Introduction to Linux systems

Introduction

- Linux everywhere
  - Desktop computers, servers, mobile devices, embedded systems, gadgets
- Growing number of users
  - > 70 000 000??
- Different distributions for different kinds of users
  - Ubuntu, Red Hat, CentOS, Specialized distributions (for video, audio or games)
- Open source development
  - Easy to modify/verify
  - Free
- Will Internet of Things be Linux-based?

Introduction

- Some examples of Linux usage
  - Networking devices (WLAN boxes, Switches, Routers)
  - Rasberry Pi
  - Rifles
  - Wearable devices
  - Gaming consoles
  - Cameras
  - Android phones/tablets
  - Television

Introduction

- Why do you need Linux skills?
  - Courses (obviously this course)
    - For example Elementary programming, Embedded systems, Introduction to Internet
  - Using faculty computers
  - Administrating your networking device
  - Building a LAN
  - At work
  - Hacking your android
  - Building a ”very-cool-gagdet”

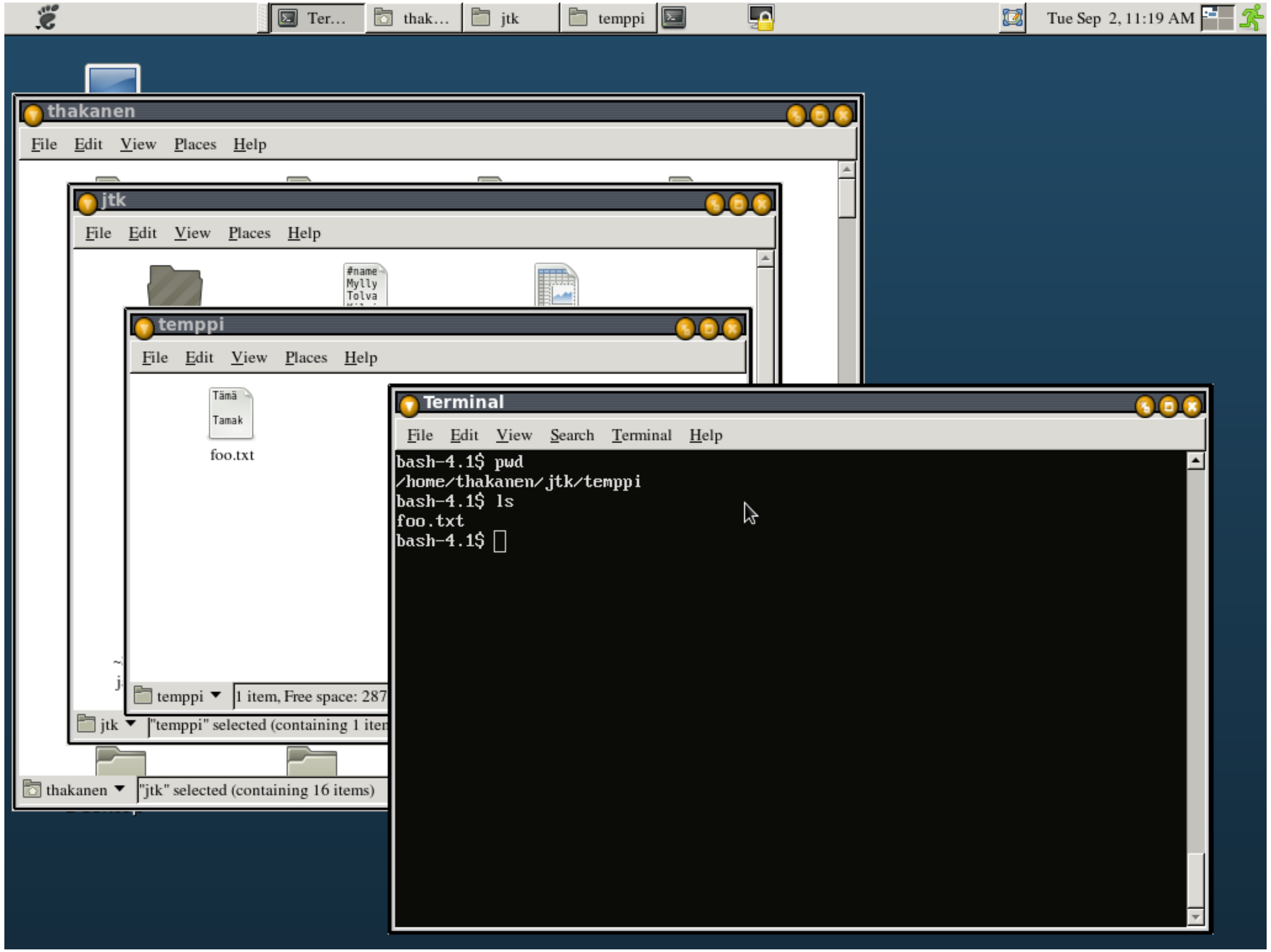
Introduction

- Faculty facilities
  - Linux classes TS137, TS138
    - ”stupid” clients connect to servers
    - St-cn0001, st-cn0002 and st-cn0003 mainly for students
  - PC classes TS134, TS135, TS136
  - Same home holder in both systems
- How to remote connect
  - > ssh st-cn0001.oulu.fi
  - Putty st-cn0001.oulu.fi
  - Thinlinc (st-cn0001.oulu.fi)

GUI vs command line

- Graphical user interface similar to windows
  - different desktop environments (gnome, KDE, unity)
  - can be easily modified
- Sometimes GUI is not available
  - for example when taking remote connection to a server
- All the same things as in GUI can be done in the command line
  - sometimes using command line is even more efficient
