Linux Fundamentals

P.R.K.Sastry

E-Security team

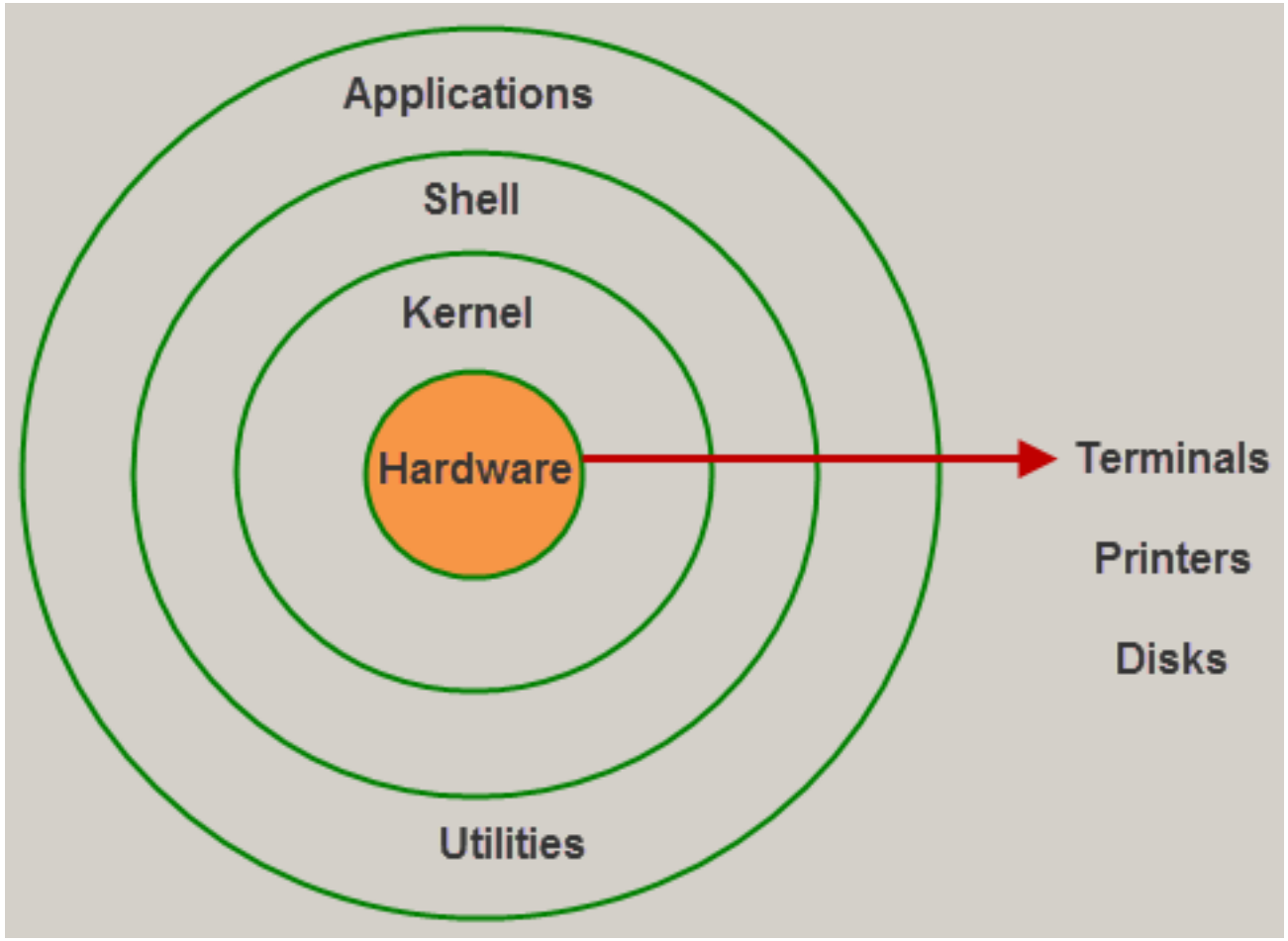
About Linux Operating System

- 1969- UNIX, first portable OS completely written in assembly, rewritten in C later in 1973
- 1991- Linux developed by Linus Torvalds, member of large family UNIX like OS.
- Linux- A fully customizable free Operating system, anyone can download the source code and modify it.
- The license for linux is known as GPL (General Public License).
- Linux Distribution- Collection of kernel, GUI, GNU C/C++ compiler, text editor and various applications under GPL.

