

User Interfaces

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User Interface

- A way to interact with the system, e.g.:
 - User to OS:
 - Inserting instructions via punch card
 - Typing on a terminal keyboard
 - Drawing on a touchscreen
 - OS to user:
 - Printing output on a paper
 - Displaying output on a screen

CLI – Command Line Interface

- Line-oriented
- Read-Evaluate-Print-Loop => REPL
- Typically running a command interpreter
- Effective and programmer friendly

```
[friday@b9b278837505 ~]$ echo $SHELL
/bin/bash
[friday@b9b278837505 ~]$ printf "\n\nThis is 'Command Line Interface' running a 'bourne-again shell'\n\n\n"

This is 'Command Line Interface' running a 'bourne-again shell'

[friday@b9b278837505 ~]$
```

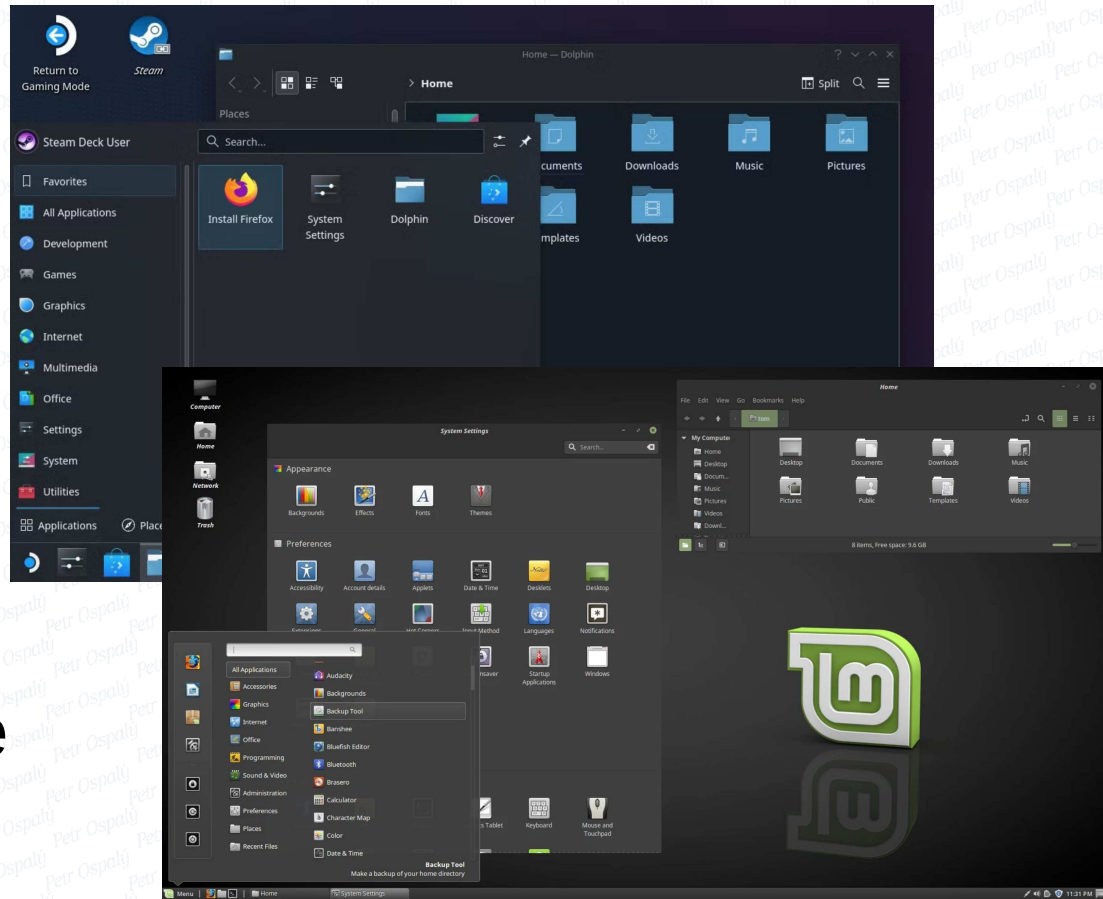

TUI – Text User Interface

- Precursor to GUI (next slide)
- Illusion of „widgets“ via „ascii art“
- Needs (n)curses library (or similar) to handle tricky terminal quirks

```
Left      File      Command      Options      Right
+-----+-----+-----+-----+-----+
|<-- /|-----|>+<-- /|-----|>+
|.n      Name      | Size |Modify time| |.n      Name      | Size |Modify time|
|~bin    |      7|Feb 25 12:33| |~bin    |      7|Feb 25 12:33|
|/boot   |     40|May  1 01:28| |/boot   |     40|May  1 01:28|
|/dev    |    360|May 25 11:18| |/dev    |    360|May 25 11:18|
|/etc    |    460|May 25 13:29| |/etc    |    460|May 25 13:29|
|/home   |     60|May 25 11:26| |/home   |     60|May 25 11:26|
|~lib    |      7|Feb 25 12:33| |~lib    |      7|Feb 25 12:33|
|~lib32  |      9|Feb 25 12:33| |~lib32  |      9|Feb 25 12:33|
|~lib64  |      7|Feb 25 12:33| |~lib64  |      7|Feb 25 12:33|
|/media  |     40|May  1 01:28| |/media  |     40|May  1 01:28|
|/mnt    |     40|May  1 01:28| |/mnt    |     40|May  1 01:28|
|/opt    |     40|May  1 01:28| |/opt    |     40|May  1 01:28|
+-----+-----+-----+-----+-----+
|-> usr/bin                                     ||-> usr/bin
+----- 6099M / 6825M (89%) -+----- 6099M / 6825M (89%) -+
Hint: Tab changes your current panel.
# [^]
1Help 2Menu 3View 4Edit 5Copy 6RenMov 7Mkdir 8Delete 9PullDn10Quit
```

