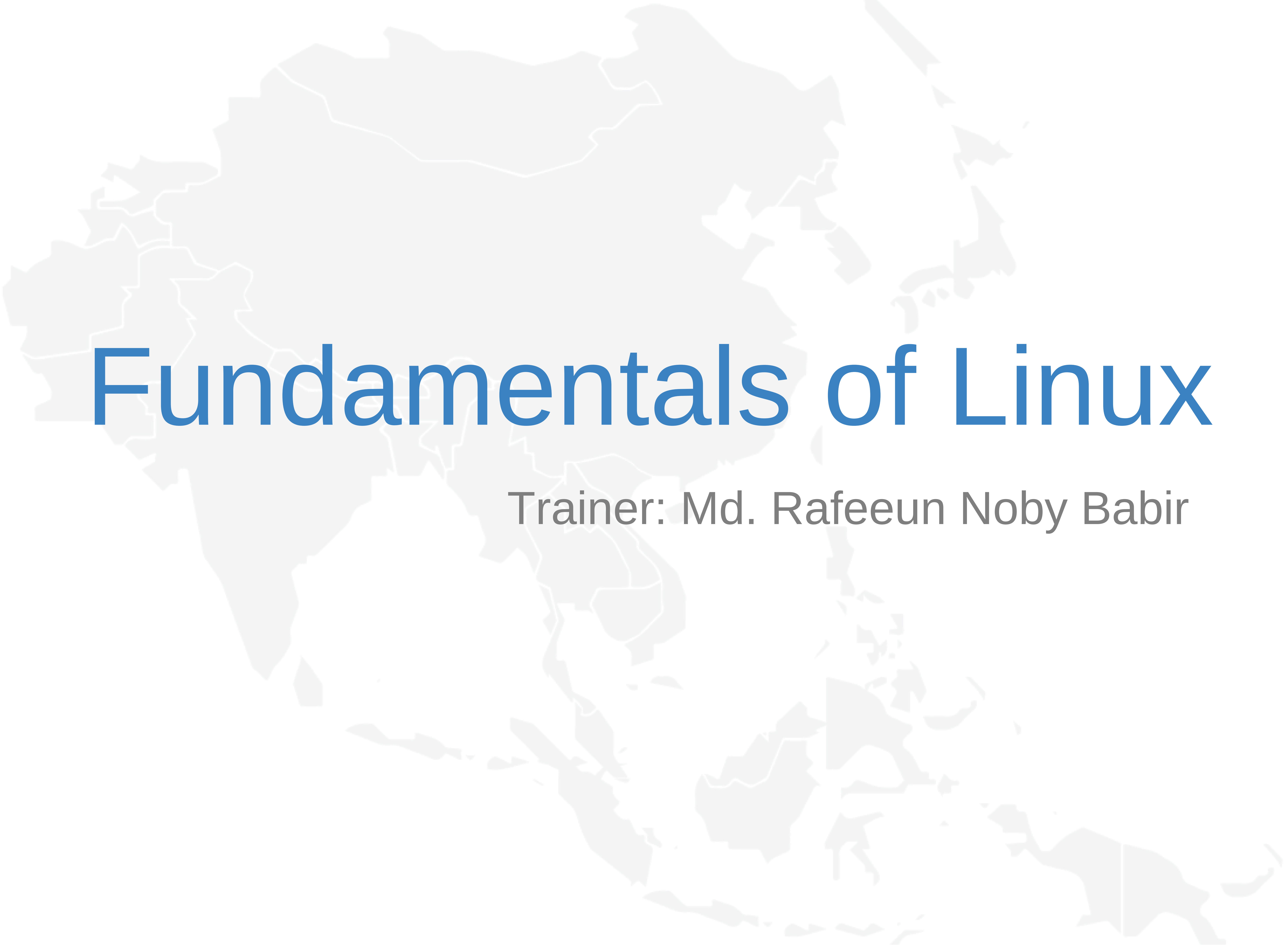
APNIC



Fundamentals of Linux

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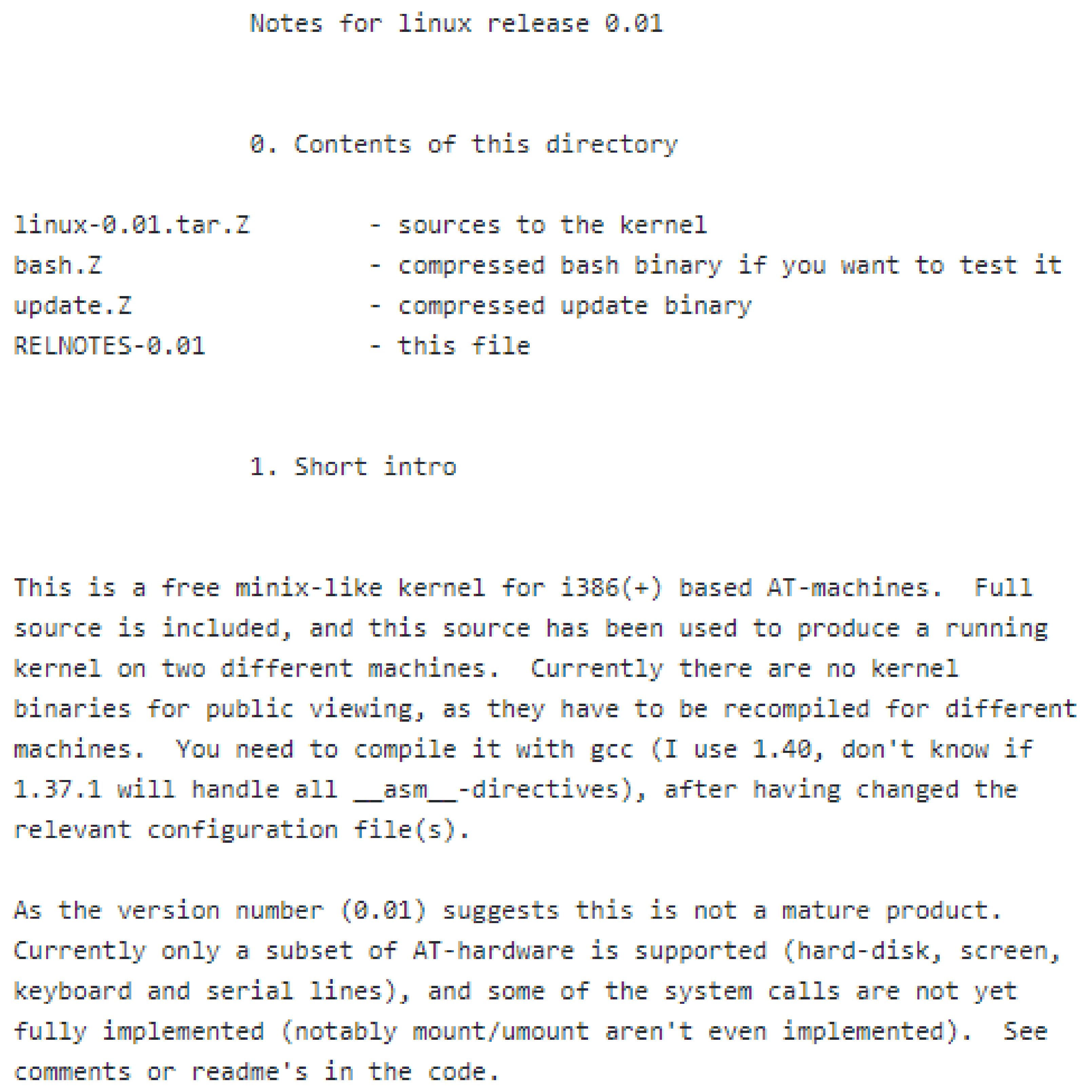
What is Linux

- It’s a Kernel, core of the operating system
- “Linux” often refers to group of operating system distributions build around the Linux Kernel
- Developed by Linus Torvalds
- Kernel version 0.01* was released on September 1991
- Major release version 1.0.0 on March 1994
- Latest Kernel release version 5.8.7 (05-09-2020)



```
                    Notes for linux release 0.01


                    0. Contents of this directory

linux-0.01.tar.Z        - sources to the kernel
bash.Z                  - compressed bash binary if you want to test it
update.Z                - compressed update binary
RELNOTES-0.01           - this file


                    1. Short intro


This is a free minix-like kernel for i386(+) based AT-machines.  Full
source is included, and this source has been used to produce a running
kernel on two different machines.  Currently there are no kernel
binaries for public viewing, as they have to be recompiled for different
machines.  You need to compile it with gcc (I use 1.40, don't know if
1.37.1 will handle all __asm__-directives), after having changed the
relevant configuration file(s).

As the version number (0.01) suggests this is not a mature product.
Currently only a subset of AT-hardware is supported (hard-disk, screen,
keyboard and serial lines), and some of the system calls are not yet
fully implemented (notably mount/umount aren't even implemented).  See
comments or readme's in the code.
```

source: https://github.com/kalamangga-net/linux-0.01

Key Features of Linux

- Kernel as core component
- Open Source
- Multiuser capability and Multitasking
- Hierarchical File System
- Portable