  - Unix/Linux uses simple programs which can be “joined” together to achieve the needed result

GUI vs command line



```
bash-4.1$ pwd
/home/thakanen/jtk/temppi
bash-4.1$ ls
foo.txt
bash-4.1$ 
```

Ter…
thak…
jtk
temppi
Tue Sep 2, 11:19 AM
thakanen
File Edit View Places Help
jtk
File Edit View Places Help
#name
Mylly
Tolva
temppi
File Edit View Places Help
Tämä
Tamak
foo.txt
temppi
1 item, Free space: 287
jtk
"temppi" selected (containing 1 iten
thakanen
"jtk" selected (containing 16 items)
Terminal
File Edit View Search Terminal Help

Using terminal (command line)

- Terminal always opens in your home directory
- Everything is case-sensitive
- Input commands with keyboard and press enter to execute
- Tabulator can be used to autocomplete or find commands/files/directories
    - type pw and press <tab> twice to get list of commands starting with pw
    - if there is only one choice it fills automatically
- You can use arrow keys to browse command history

Using terminal (command line)

- Commands may need options or arguments
  - options define how the command is executed
    - options can be easily found with *man <command>*
  - arguments define the data (file, folder) used as an input for the command
  - *ls -l /home/<username>/* where ls is the command, -l is an option and directory path is an argument
  - There can be multiple options and arguments given for a command

Some basic commands

Command	Explanation
pwd	Print working directory
ls	Print content of directory
cd	Change directory
cat	Print the contents of a file
cp	Copy a file
mv	Move a file
rm	Remove a file
less	Read the contents of a file
clear	Clear the terminal screen
head	Show the first 10 lines of a file
tail	Show the last 10 lines of a file
nano	Text editor, to modify text files
wget	Download a file from an URL

