fdisk -l

Disk /dev/sda: 8589 MB, 8589934592 bytes
255 heads, 63 sectors/track, 1044 cylinders, total 16777216 sector
s
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x00016eeb

   Device Boot      Start         End      Blocks   Id  System
/dev/sda1   *        2048     14680063     7339008   83   Linux
/dev/sda2             14682110     16775167     1046529    5   Extended
/dev/sda5             14682112     16775167     1046528   82   Linux swap
 / Solaris

Disk /dev/sdb: 8589 MB, 8589934592 bytes
255 heads, 63 sectors/track, 1044 cylinders, total 16777216 sector
s
Units = sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disk identifier: 0x00000000

Disk /dev/sdb doesn't contain a valid partition table
root@linux-VirtualBox:/home/linux#
```


Mounting File Systems

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

```
root@linux-VirtualBox: /home/linux
Command (m for help): n
Partition type:
   p   primary (0 primary, 0 extended, 4 free)
   e   extended
Select (default p): p
Partition number (1-4, default 1):
Using default value 1
First sector (2048-16777215, default 2048):
Using default value 2048
Last sector, +sectors or +size{K,M,G} (2048-16777215, default 16777215):
Using default value 16777215

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.
Syncing disks.
root@linux-VirtualBox:/home/linux#
```

Mounting File Systems

- **mkfs -t ext4 /dev/sdb1**

```
root@linux-VirtualBox: /home/linux
root@linux-VirtualBox:/home/linux# mkfs -t ext4 /dev/sdb1
mke2fs 1.42.9 (4-Feb-2014)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
Stride=0 blocks, Stripe width=0 blocks
524288 inodes, 2096896 blocks
104844 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=2147483648
64 block groups
32768 blocks per group, 32768 fragments per group
8192 inodes per group
Superblock backups stored on blocks:
    32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632

Allocating group tables: done
Writing inode tables: done
Creating journal (32768 blocks): done
Writing superblocks and filesystem accounting information: done

root@linux-VirtualBox:/home/linux#
```

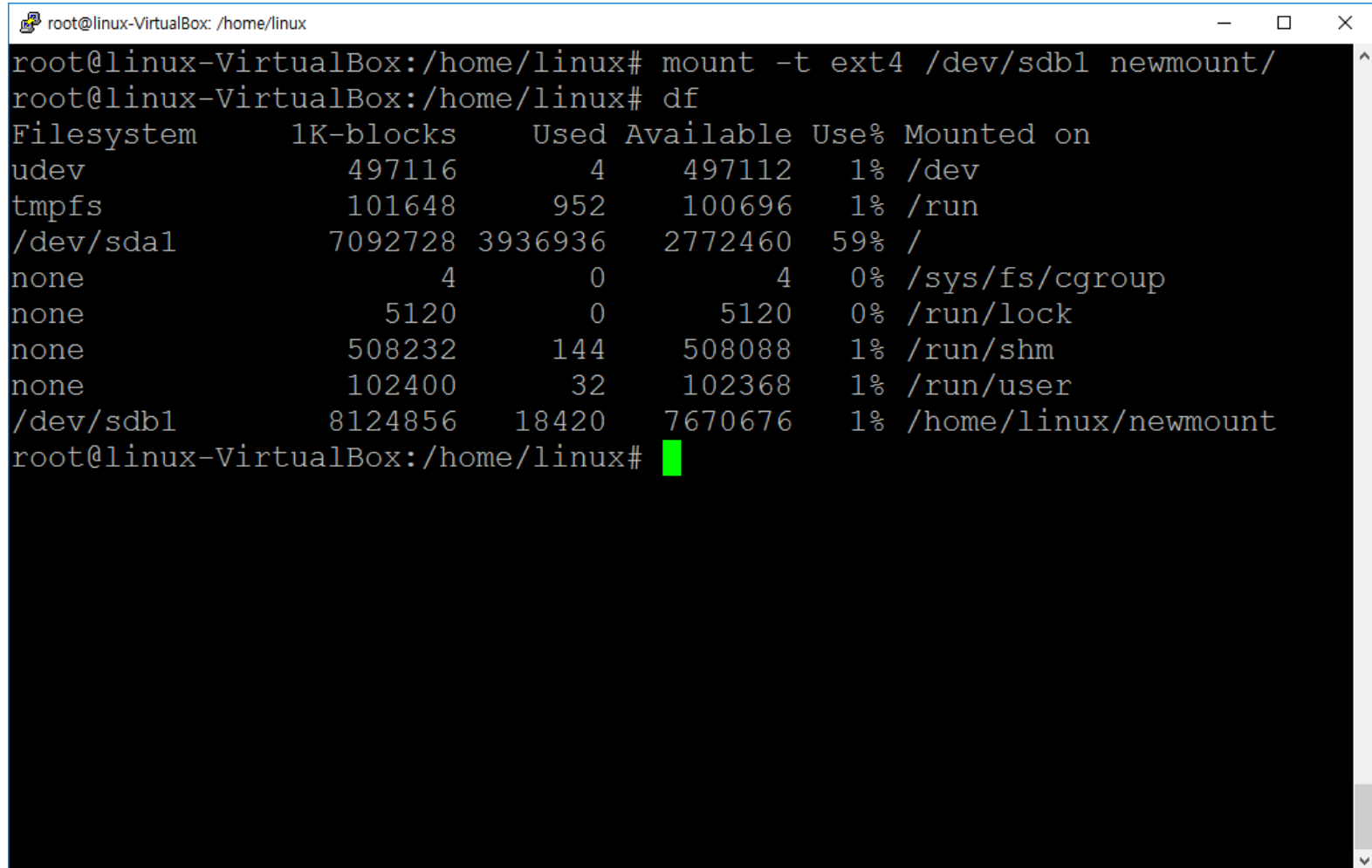
Mounting File Systems

- Create a mounting point