Linux Distributions

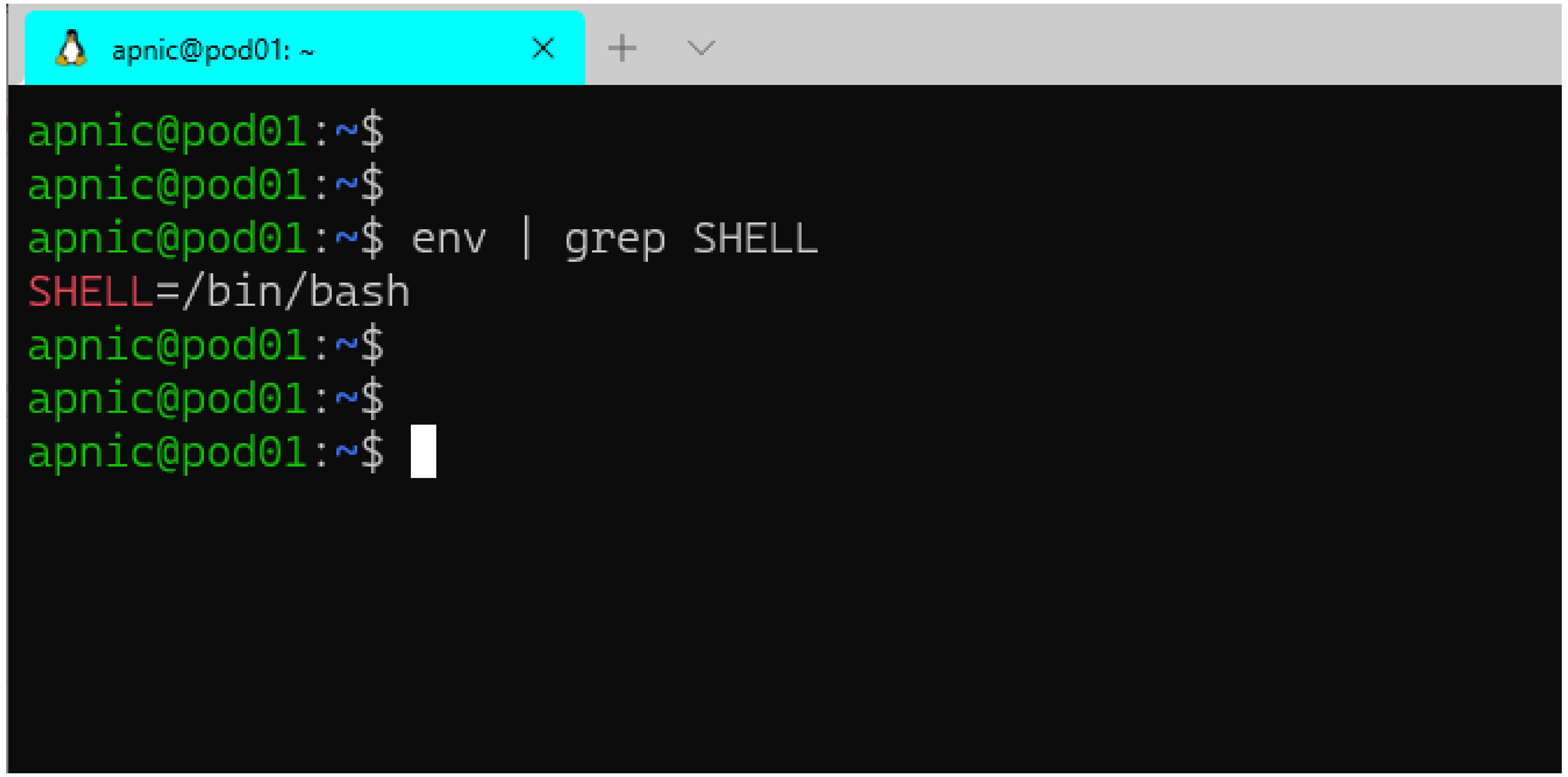
Powered By
Mandriva
Powered By
SuSE
Powered By
ubuntu
Powered By
kubuntu
Powered By
archlinux
Powered By
gentoo
Powered By
slackware
Powered By
CentOS
Powered By
debian
Powered By
fedora
Powered By
xubuntu
Powered By
Linux
Powered By
KATEOS
Powered By
edubuntu

The Shell

- Command interpreter on Linux systems
- The shell is not part of system kernel, but uses the system kernel to execute programs, create files etc
- Several Shells are available for Linux:
  - BASH (Bourne-Again SHell)
  - CSH (C SHell)
  - KSH (Korn SHell)
  - Zsh Shell
- Find out the Shell