VIB

http://wiki.bits.vib.be/index.php/Linux_Beginner%27s_Cheat_page

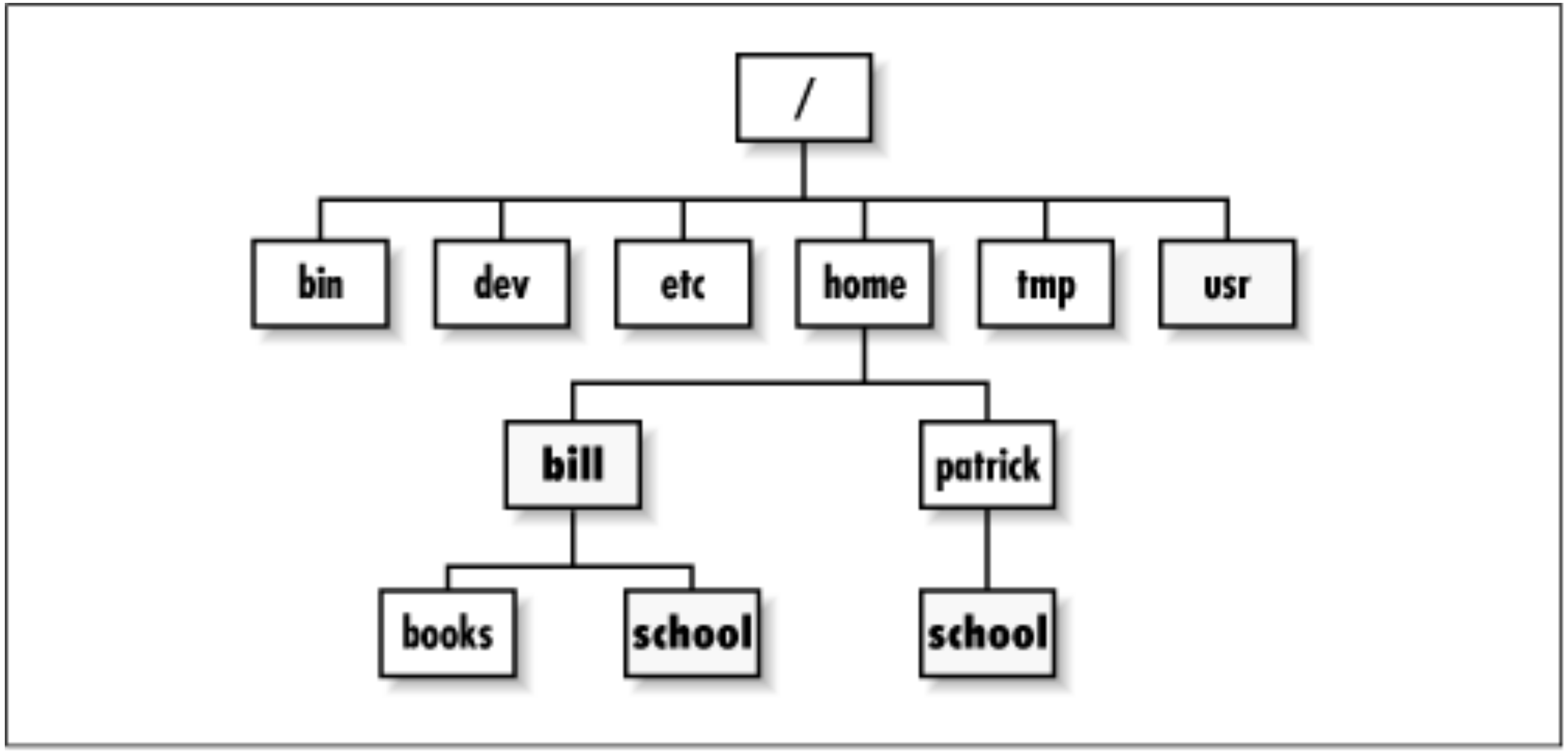
Help me!