```
root@linux-VirtualBox: /home/linux
root@linux-VirtualBox:/home/linux# ls
examples.desktop  다운로드  바탕 화면  사진  템플릿
공개              문서      비디오     음악
root@linux-VirtualBox:/home/linux# mkdir newmount
root@linux-VirtualBox:/home/linux# ls
examples.desktop  공개      문서      비디오     음악
newmount          다운로드  바탕 화면  사진      템플릿
root@linux-VirtualBox:/home/linux#
```

Mounting File Systems

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



```
root@linux-VirtualBox: /home/linux
root@linux-VirtualBox:/home/linux# mount -t ext4 /dev/sdb1 newmount/
root@linux-VirtualBox:/home/linux# df
Filesystem      1K-blocks    Used Available Use% Mounted on
udev            497116         4    497112   1% /dev
tmpfs           101648        952    100696   1% /run
/dev/sda1       7092728 3936936    2772460  59% /
none              4           0         4   0% /sys/fs/cgroup
none             5120         0        5120   0% /run/lock
none            508232       144    508088   1% /run/shm
none            102400        32    102368   1% /run/user
/dev/sdb1       8124856    18420    7670676   1% /home/linux/newmount
root@linux-VirtualBox:/home/linux#
```

Unmounting File Systems

- **umount newdisk**

```
root@linux-VirtualBox: /home/linux
root@linux-VirtualBox:/home/linux# mount -t ext4 /dev/sdb1 newmount/
root@linux-VirtualBox:/home/linux# df
Filesystem      1K-blocks    Used Available Use% Mounted on
udev            497116         4    497112   1% /dev
tmpfs           101648        952    100696   1% /run
/dev/sda1       7092728 3936936    2772460  59% /
none              4           0         4   0% /sys/fs/cgroup
none            5120          0        5120   0% /run/lock
none           508232       144    508088   1% /run/shm
none           102400        32    102368   1% /run/user
/dev/sdb1       8124856    18420    7670676   1% /home/linux/newmount
root@linux-VirtualBox:/home/linux# umount newmount/
root@linux-VirtualBox:/home/linux# df
Filesystem      1K-blocks    Used Available Use% Mounted on
udev            497116         4    497112   1% /dev
tmpfs           101648        952    100696   1% /run
/dev/sda1       7092728 3936936    2772460  59% /
none              4           0         4   0% /sys/fs/cgroup
none            5120          0        5120   0% /run/lock
none           508232       144    508088   1% /run/shm
none           102400        32    102368   1% /run/user
root@linux-VirtualBox:/home/linux#
```

Filesystem Check

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

```
root@linux-VirtualBox: /home/linux
udev                497116          4    497112    1% /dev
tmpfs               101648          952   100696    1% /run
/dev/sda1           7092728 3936936   2772460   59% /
none                 4              0        4    0% /sys/fs/cgroup
none                 5120           0       5120    0% /run/lock
none                 508232         144   508088    1% /run/shm
none                 102400          32   102368    1% /run/user
/dev/sdb1           8124856   18420   7670676    1% /home/linux/newmount
root@linux-VirtualBox:/home/linux# umount newmount/
root@linux-VirtualBox:/home/linux# df
Filesystem      1K-blocks    Used Available Use% Mounted on
udev            497116         4    497112    1% /dev
tmpfs           101648        952   100696    1% /run
/dev/sda1       7092728 3936936   2772460   59% /
none             4             0         4    0% /sys/fs/cgroup
none            5120          0       5120    0% /run/lock
none            508232        144   508088    1% /run/shm
none            102400         32   102368    1% /run/user
root@linux-VirtualBox:/home/linux# fsck /dev/sdb1
fsck from util-linux 2.20.1
e2fsck 1.42.9 (4-Feb-2014)
/dev/sdb1: clean, 11/524288 files, 70287/2096896 blocks
root@linux-VirtualBox:/home/linux#
```



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)