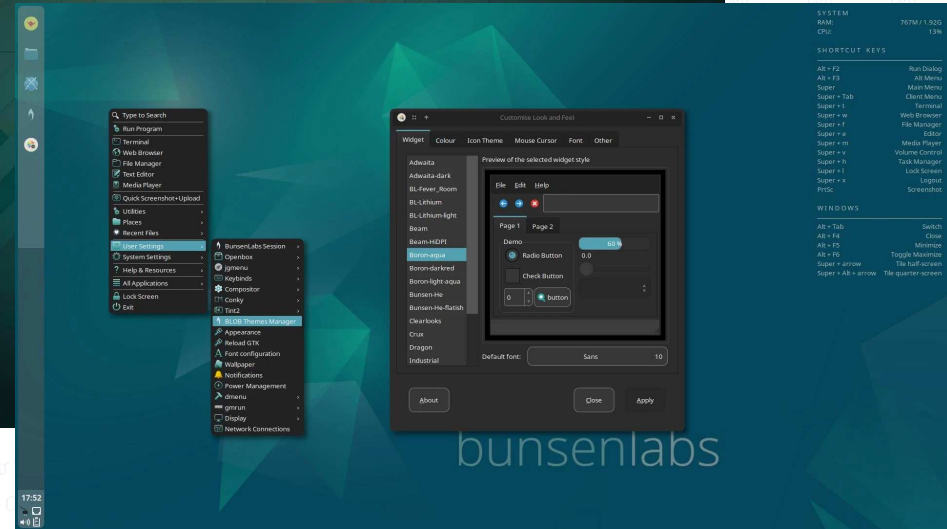
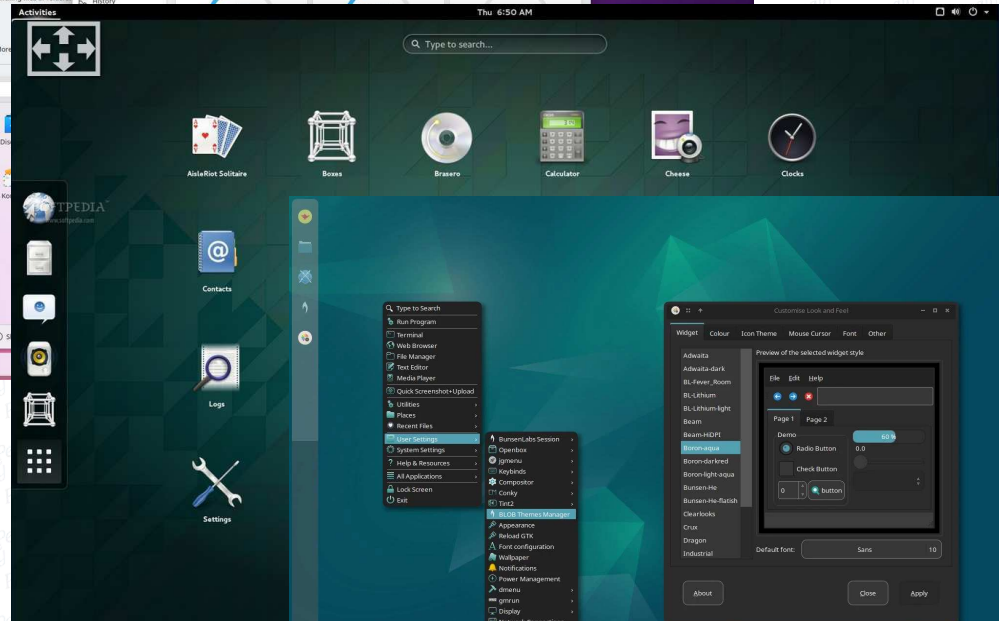
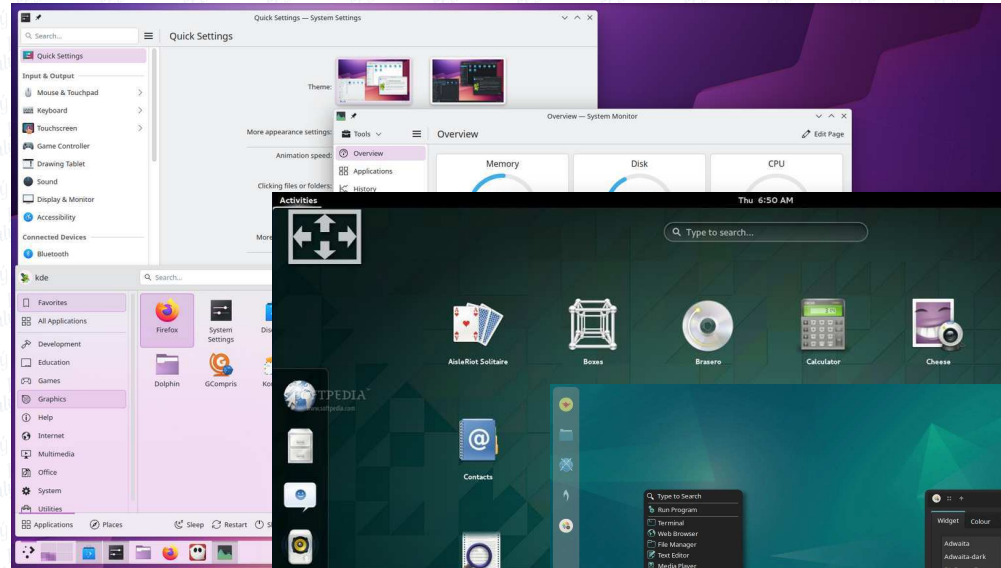
GUI – Graphical User Interface

- Utilizes vector or raster graphics (pixels on screen)
- Think of a desktop OS
- Linux/BSD has (too) many options
- Windows/Apple has one baked-in for each release



Linux Desktop Environments

- KDE
- MATE
- Gnome-shell
- Cinnamon
- XFCE
- LXDE
- WMs...