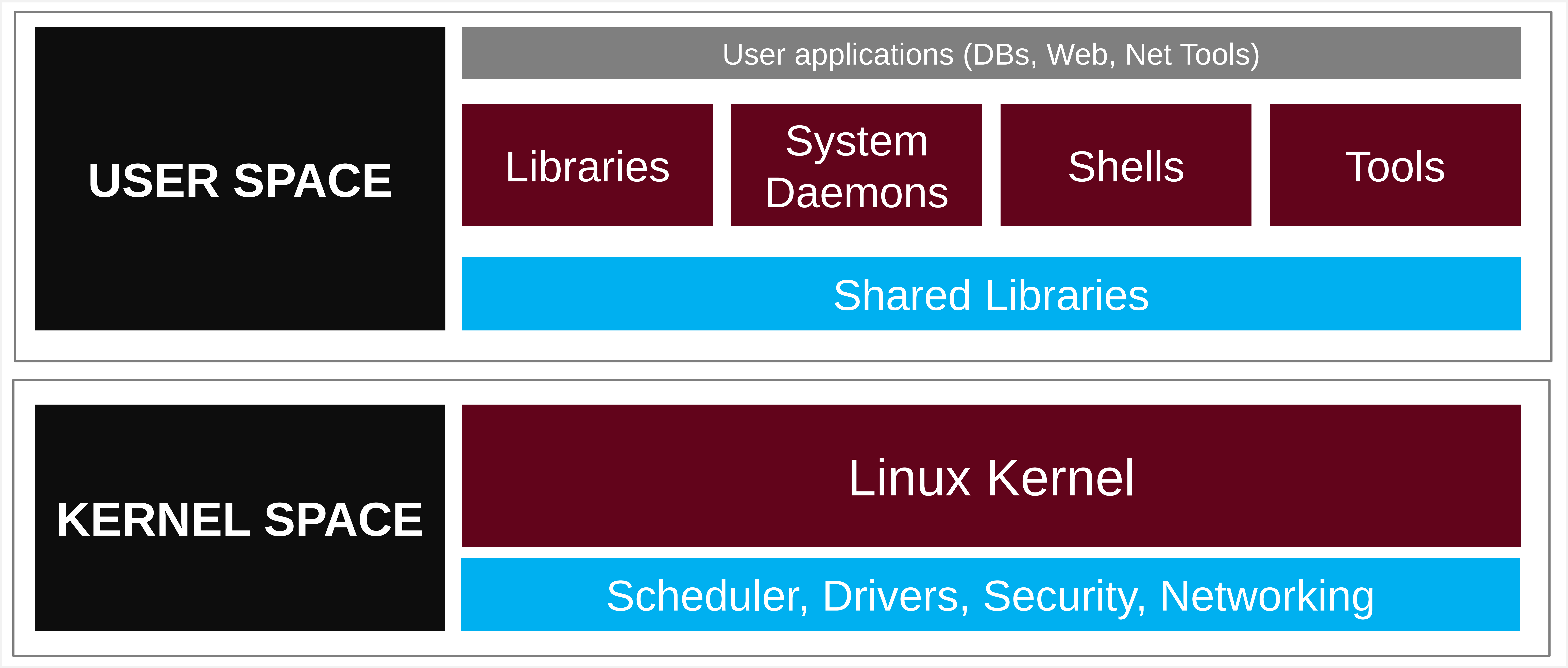
```
apnic@pod01:~$ echo $SHELL
```

```
/bin/bash
```



```
apnic@pod01:~$
apnic@pod01:~$
apnic@pod01:~$ env | grep SHELL
SHELL=/bin/bash
apnic@pod01:~$
apnic@pod01:~$
apnic@pod01:~$
```

Linux based OS Architecture



USER SPACE

User applications (DBs, Web, Net Tools)

Libraries

System Daemons

Shells

Tools

Shared Libraries

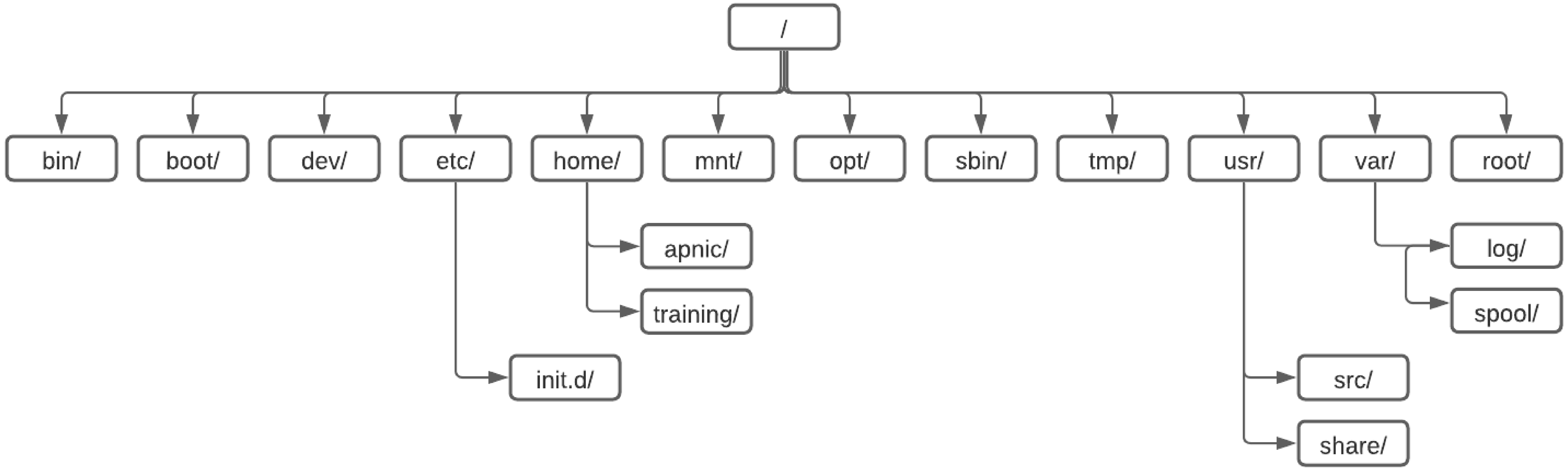
KERNEL SPACE

Linux Kernel

Scheduler, Drivers, Security, Networking

Directory Structure

- The Filesystem Hierarchy Standard (FHS) defines the directory structure and directory contents in Linux distributions
- In the FHS, all files and directories appear under the root directory /