```
linux@linux-VirtualBox: ~  
linux@linux-VirtualBox:~$ sudo apt-get install chromium-browser  
패키지 목록을 읽는 중입니다 ... 완료  
의존성 트리를 만드는 중입니다  
상태 정보를 읽는 중입니다 ... 완료  
다음 패키지를 더 설치할 것입니다 :  
  chromium-browser-l10n  
제안하는 패키지 :  
  webaccounts-chromium-extension unity-chromium-extension adobe-flashplu  
gin  
다음 새 패키지를 설치할 것입니다 :  
  chromium-browser chromium-browser-l10n  
0개 업그레이드, 2개 새로 설치, 0개 제거 및 52개 업그레이드 안 함 .  
0 바이트 / 57.0 M바이트 아카이브를 받아야 합니다 .  
이 작업 후 230 M바이트의 디스크 공간을 더 사용하게 됩니다 .  
계속 하시겠습니까? [Y/n]
```

APT (Advanced Packaging Tool)



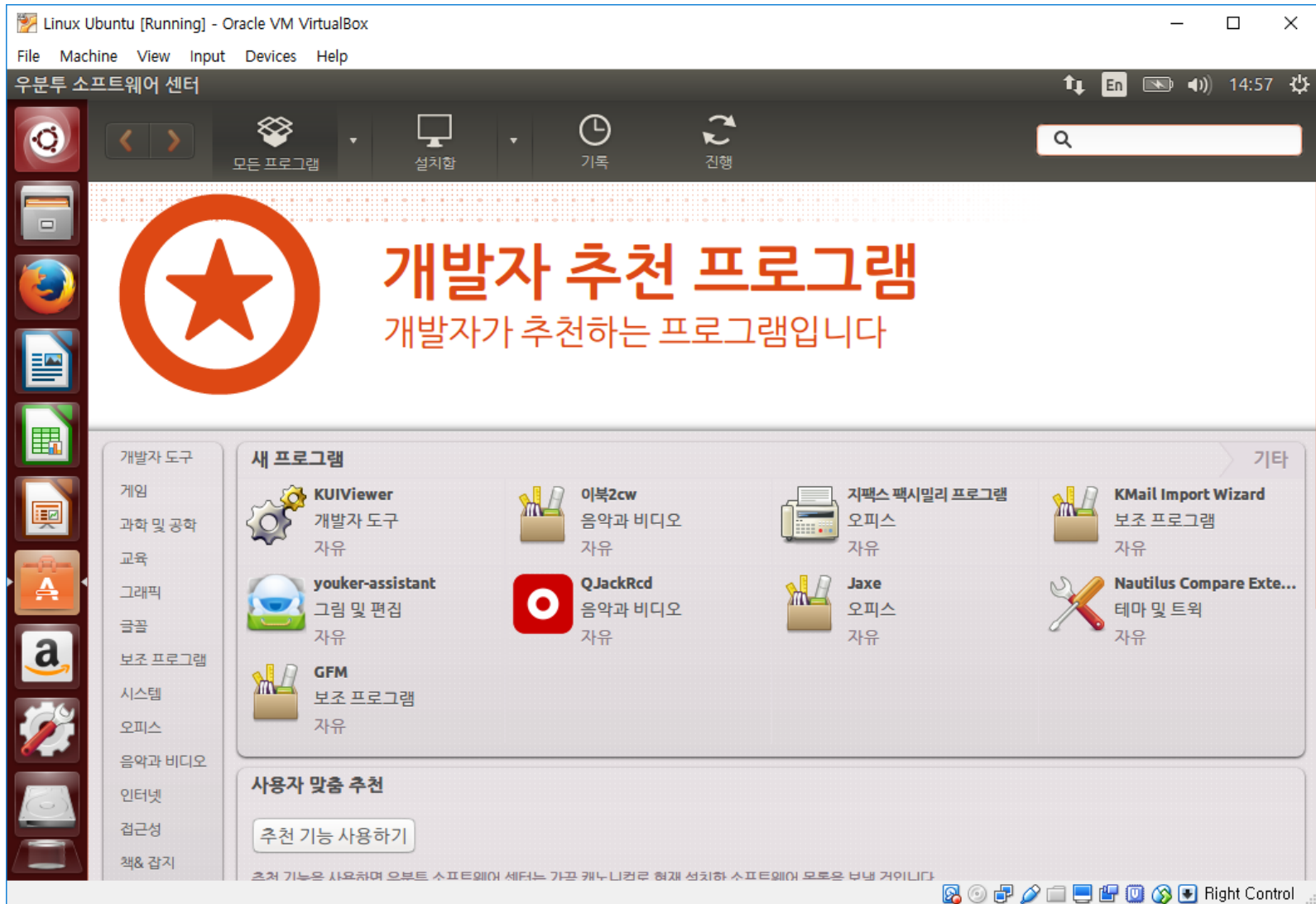
APT (Advanced Packaging Tool)

```
linux@linux-VirtualBox: ~  
linux@linux-VirtualBox:~$ sudo apt-get remove chromium-browser  
패키지 목록을 읽는 중입니다 ... 완료  
의존성 트리를 만드는 중입니다  
상태 정보를 읽는 중입니다 ... 완료  
다음 패키지를 지울 것입니다:  
  chromium-browser chromium-browser-l10n  
0개 업그레이드, 0개 새로 설치, 2개 제거 및 52개 업그레이드 안 함.  
이 작업 후 230 M바이트의 디스크 공간이 비워집니다.  
계속 하시겠습니까? [Y/n] y  
(데이터베이스 읽는 중 ... 현재 170993개의 파일과 디렉터리가 설치되어 있습니다.)  
Removing chromium-browser-l10n (52.0.2743.116-0ubuntu0.14.04.1.1134) ...  
Removing chromium-browser (52.0.2743.116-0ubuntu0.14.04.1.1134) ...  
Processing triggers for gnome-menus (3.10.1-0ubuntu2) ...  
Processing triggers for desktop-file-utils (0.22-1ubuntu1) ...  
Processing triggers for bamfdaemon (0.5.1+14.04.20140409-0ubuntu1) ...  
Rebuilding /usr/share/applications/bamf-2.index...  
Processing triggers for mime-support (3.54ubuntu1.1) ...  
Processing triggers for man-db (2.6.7.1-1ubuntu1) ...  
Processing triggers for hicolor-icon-theme (0.13-1) ...  
linux@linux-VirtualBox:~$
```

APT (Advanced Packaging Tool)

```
linux@linux-VirtualBox: ~  
Processing triggers for hicolor-icon-theme (0.13-1) ...  
linux@linux-VirtualBox:~$ clear  
linux@linux-VirtualBox:~$ sudo apt-get update  
무 시 http://kr.archive.ubuntu.com trusty InRelease  
  
받 기 :1 http://kr.archive.ubuntu.com trusty-updates InRelease [65.9 kB]  
  
기 존 http://kr.archive.ubuntu.com trusty-backports InRelease  
100% [1 InRelease gpgv 65.9 kB] [kr.archive.ubuntu.com(103.22.220.133)에  
  
기 존 http://kr.archive.ubuntu.com trusty Release.gpg  
100% [InRelease gpgv 65.9 kB] [security.ubuntu.com(91.189.88.162)에 연 결  
  
받 기 :2 http://kr.archive.ubuntu.com trusty-updates/main Sources [381 kB]  
16% [2 Sources 4,153 B/381 kB 1%] [security.ubuntu.com(91.189.88.162)에  
  