Reasons to use CLI

- Clean and minimalist
- Ubiquitous and same across environments
- Productive, programmer friendly, scriptable
- Low on resources – works over slow connections

```
Starting CRON... done
pfSense (pfSense) 2.3
Bootup complete

FreeBSD/amd64 (pfSense)
*** Welcome to pfSense ***

WAN (wan)      -> e
LAN (lan)      -> e

0) Logout (SSH only)
1) Assign Interfaces
2) Set interface(s)
3) Reset webConfigurator password
4) Reset to factory defaults
5) Reboot system
6) Halt system
7) Ping host
8) Shell

12) pfSense Developer Shell
13) Update from console
14) Enable Secure Shell (sshd)
15) Restore recent configuration
16) Restart PHP-FPM

Enter an option: 
```

```
BusyBox v1.33.2 (2022-10-20 23:59:29 UTC) built-in shell (ash)
```

```

  _ _ _ _ _
 / _ _ _ _ \
( _ _ _ _ _ )
 \ _ _ _ _ /
  _ _ _ _ _

```

```
-----
TurrisOS 6.4.2, Turris Omnia
-----
```

```
root@turris:~# sensors
mv88e6xxx102-mdio-2
Adapter: MDIO adapter
temp1:      +59.0°C (crit = +100.0°C)
```

```
mv88e6xxx100-mdio-0
Adapter: MDIO adapter
temp1:      +59.0°C (crit = +100.0°C)
```

```
f1072004mdiomii01-mdio-1
Adapter: MDIO adapter
temp1:      +43.0°C (crit = +100.0°C)
```

```
mv88e6xxx103-mdio-3
Adapter: MDIO adapter
temp1:      +59.0°C (crit = +100.0°C)
```

```
mv88e6xxx101-mdio-1
Adapter: MDIO adapter
temp1:      +59.0°C (crit = +100.0°C)
```

```
f10e4078.thermal-virtual-0
Adapter: Virtual device
temp1:      +63.2°C
```

```
mv88e6xxx104-mdio-4
Adapter: MDIO adapter
temp1:      +59.0°C (crit = +100.0°C)
```