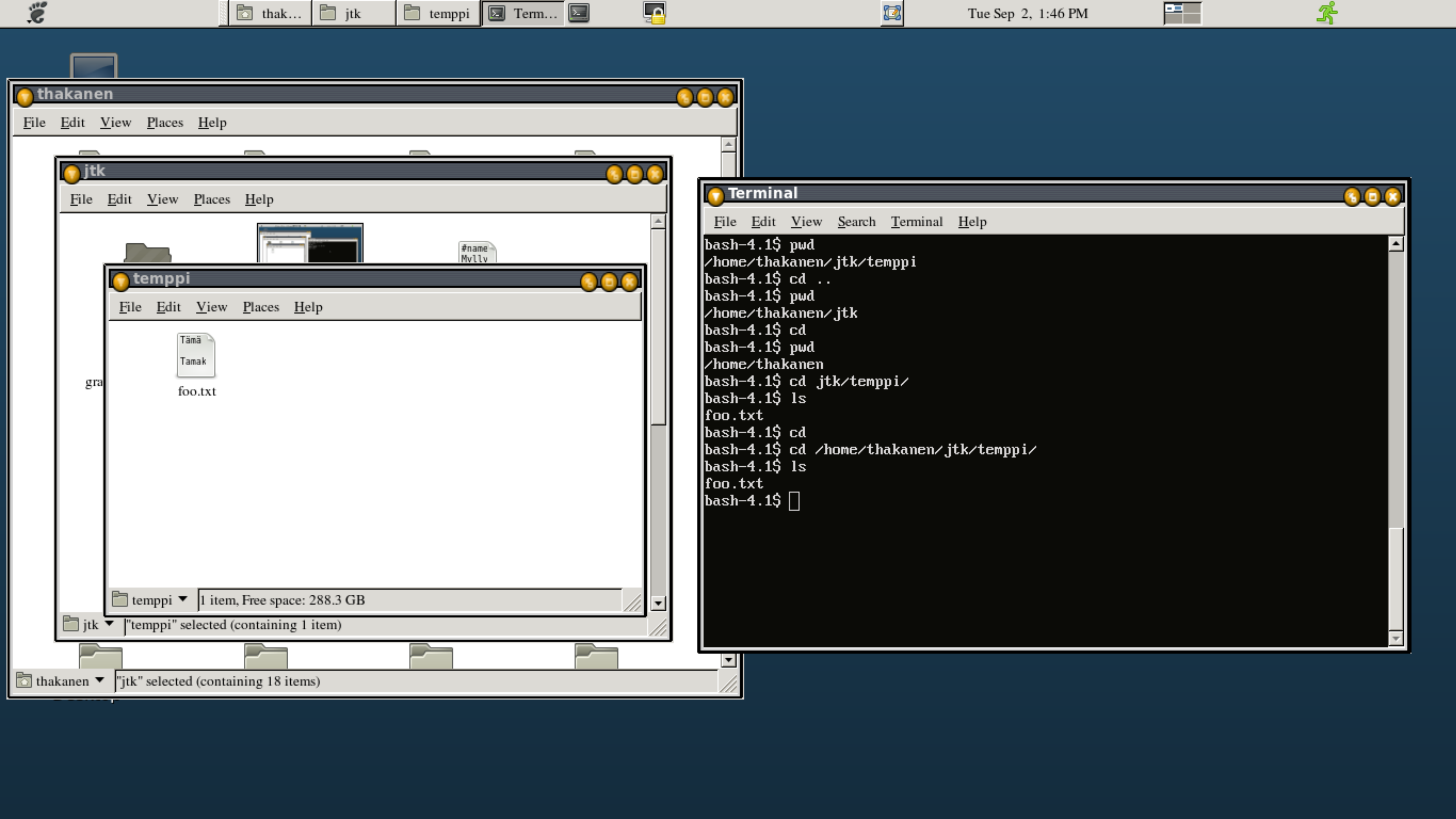
- Unix-based systems use sometimes hard to remember abbreviations of the commands
  - for example *copy = cp* or *change directory = cd* or *print working directory = pwd*
- So how can you find the needed command??
  - using google may be the easiest way
    - “Linux find IP address”
  - there is also information pages for basic commands which can be found using *man* or *info* commands
    - for example *man cp* or *info pwd*
    - used mostly when you know the command but not how to use it