Directory Structure

Directory	Description	Example
/ –> Root	Every single file and directory starts from the root directory	
/bin –> Users Binaries	Contains binary executables	ls, ping, mv, cp
/sbin –> System Binaries	Contains binary executables like /bin	iptables, fdisk, ifconfig
/etc –> Configuration Files	Contains start up and shutdown shell scripts used to start/stop individual programs	/etc/resolv.conf /etc/hostname
/dev –> Device Files	Contains devices files	/dev/tty1
/var –> Variables Files	The content of the files that are expected to grow can be found under this directory	/var/log

Directory Structure

Directory	Description	Example
/tmp –> Temporary Files	Temporary files created by system and users.	
/home –> Home Directories	Store their personal files for all users	/home/apnic
/boot –> Boot Loader Files	Contains bootloader related files.	initrd.img-5.4.0-45-generic
/opt –> Optional add-on Applications	Contains add-on applications from individual vendors	installed under either /opt/ or /opt/ sub-directory
/mnt –> Mount Directory	Temporary mount directory where sysadmins can mount filesystems	

Users and Groups

- Two types of users
  - System users
  - Regular users
- Super user
  - Also know as root user
  - Has the ability to override any file ownership, permission restrictions and make system-wide changes
  - Just like “Administrator” in your Windows PC
  - We can create user with “superuser rights”
- `/etc/passwd` list all the users and related information

```
apnic:x:1001:1001:APNIC,,,:/home/apnic:/bin/bash
```

Users and Groups

- Groups are collections of zero or more users
- A user belongs to a default group, and can also be a member of any of the other groups
- `/etc/group` list all the group and related information

```
sudo:x:27:apnic
```

```
apnic:x:1001:
```

Ownership and Permissions

- All files and directories in Linux have a standard set of access permissions
- These access permissions control who can access what files
- Provides a fundamental level of security to the files and directories in a system
- Command(s) to modify ownership and permission:

  `chown` `chgrp` `chmod`

Ownership and Permissions

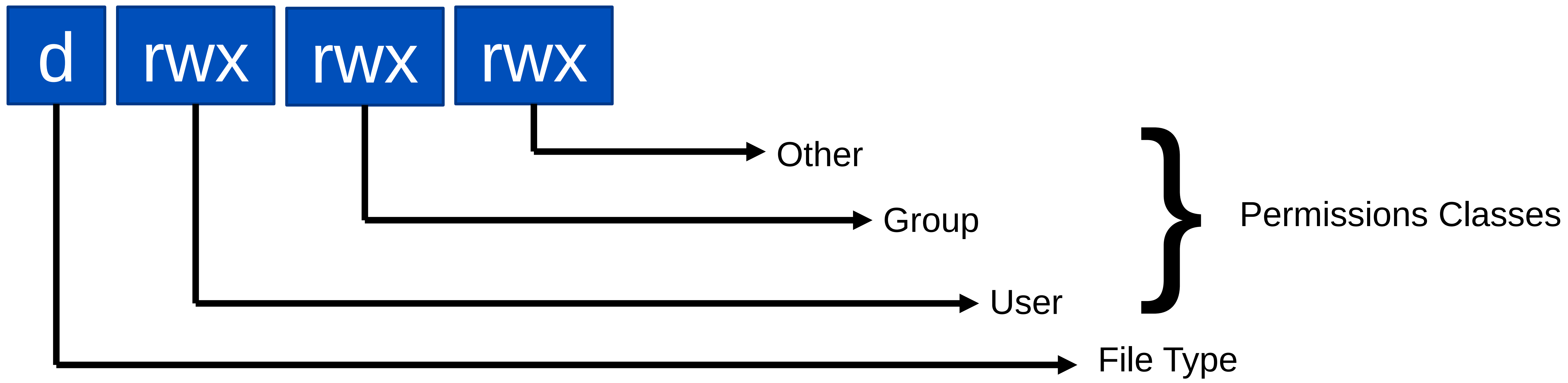
- Permission Groups

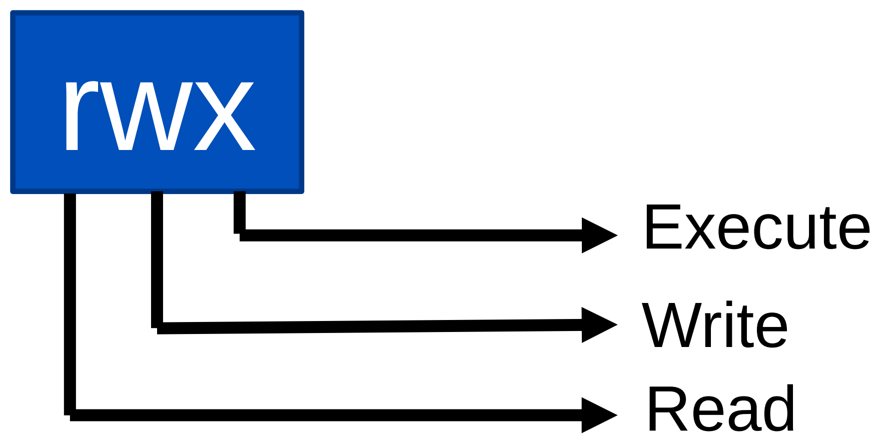
Permission	Description
Owner	Permissions used by the assigned owner of the file or directory
Group	Permissions used by members of the group that owns the file or directory
Other	Permissions used by all users other than the file owner, and members of the group that owns the file or the directory

Ownership and Permissions

- Permission Set

Permission	Access for File	Access for a Directory
Read (r) (4)	File contents and copy the file	List the directory contents
Write (w) (2)	Modify the file contents	Modify the contents of a directory
Execute (x) (1)	Execute the file	Access the directory. If read permission, will be able to list contents





Ownership and Permissions

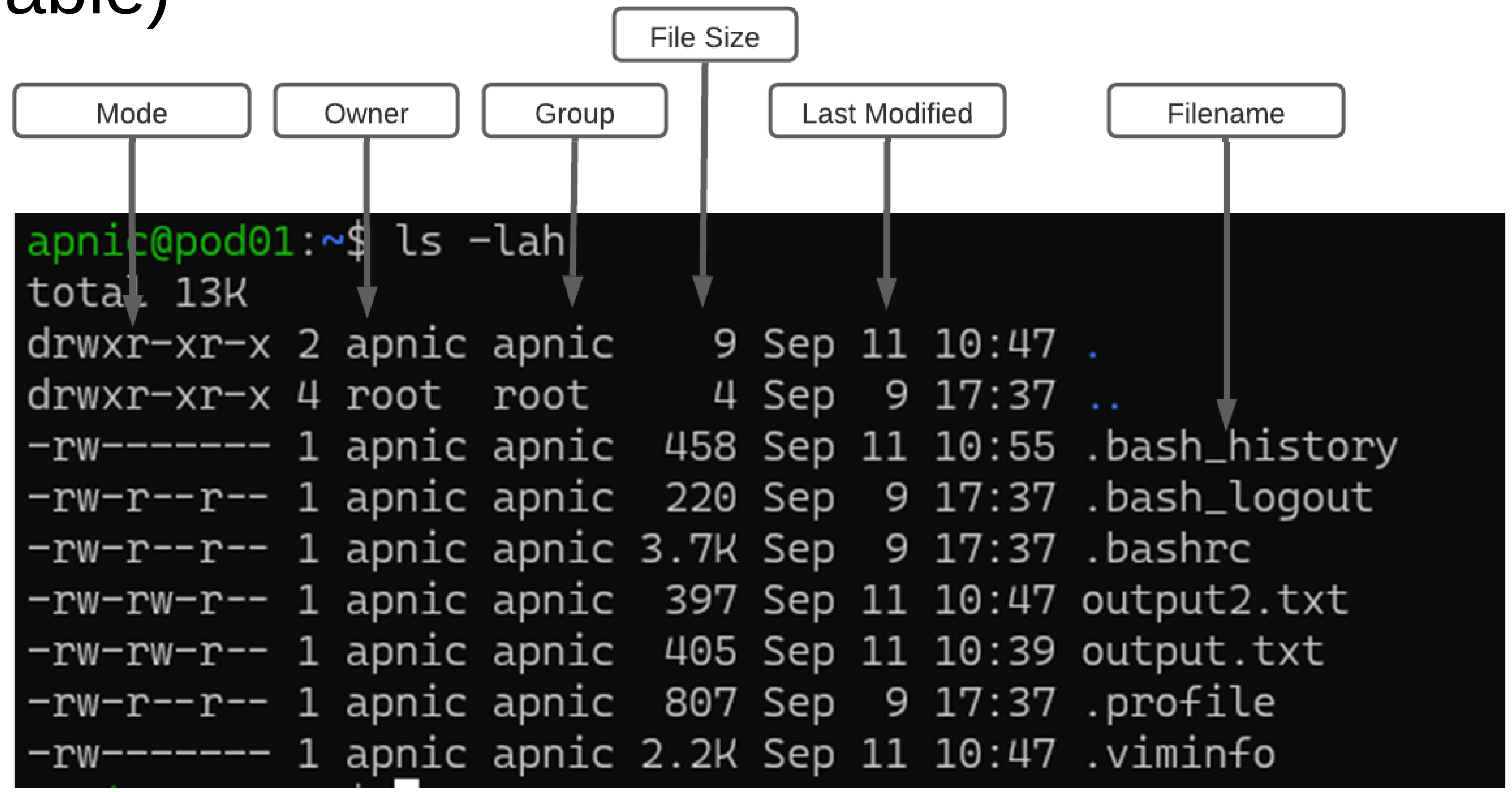
- We can use `ls -lah` command to get the list of files with details information