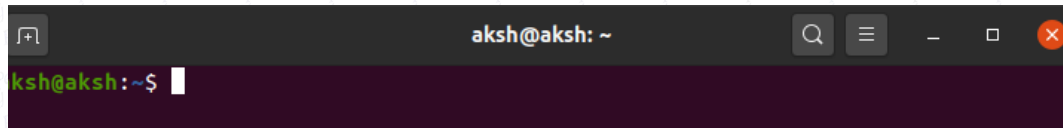
```
root@turris:~# |
```

Terminal

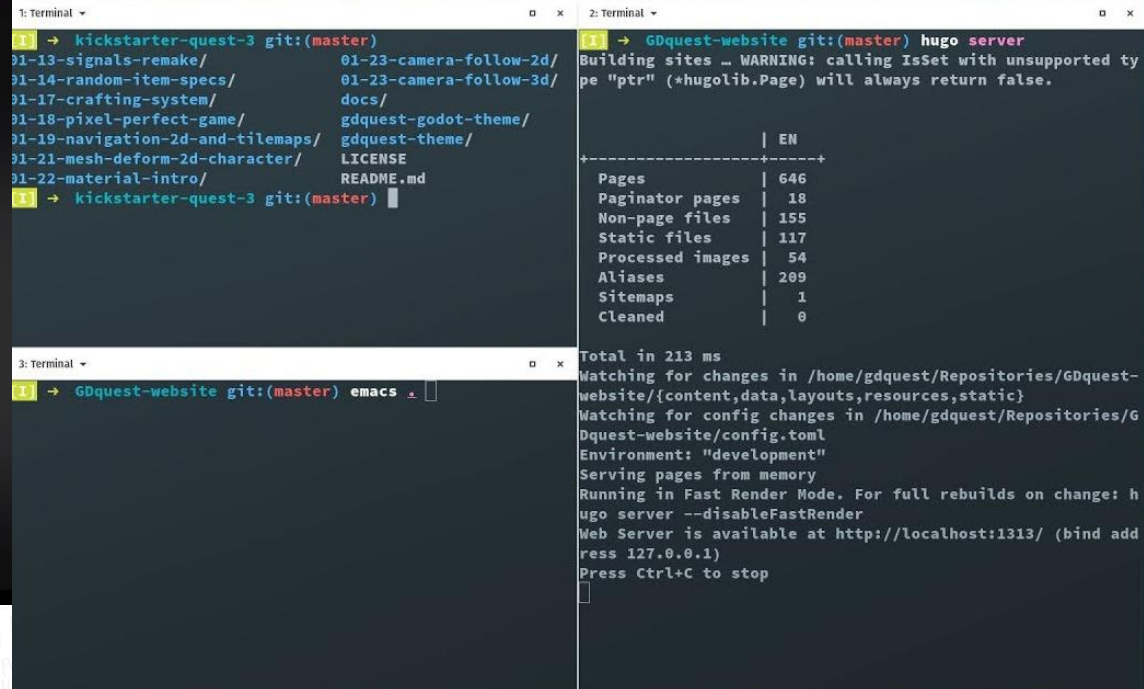


- Originally a simple physical device with no local processing
- Think of a “typewriter” that uses a video screen instead of a paper
- There are no longer used in physical form but they survived emulated
- Running terminal window with a shell (command interpreter) is an idiomatic way to work on a *nix machine like Linux or Apple OSes
- Even Windows provide their old DOS era *cmd.exe* and modern *powershell* – these are not actually implementation of the original terminal devices but they are **still text-based command line interfaces**
- Recently Linux based *WSL terminal* is also available on Windows

Terminal Emulators



- ▲ ~/ # Hyper is an Electron-based Terminal
- ▲ ~/ # Built on HTML/CSS/JS
- ▲ ~/ # Fully extensible!
- ▲ ~/ hyper i verminal
- verminal installed successfully!
- ▲ ~/