받 기 :3 http://kr.archive.ubuntu.com trusty-updates/restricted Sources [5  
,360 B]  
  
받 기 :4 http://kr.archive.ubuntu.com trusty-updates/universe Sources [164  
kB]  
78% [2 Sources bzip2 0 B] [4 Sources 27.5 kB/164 kB 17%] [security.ubunt  
  
받 기 :5 http://kr.archive.ubuntu.com trusty-updates/multiverse Sources [7  
,126 B]
```

Ubuntu Software Center





SSH

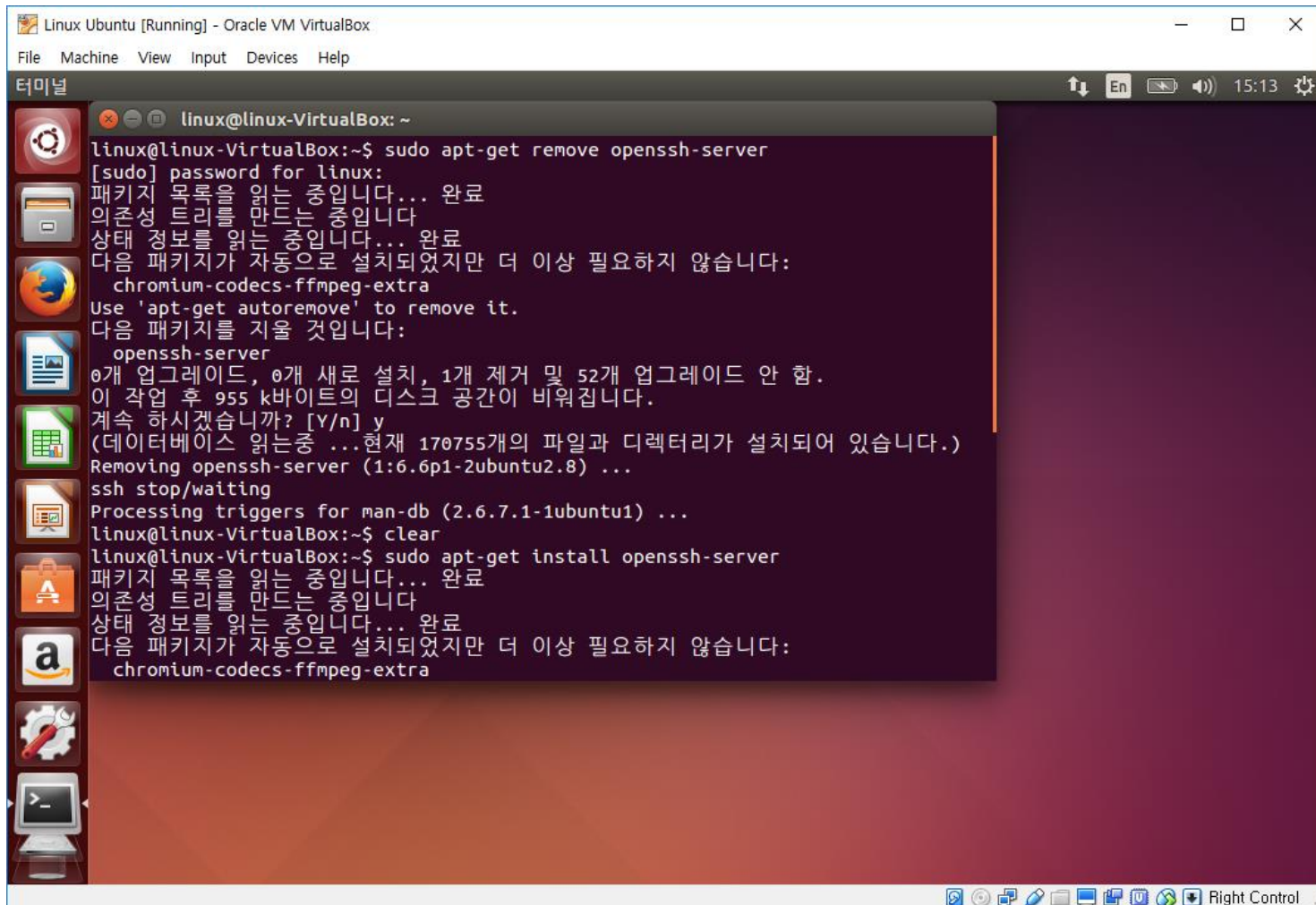
- **Secure Shell**
- **Supports secure remote logins, secure remote command execution, secure file transfers**
- **Has a client server architecture – SSH server program and client program**

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**

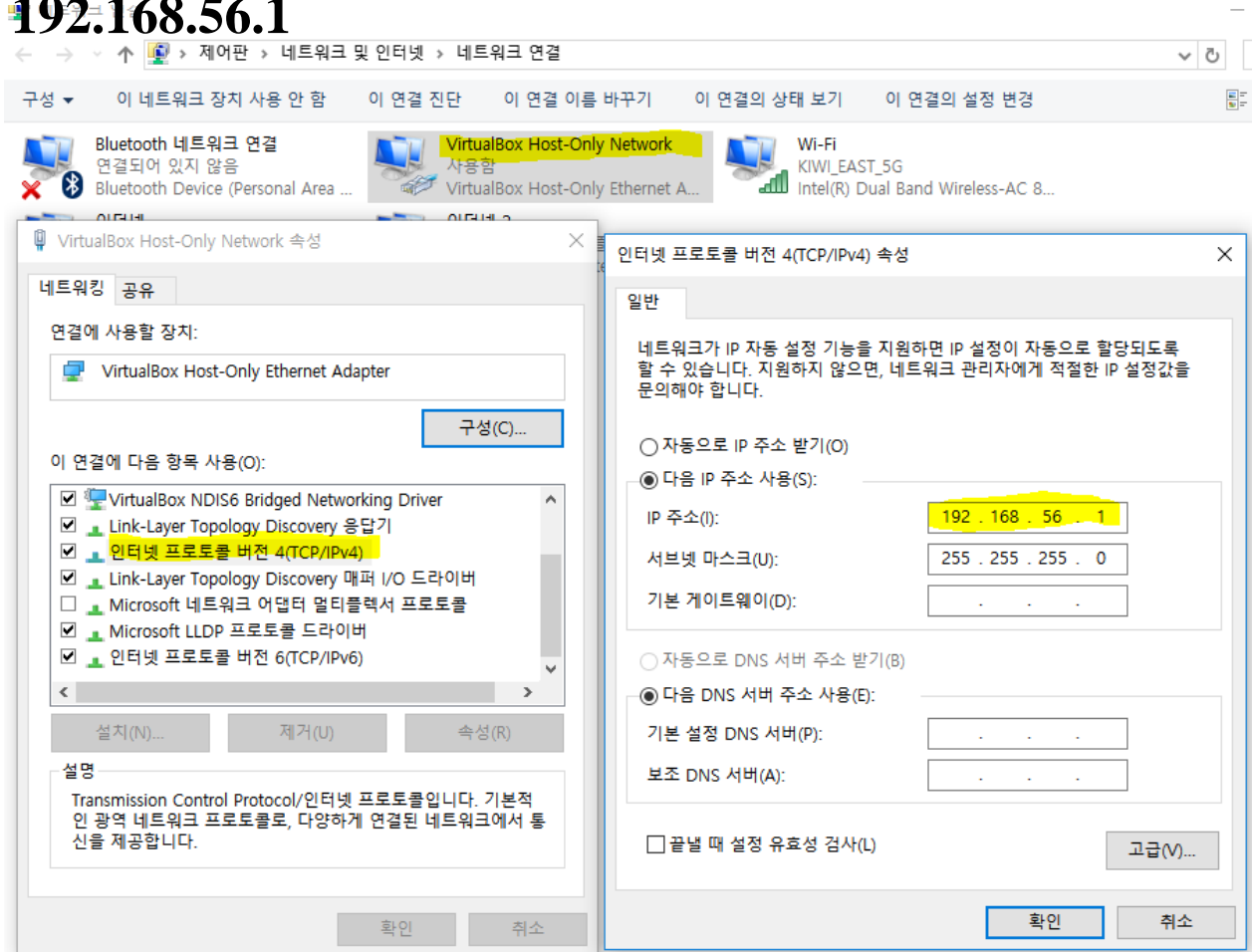


The screenshot shows a terminal window titled "linux@linux-VirtualBox: ~" with the following commands and output:

```
linux@linux-VirtualBox:~$ sudo apt-get remove openssh-server
[sudo] password for linux:
패키지 목록을 읽는 중입니다... 완료
의존성 트리를 만드는 중입니다
상태 정보를 읽는 중입니다... 완료
다음 패키지가 자동으로 설치되었지만 더 이상 필요하지 않습니다:
  chromium-codecs-ffmpeg-extra
Use 'apt-get autoremove' to remove it.
다음 패키지를 지울 것입니다:
  openssh-server
0개 업그레이드, 0개 새로 설치, 1개 제거 및 52개 업그레이드 안 함.
이 작업 후 955 k바이트의 디스크 공간이 비워집니다.
계속 하시겠습니까? [Y/n] y
(데이터베이스 읽는중 ...현재 170755개의 파일과 디렉터리가 설치되어 있습니다.)
Removing openssh-server (1:6.6p1-2ubuntu2.8) ...
ssh stop/waiting
Processing triggers for man-db (2.6.7.1-1ubuntu1) ...
linux@linux-VirtualBox:~$ clear
linux@linux-VirtualBox:~$ sudo apt-get install openssh-server
패키지 목록을 읽는 중입니다... 완료
의존성 트리를 만드는 중입니다
상태 정보를 읽는 중입니다... 완료
다음 패키지가 자동으로 설치되었지만 더 이상 필요하지 않습니다:
  chromium-codecs-ffmpeg-extra
```

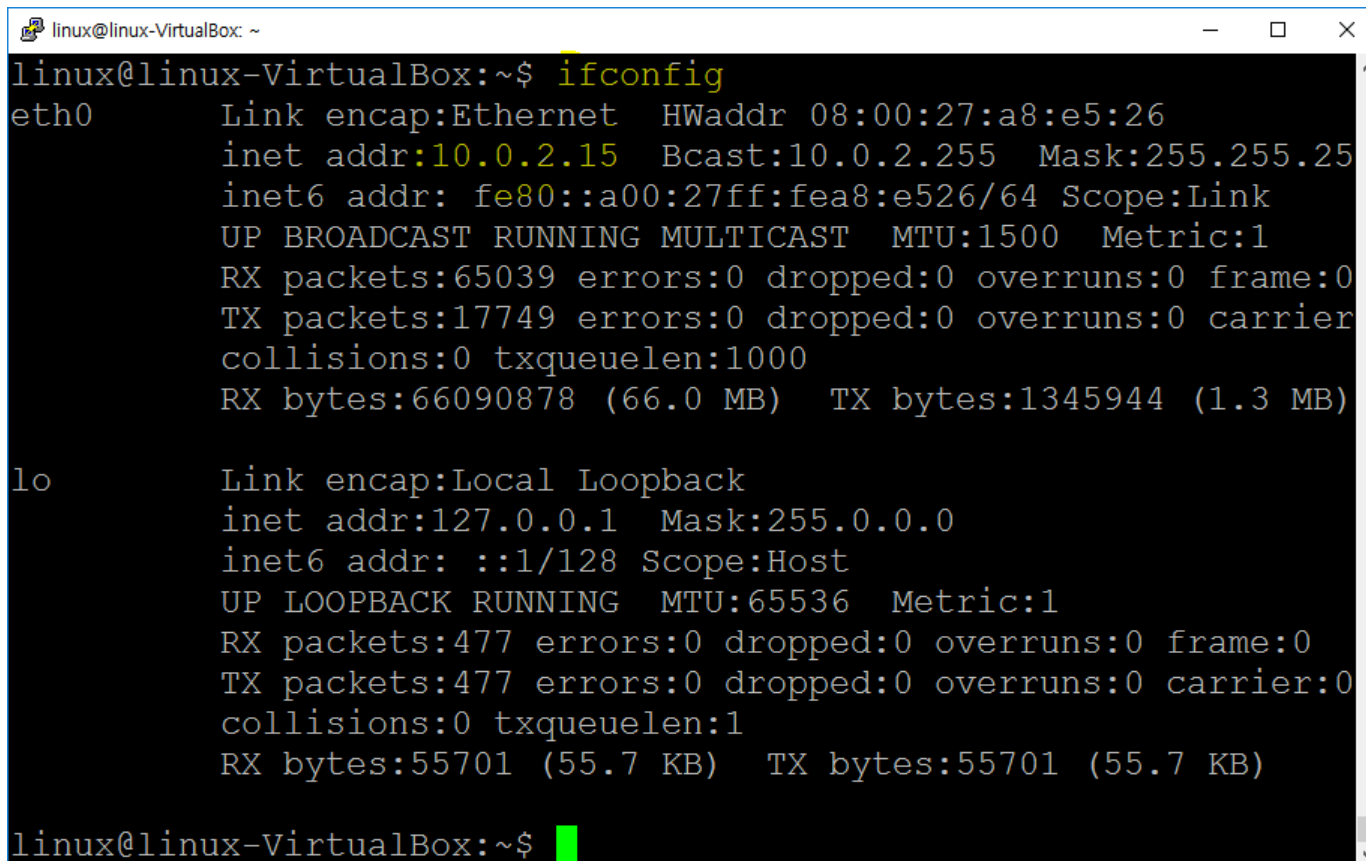
Configuring Virtualbox for SSH

- IP of VirtualBox Host-Only Network
 - 192.168.56.1



Configuring Virtualbox for SSH

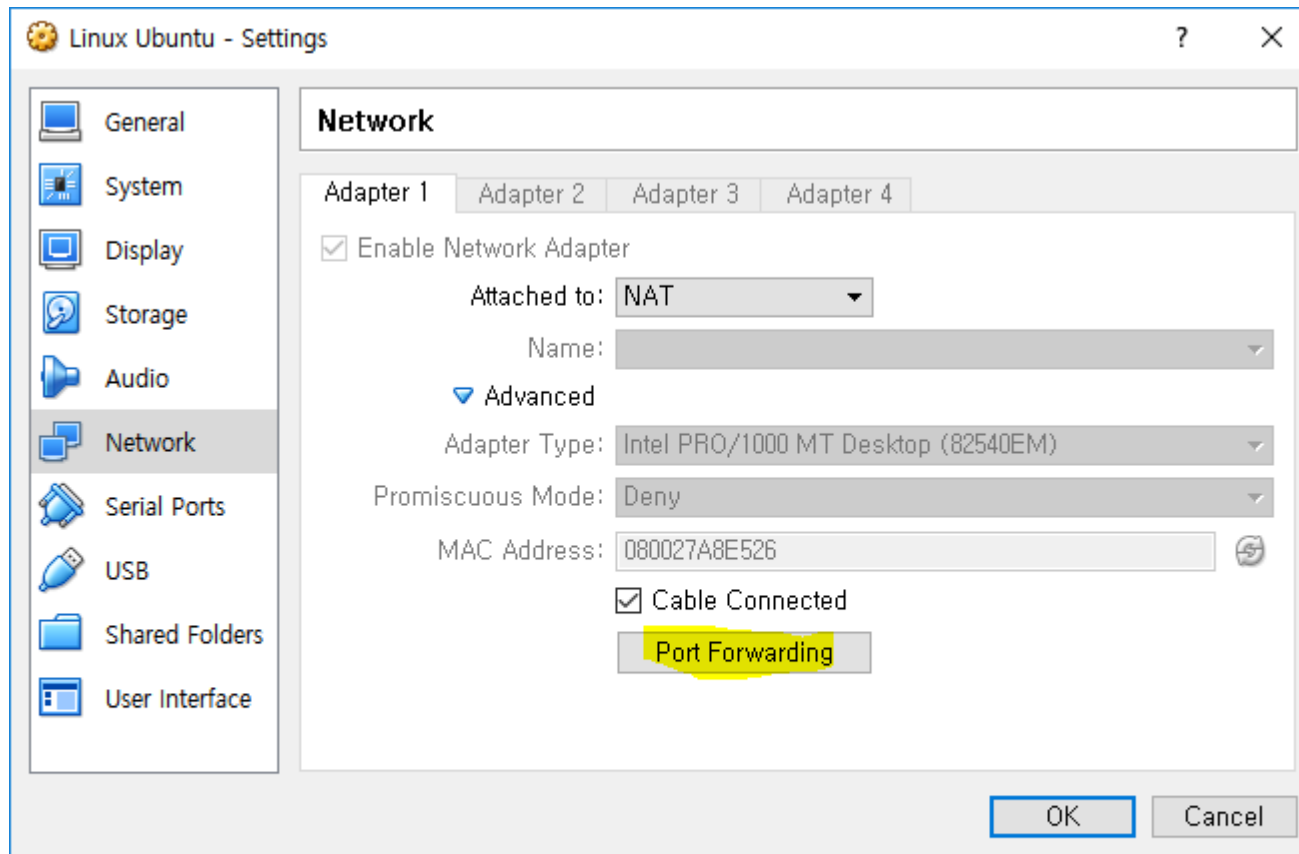
- IP of Linux with ifconfig
 - 10.0.2.15