File system

- Files and folders in Linux systems are organized in a hierarchical tree
- Base of the tree is root directory or /
- command *cd* can be used to move on the directory tree
    - typing plain *cd* takes you to your home directory
    - *cd /home/<username>* also takes you to your home directory
    - *cd* ~ - guess what happens or try it out
    - *cd* .. goes one step up in a directory tree
    - *cd* is the same as double clicking folders in windows or in GUI

File system




thak…
jtk
temppi
Term…
Tue Sep 2, 1:46 PM
thakanen
File Edit View Places Help
jtk
File Edit View Places Help
#name
Myllv
gra
temppi
File Edit View Places Help
Tämä
Tamak
foo.txt
temppi
jtk
thakanen
Terminal
File Edit View Search Terminal Help

1 item, Free space: 288.3 GB

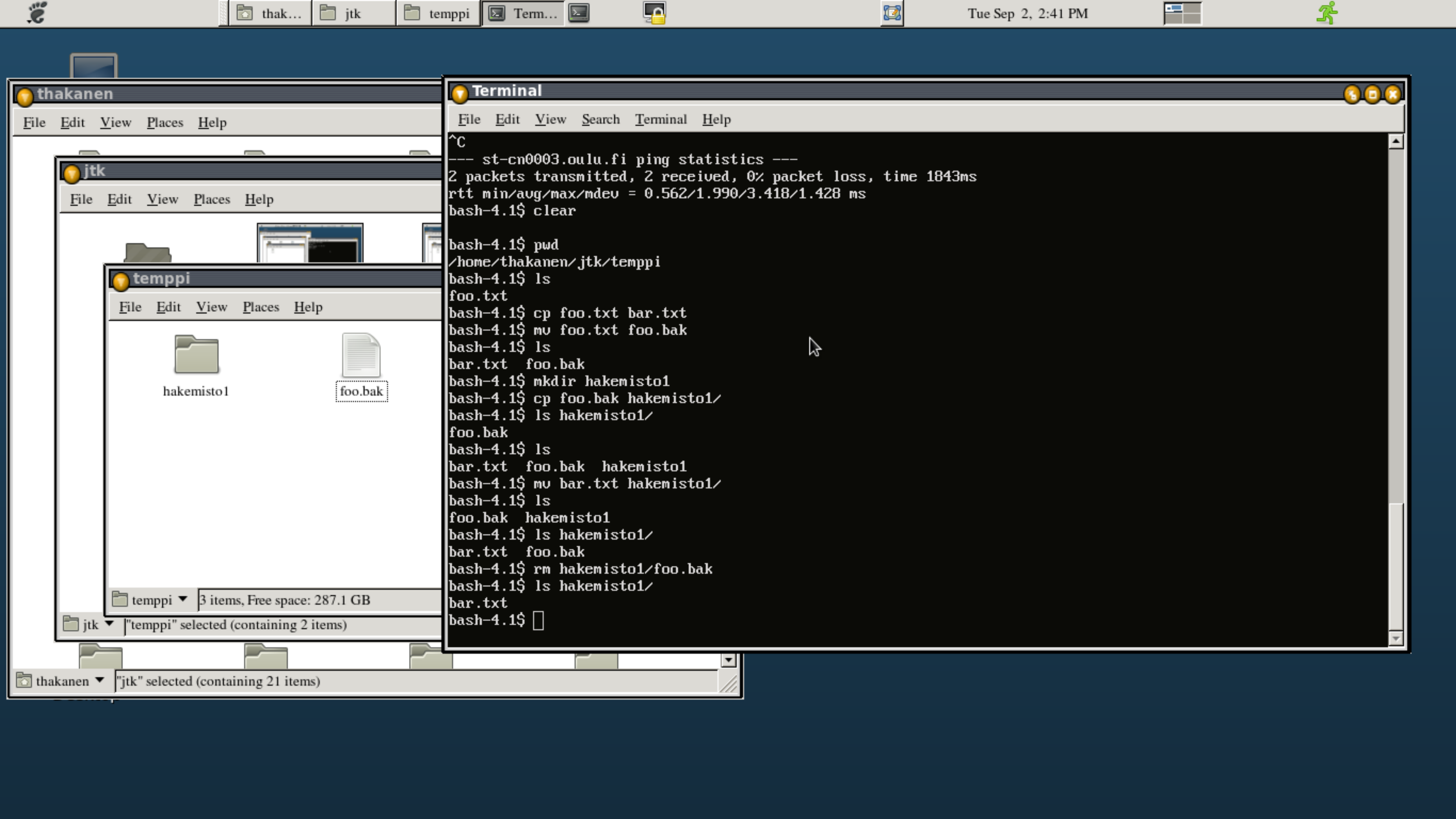
"temppi" selected (containing 1 item)