CLI/Terminals on Windows

```
C:\WINDOWS\system32\cmd.exe

WindowsPowerShell\v1.0\
PATHEXT=.COM;.EXE;.BAT;.CMD;.UBS;.UBE;.JS;.JSE;.WSF;.WSH;.MSC
PROCESSOR_ARCHITECTURE=AMD64
PROCESSOR_IDENTIFIER=0000000000000000
PROCESSOR_LEVEL=6
PROCESSOR_REVISION=1000
ProgramData=C:\ProgramData
ProgramFiles=C:\ProgramFiles
ProgramFiles(x86)=C:\ProgramFiles(x86)
PUBLIC=C:\Users\Public
SESSIONNAME=Console
SystemDrive=C:
SystemRoot=C:\WINDOWS
TEMP=C:\Users\Amin\AppData\Local\Temp
USERDOMAIN=PCAMIN
USERDOMAIN_ROAMINGPROFILE=PCAMIN
USERNAME=Amin
USERPROFILE=C:\Users\Amin\
windir=C:\WINDOWS

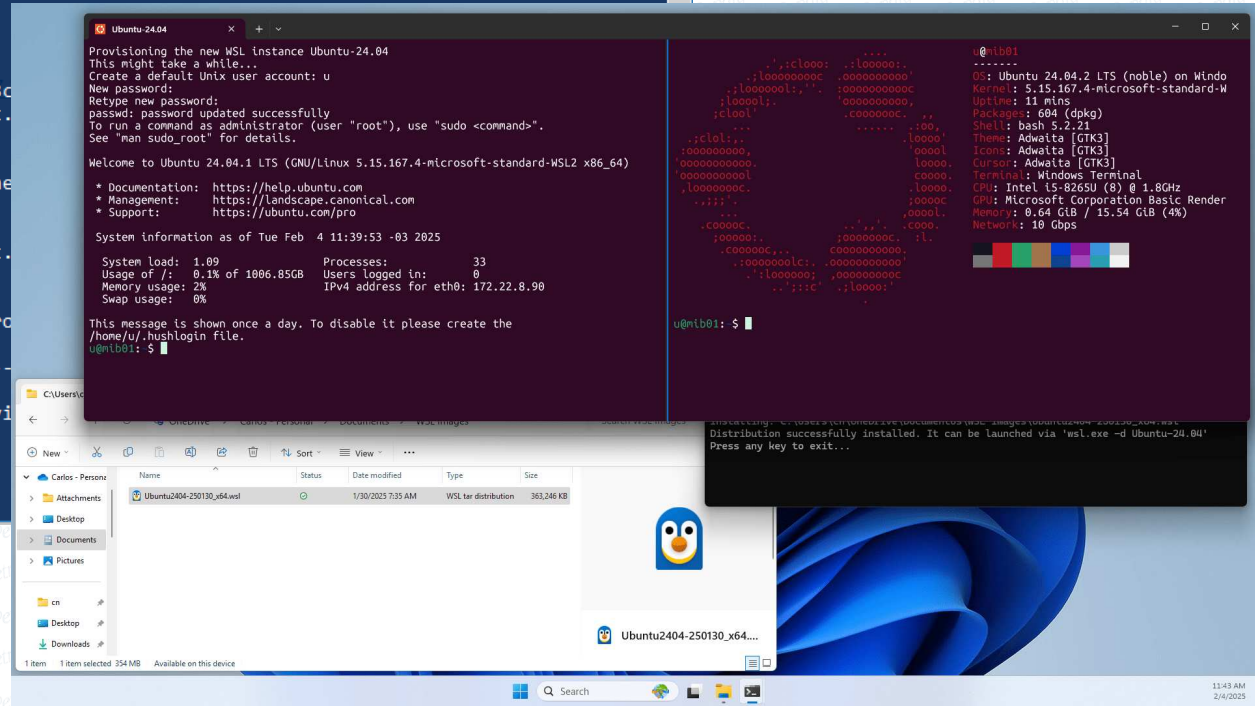
C:\Users\Amin>
```

```
PowerShell 7 (x64)
PowerShell 7.3.2
PS C:\Users\mark> Get-Host

Name           : ConsoleHost
Version        : 7.3.2
InstanceId     : 5e86d866-65a1-423c-b000-000000000000
UI             : System.Management.Automation
CurrentCulture : en-GB
CurrentUICulture : en-GB
PrivateData    : Microsoft.PowerShell.Commands.Management
DebuggerEnabled : True
IsRunspacePushed : False
Runspace       : System.Management.Automation.Runspace

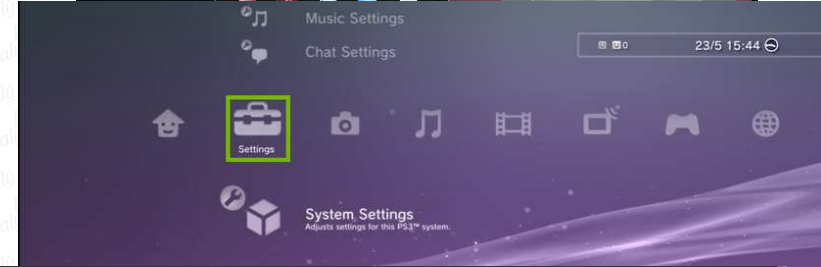
PS C:\Users\mark> winget search Micro

Name           Id
-----
PowerShell      Microsoft.PowerShell
PowerShell      Microsoft.PowerShell.Preview
PS C:\Users\mark>
```