```
linux@linux-VirtualBox: ~  
linux@linux-VirtualBox:~$ ifconfig  
eth0      Link encap:Ethernet  HWaddr 08:00:27:a8:e5:26  
          inet addr:10.0.2.15  Bcast:10.0.2.255  Mask:255.255.255  
          inet6 addr: fe80::a00:27ff:fea8:e526/64 Scope:Link  
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1  
          RX packets:65039 errors:0 dropped:0 overruns:0 frame:0  
          TX packets:17749 errors:0 dropped:0 overruns:0 carrier  
          collisions:0 txqueuelen:1000  
          RX bytes:66090878 (66.0 MB)  TX bytes:1345944 (1.3 MB)  
  
lo        Link encap:Local Loopback  
          inet addr:127.0.0.1  Mask:255.0.0.0  
          inet6 addr: ::1/128 Scope:Host  
          UP LOOPBACK RUNNING  MTU:65536  Metric:1  
          RX packets:477 errors:0 dropped:0 overruns:0 frame:0  
          TX packets:477 errors:0 dropped:0 overruns:0 carrier:0  
          collisions:0 txqueuelen:1  
          RX bytes:55701 (55.7 KB)  TX bytes:55701 (55.7 KB)  
  
linux@linux-VirtualBox:~$
```

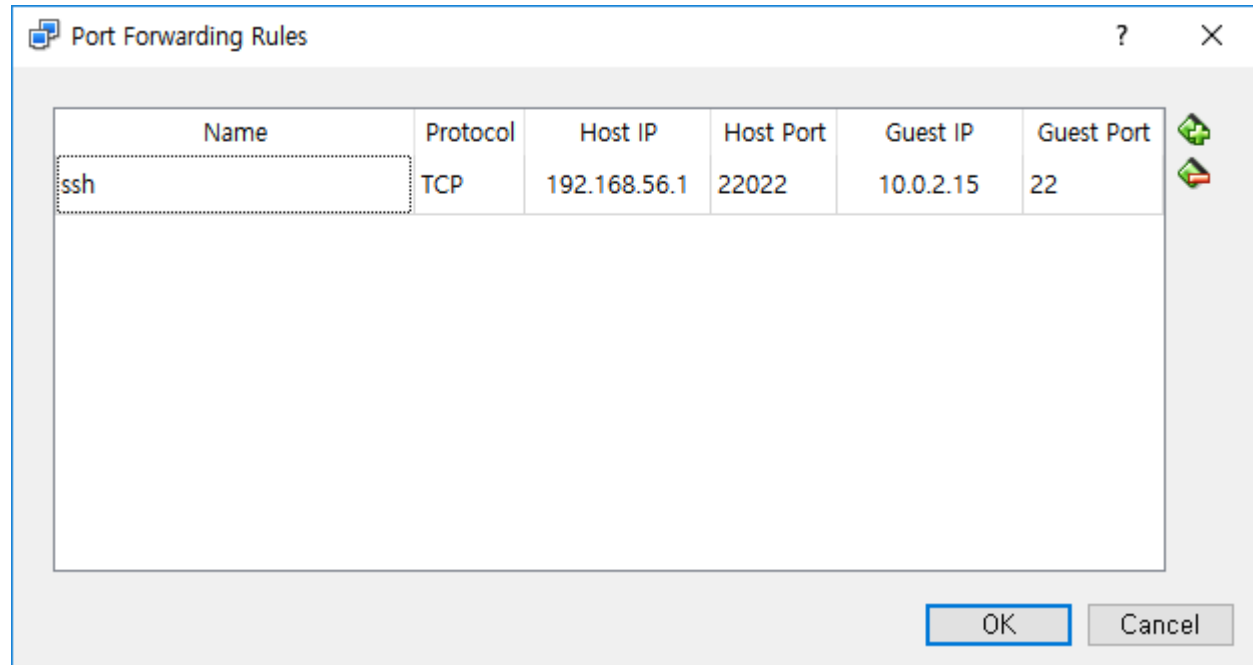
Configuring Virtualbox for SSH

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



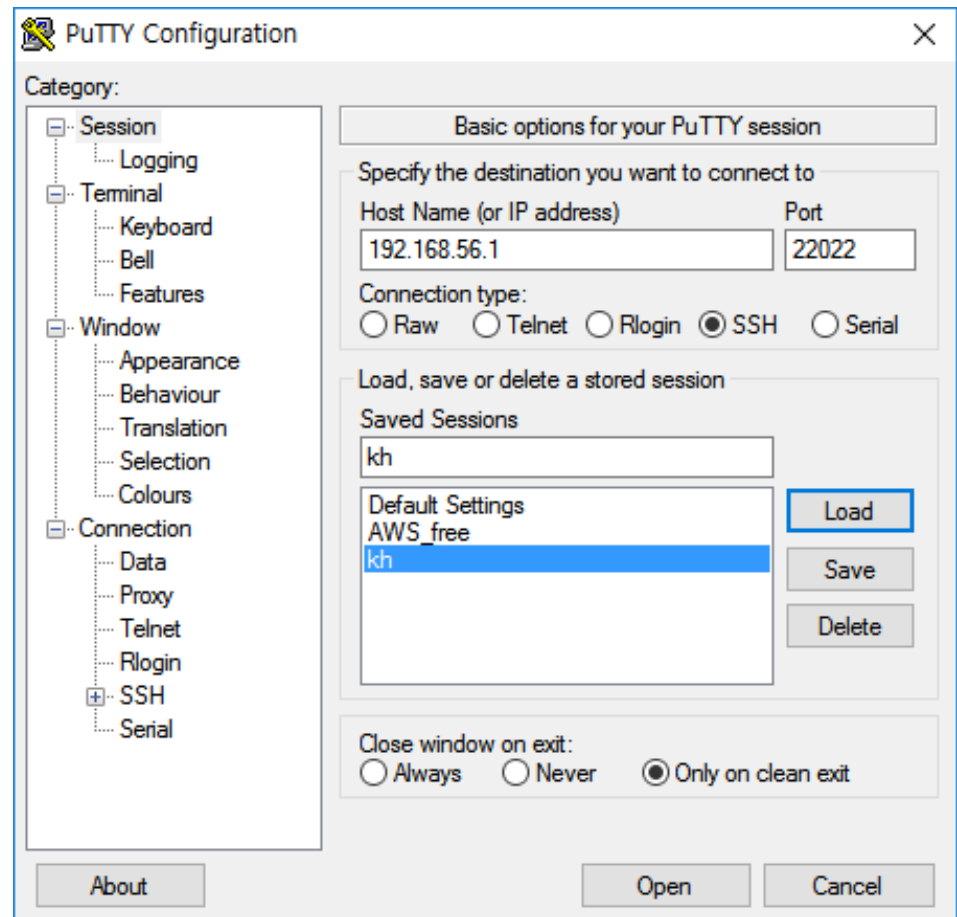
Configuring Virtualbox for SSH

- **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**

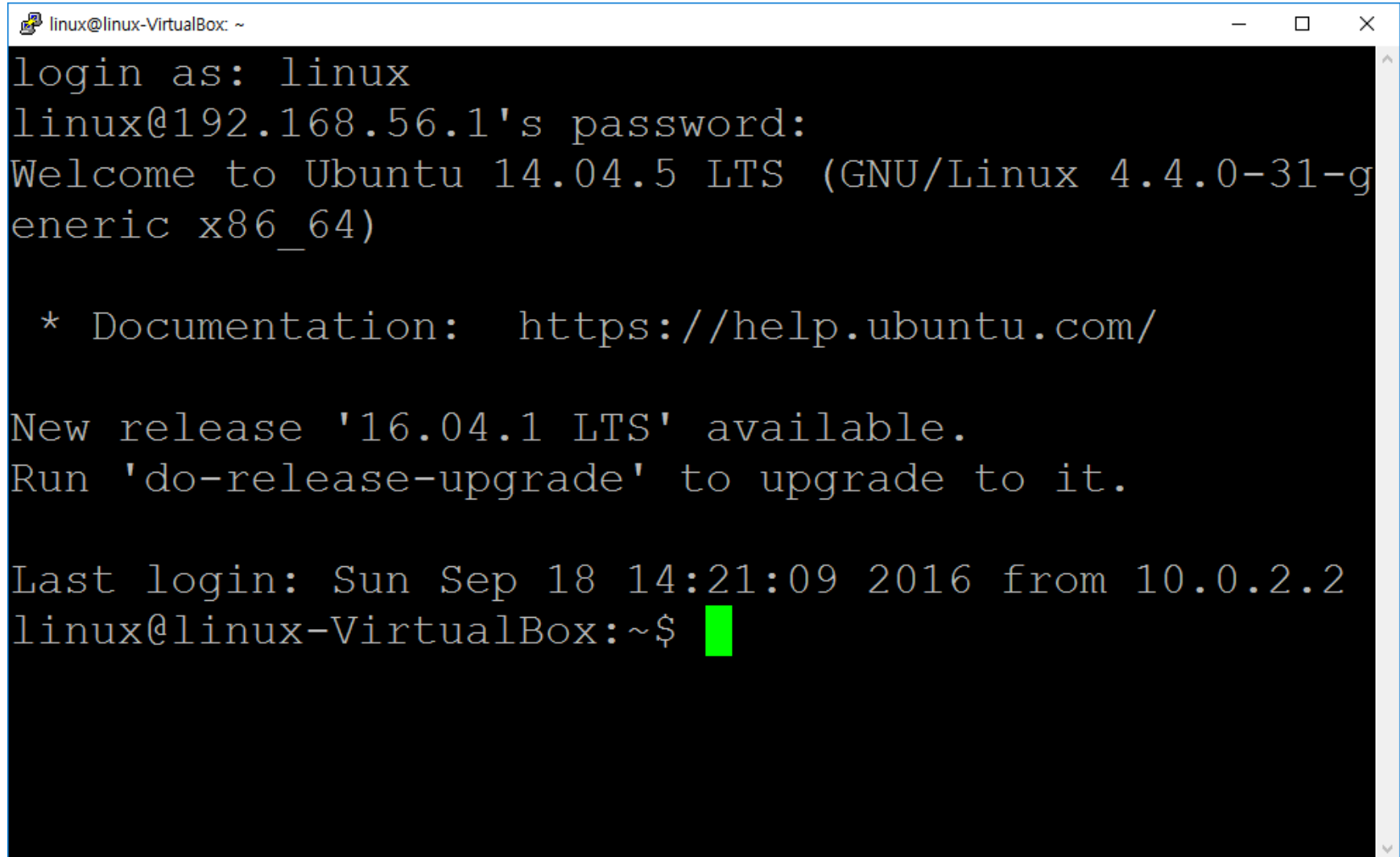


Putty

- SSH client
 - <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

A terminal window titled 'linux@linux-VirtualBox: ~' with standard window controls. The terminal displays the login process for a user named 'linux' on an Ubuntu 14.04.5 LTS system. It shows the password prompt, a welcome message, documentation link, upgrade notice for 16.04.1 LTS, and the last login details. The prompt ends with a green cursor.

```
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-generic 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:~$
```