"jtk" selected (containing 18 items)

```
bash-4.1$ pwd
/home/thakanen/jtk/temppi
bash-4.1$ cd ..
bash-4.1$ pwd
/home/thakanen/jtk
bash-4.1$ cd
bash-4.1$ pwd
/home/thakanen
bash-4.1$ cd jtk/temppi/
bash-4.1$ ls
foo.txt
bash-4.1$ cd
bash-4.1$ cd /home/thakanen/jtk/temppi/
bash-4.1$ ls
foo.txt
bash-4.1$ 
```

Handling files

- What do you need to do with files?
  - create - *touch* or with editor like *nano*
  - edit - *nano*
  - copy - *cp*
  - move - *mv*
  - delete/remove - *rm*


thak…
jtk
temppi
Term…
Tue Sep 2, 2:41 PM
thakanen
File Edit View Places Help
jtk
File Edit View Places Help
temppi
File Edit View Places Help
hakemisto1
foo.bak
temppi
jtk
thakanen
Terminal
File Edit View Search Terminal Help

```
^C
--- st-cn0003.oulu.fi ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1843ms
rtt min/avg/max/mdev = 0.562/1.990/3.418/1.428 ms
bash-4.1$ clear

bash-4.1$ pwd
/home/thakanen/jtk/temppi
bash-4.1$ ls
foo.txt
bash-4.1$ cp foo.txt bar.txt
bash-4.1$ mv foo.txt foo.bak
bash-4.1$ ls
bar.txt  foo.bak
bash-4.1$ mkdir hakemisto1
bash-4.1$ cp foo.bak hakemisto1/
bash-4.1$ ls hakemisto1/
foo.bak
bash-4.1$ ls
bar.txt  foo.bak  hakemisto1
bash-4.1$ mv bar.txt hakemisto1/
bash-4.1$ ls
foo.bak  hakemisto1
bash-4.1$ ls hakemisto1/
bar.txt  foo.bak
bash-4.1$ rm hakemisto1/foo.bak
bash-4.1$ ls hakemisto1/
bar.txt
bash-4.1$ 
```

3 items, Free space: 287.1 GB

"temppi" selected (containing 2 items)

"jtk" selected (containing 21 items)