Shell

- Shell is the actual program interfacing with the user
- Varies on context, e.g.:
 - Gnome 3 is a desktop “shell”
 - Console launcher is also a shell (PS, Xbox)
 - Terminals are running shell programs too – otherwise they would not be much useful
- Shell in our context is the command interpreter
- Many variants of shells....:
 - POSIX shell / bourne shell
 - BASH (Bourne Again Shell)
 - KSH, ASH, DASH, ZSH etc...



```
[osp@donatello] 18:11 ~  
% echo $TERM  
xterm-256color  
[osp@donatello] 18:11 ~  
% echo $SHELL  
/bin/bash  
[osp@donatello] 18:11 ~  
%
```

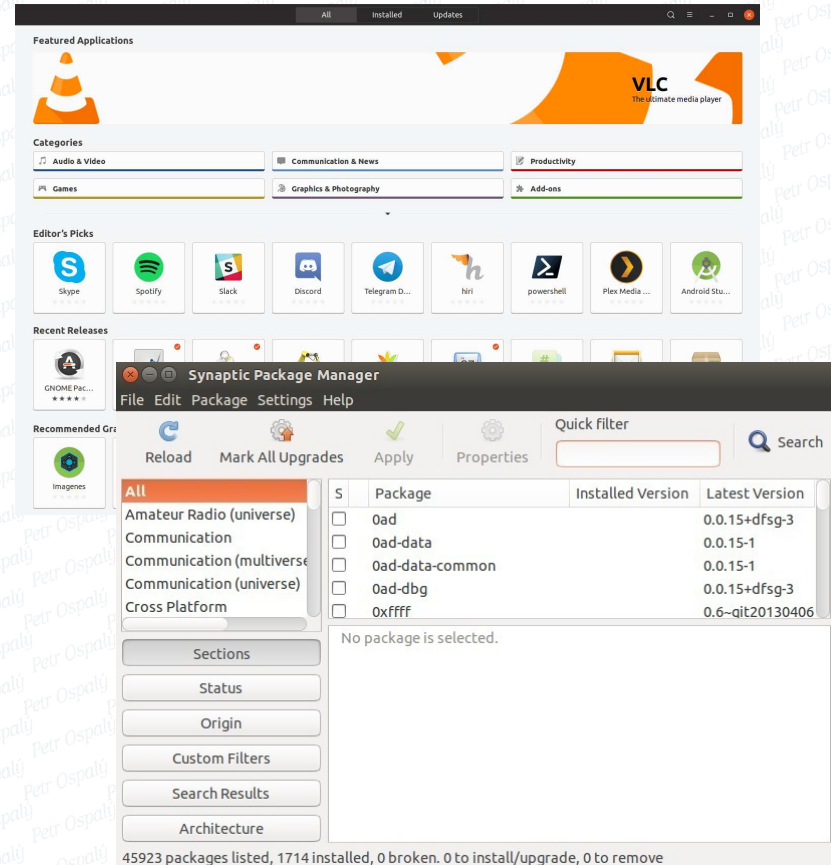

Comparison CLI vs GUI (1/4)

- Go-to tool to manage software on Linux is some package manager
- Let's take example from Ubuntu
- You can either use command in the terminal as **aptitude** or use some graphical frontend (synaptic)
- The fact is that GUI application will never do more than the CLI tool will