- ls - list directory contents

  -l = List files in long format

  -a = List files including hidden files (all files)

  -h = List files with readable file sizes (human readable)



```
apnic@pod01:~$ ls -lah
total 13K
drwxr-xr-x 2 apnic apnic    9 Sep 11 10:47 .
drwxr-xr-x 4 root  root     4 Sep  9 17:37 ..
-rw------- 1 apnic apnic  458 Sep 11 10:55 .bash_history
-rw-r--r-- 1 apnic apnic  220 Sep  9 17:37 .bash_logout
-rw-r--r-- 1 apnic apnic 3.7K Sep  9 17:37 .bashrc
-rw-rw-r-- 1 apnic apnic  397 Sep 11 10:47 output2.txt
-rw-rw-r-- 1 apnic apnic  405 Sep 11 10:39 output.txt
-rw-r--r-- 1 apnic apnic  807 Sep  9 17:37 .profile
-rw------- 1 apnic apnic 2.2K Sep 11 10:47 .viminfo
```

Examples of Modes & Permissions

`-rw-------`	A file that is only accessible by its owner
`-rwxr-xr-x`	A file that is executable by every user on the system. A “world-executable” file
`-rw-rw-rw-`	A file that is open to modification by every user on the system. A “world-writable” file
`drwxr-xr-x`	A directory that every user on the system can read and access
`drwxrwx---`	A directory that is modifiable (including its contents) by its owner and group
`drwxr-x---`	A directory that is accessible by its group

bash Scripts

- A Bash script is a plain text file which contains a series of commands.
- These commands are a mixture of commands we would normally type ourselves on the command line
- Anything you can run normally on the command line can be put into a script and it will do exactly the same thing
- Sample Bash Script:

```
#!/bin/bash
echo "Hello World"
```

CRON – Task Schedule

- CRON is a task scheduler (a daemon) which runs commands at predetermined times and intervals

- A cron job can be used to send emails, to backup data, to update with the latest security patches, etc

```
#  .---------------- minute (0 - 59)
#  |  .------------- hour (0 - 23)
#  |  |  .---------- day of month (1 - 31)
#  |  |  |  .------- month (1 - 12) OR jan,feb,mar,apr ...
#  |  |  |  |  .---- day of week (0 - 6) (Sunday=0 or 7) OR sun,mon,tue,wed,thu,fri,sat
#  |  |  |  |  |
#  *  *  *  *  * user-name  command to be executed
```

- crontab syntax generators can make the job easier
  - https://crontab.guru/
  - https://crontab-generator.org/