Permissions

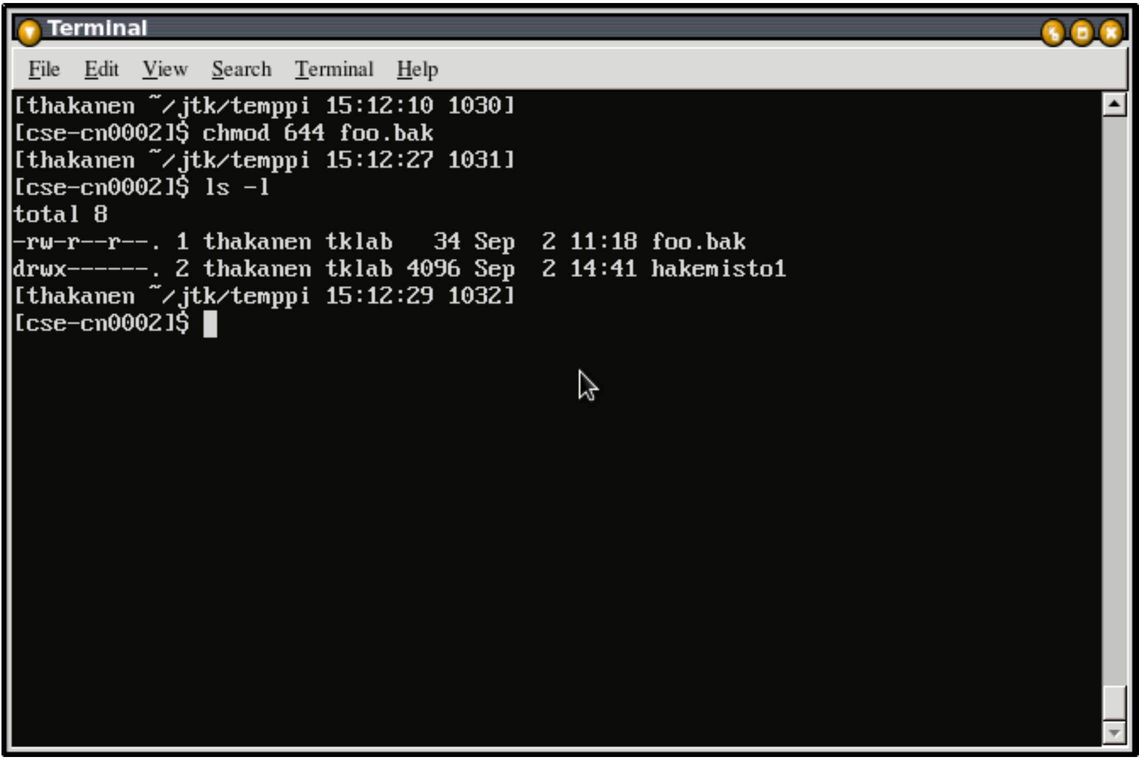
- To ensure security we need a way to make sure that only users with permission can read/write/execute files or folders
- By default your home directory is accessible only to you
  - no other user can access your files or folders if you don’t give them permission
  - same way you cannot access other’s home directories without permission
  - Standard user cannot access system configuration files or services

Permissions

- Three kinds of permissions:
  - read - user is allowed to read the content of file or directory
  - write - user can edit and create new files or directories
  - execute - user is allowed to execute file (commands inside)
- Permissions can be given to user, group, or everyone
  - user is the owner of the file
  - groups are sets of users
  - everyone else...well you know

Permissions

- foo.bak has:
  - read and write permissions for owner
  - read for group (tklab)
  - read for others
- hakemisto1 has:
  - read, write and execute for owner
  - none for others



```
[thakanen ~/jtk/temppi 15:12:10 1030]
[cse-cn0002]$ chmod 644 foo.bak
[thakanen ~/jtk/temppi 15:12:27 1031]
[cse-cn0002]$ ls -l
total 8
-rw-r--r--. 1 thakanen tklab   34 Sep  2 11:18 foo.bak
drwx------. 2 thakanen tklab 4096 Sep  2 14:41 hakemisto1
[thakanen ~/jtk/temppi 15:12:29 1032]
[cse-cn0002]$ 
```

Remote connection

- When you need to access another computer which is in a remote location, you can use program called *ssh* (secure shell)
- For example if you are on your home computer and want to access st-cn0001.oulu.fi:
  - if you are using unix-based system type *ssh st-cn0001.oulu.fi*
    - use man to find out how to give username
  - if you are using windows, download program called *putty* and use that for connecting to remote host
  - use program called *thinlinc* to access the GUI