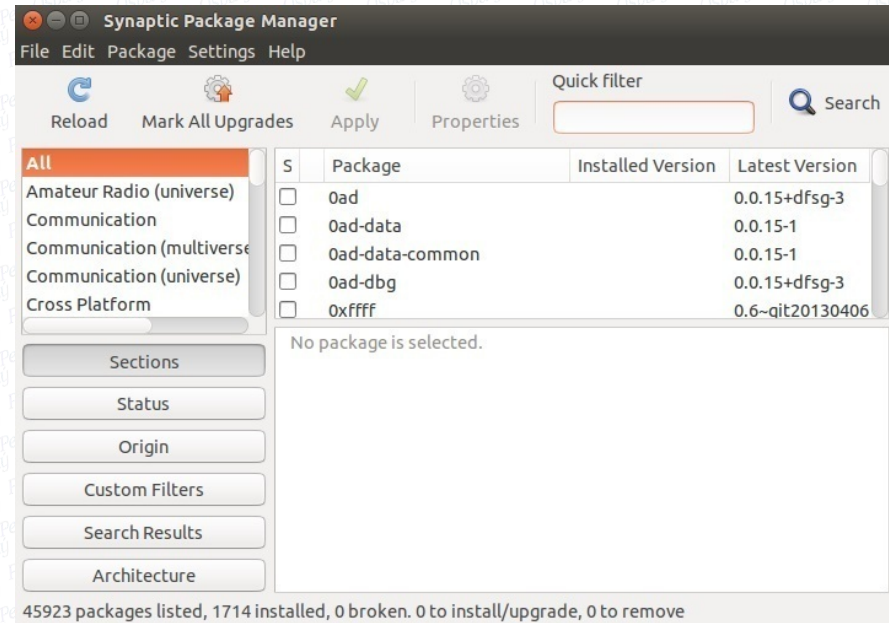
Comparison CLI vs GUI (2/4)

- Maybe we want to fully upgrade our system and install extra package (vlc)
- Graphical tool will require typing in search fields and clicking on buttons
- We even have more GUI frontends to do so



Comparison CLI vs GUI (3/4)

- In synaptic we have to:
 - Click on **reload** button
 - **Mark All Upgrades** button
 - **Apply** button
 - Typing “vlc” in the quick filter
 - Ticking box in the main section for vlc package
 - **Apply** again



Comparison CLI vs GUI (4/4)

- In the terminal with the CLI:
 - **DEBIAN_FRONTEND=noninteractive **
**apt-get update **
**&& apt-get dist-upgrade **
&& apt-get install vlc
 - This is one long line which will not prompt the user for any input and will do all the tasks in one go
- Easily embedded in scripts

Terminal in practice

- Pictures of logos
- Joining into one
- Converting from PNG to JPG
- Result is below

```
~/tmp/pics
[osp@donatello] 16:20 ~/tmp/pics
% ls
arch.png      fedora.png    mint.png      slackware.png
debian.png    gentoo.png    redhat.png    ubuntu.png
[osp@donatello] 16:20 ~/tmp/pics
% magick *.png +append all.png
[osp@donatello] 16:20 ~/tmp/pics
% ls all.png
all.png
[osp@donatello] 16:20 ~/tmp/pics
% convert all.png -background white -alpha remove -alpha off all.jpg
[osp@donatello] 16:20 ~/tmp/pics
% ls all.jpg
all.jpg
[osp@donatello] 16:20 ~/tmp/pics
% file all.jpg
all.jpg: JPEG image data, JFIF standard 1.01, aspect ratio, density 0x0, segment length 16, comment: "Created by DistroWatch.com", baseline, precision 8, 724x114, components 3
[osp@donatello] 16:20 ~/tmp/pics
%
```



archlinux

debian

fedora

gentoo

linuxlinuxmint

Red Hat

slackware

ubuntu

Final words

- **Terminal and shell are often lumped together**
- **Linux distributions traditionally package all software in their repositories**
- GUI and CLI both has its places
- Graphical/Creative software is better served by GUI conveniences
- Outputs of many of these GUI applications are text files (e.g. XML)
- Many CLI tools exists to handle, parse and modify files (especially text) or they are backends to their GUI extensions
- Modern systems usually talk to each other via text interfaces (e.g. REST API + JSON)
- Many services, clients, servers and tools have no graphical representation or the CLI version is more convenient and/or more powerful