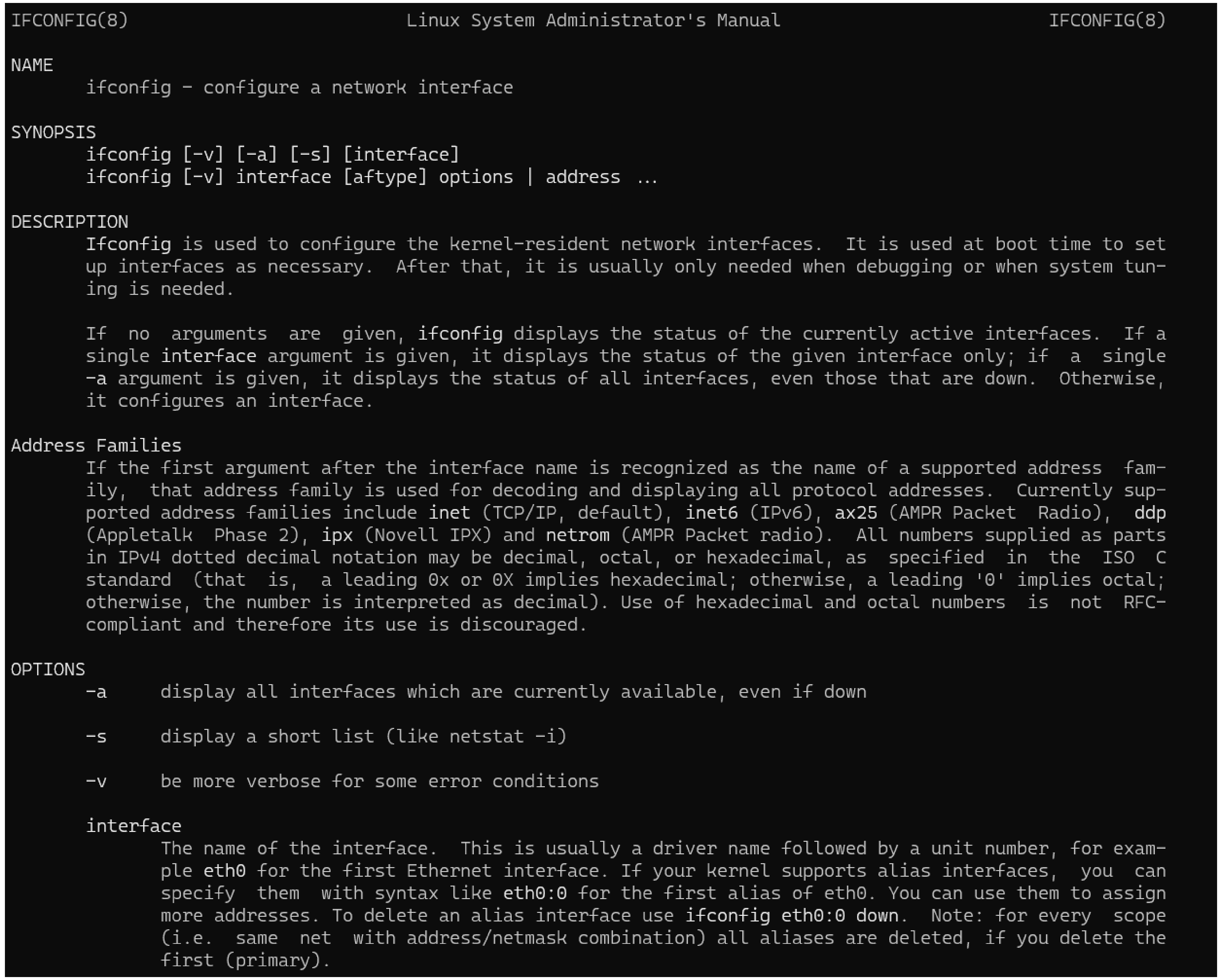
Text Editor(s)

- A text editor is a program used for editing text files
- Most configuration of Linux systems is done by editing text files
- All Linux distributions ship with multiple text editors included
- There are two types of text editors in Linux:
  - Command Line editors : vi, nano, pico
  - GUI editors : gedit (for GNOME), KWrite (for KDE)
- It’s really important to get comfortable with text editor

man (manual) page

- A man page (short for manual page) is a form of software documentation
- Accessible via `man` command from CLI. Example:

```
man ifconfig
```



```
IFCONFIG(8)                    Linux System Administrator's Manual                    IFCONFIG(8)

NAME
       ifconfig - configure a network interface

SYNOPSIS
       ifconfig [-v] [-a] [-s] [interface]
       ifconfig [-v] interface [aftype] options | address ...

DESCRIPTION
       Ifconfig is used to configure the kernel-resident network interfaces.  It is used at boot time to set
       up interfaces as necessary.  After that, it is usually only needed when debugging or when system tun-
       ing is needed.

       If  no  arguments  are  given, ifconfig displays the status of the currently active interfaces.  If a
       single interface argument is given, it displays the status of the given interface only; if  a  single
       -a argument is given, it displays the status of all interfaces, even those that are down.  Otherwise,
       it configures an interface.

Address Families
       If the first argument after the interface name is recognized as the name of a supported address  fam-
       ily,  that address family is used for decoding and displaying all protocol addresses.  Currently sup-
       ported address families include inet (TCP/IP, default), inet6 (IPv6), ax25 (AMPR Packet  Radio),  ddp
       (Appletalk  Phase 2), ipx (Novell IPX) and netrom (AMPR Packet radio).  All numbers supplied as parts
       in IPv4 dotted decimal notation may be decimal, octal, or hexadecimal, as  specified  in  the  ISO  C
       standard  (that  is,  a leading 0x or 0X implies hexadecimal; otherwise, a leading '0' implies octal;
       otherwise, the number is interpreted as decimal). Use of hexadecimal and octal numbers  is  not  RFC-
       compliant and therefore its use is discouraged.

OPTIONS
       -a     display all interfaces which are currently available, even if down

       -s     display a short list (like netstat -i)

       -v     be more verbose for some error conditions

       interface
              The name of the interface.  This is usually a driver name followed by a unit number, for exam-
              ple eth0 for the first Ethernet interface. If your kernel supports alias interfaces,  you  can
              specify  them  with syntax like eth0:0 for the first alias of eth0. You can use them to assign
              more addresses. To delete an alias interface use ifconfig eth0:0 down.  Note: for every  scope
              (i.e.  same  net  with address/netmask combination) all aliases are deleted, if you delete the
              first (primary).
```

Thank You!