About Linux Operating System

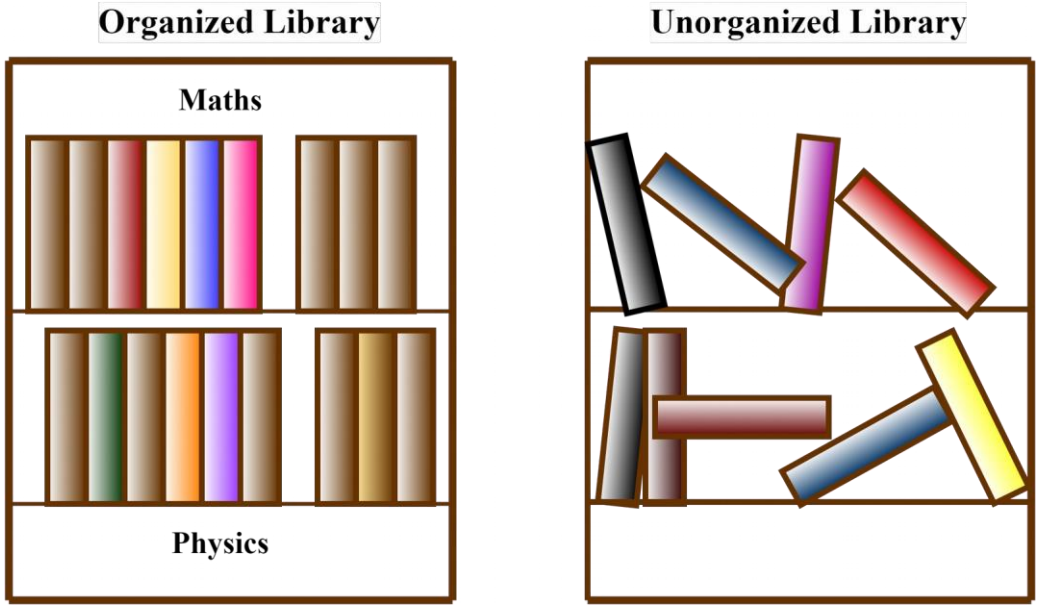
- More than 600+ distributions available. Popular are RedHat, Fedora, Debian, Ubuntu, Mint, OpenSUSE etc.
- Features of Linux are
  - Multithreading
  - Monolithic Kernel
  - Filesystem
  - Multi user capability

Linux Architecture

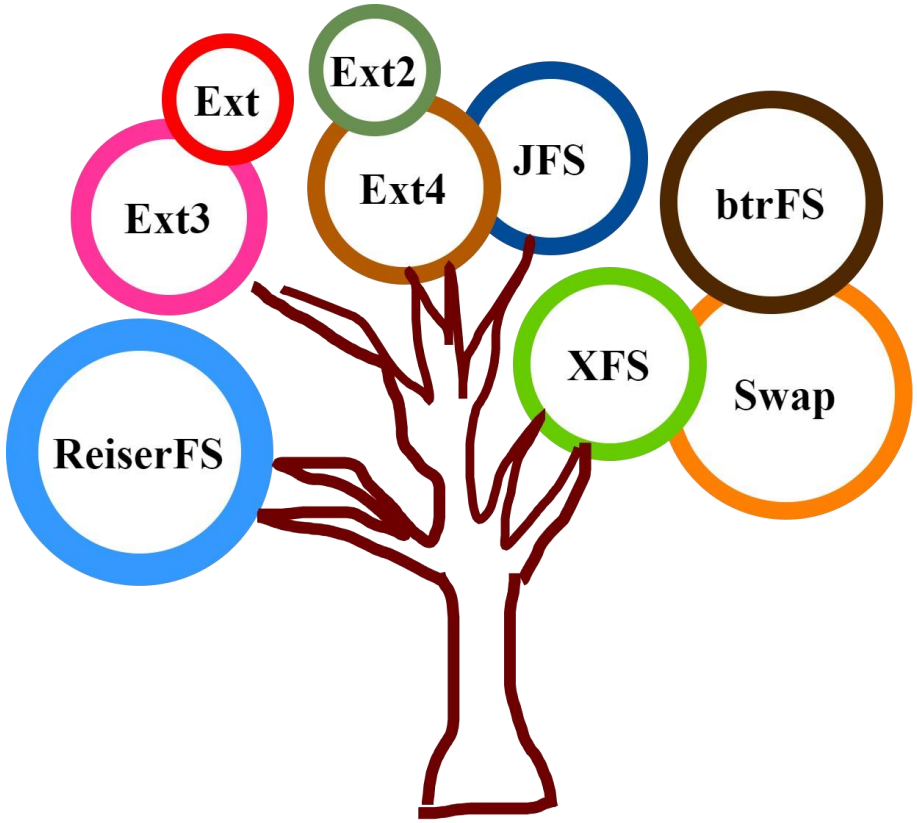


Linux File System

- File System
  - Used to control how data is stored and retrieved
  - Structured collection of file
  - Everything is a file in Linux
  - "Files have spaces & Processes have lives“



File Systems



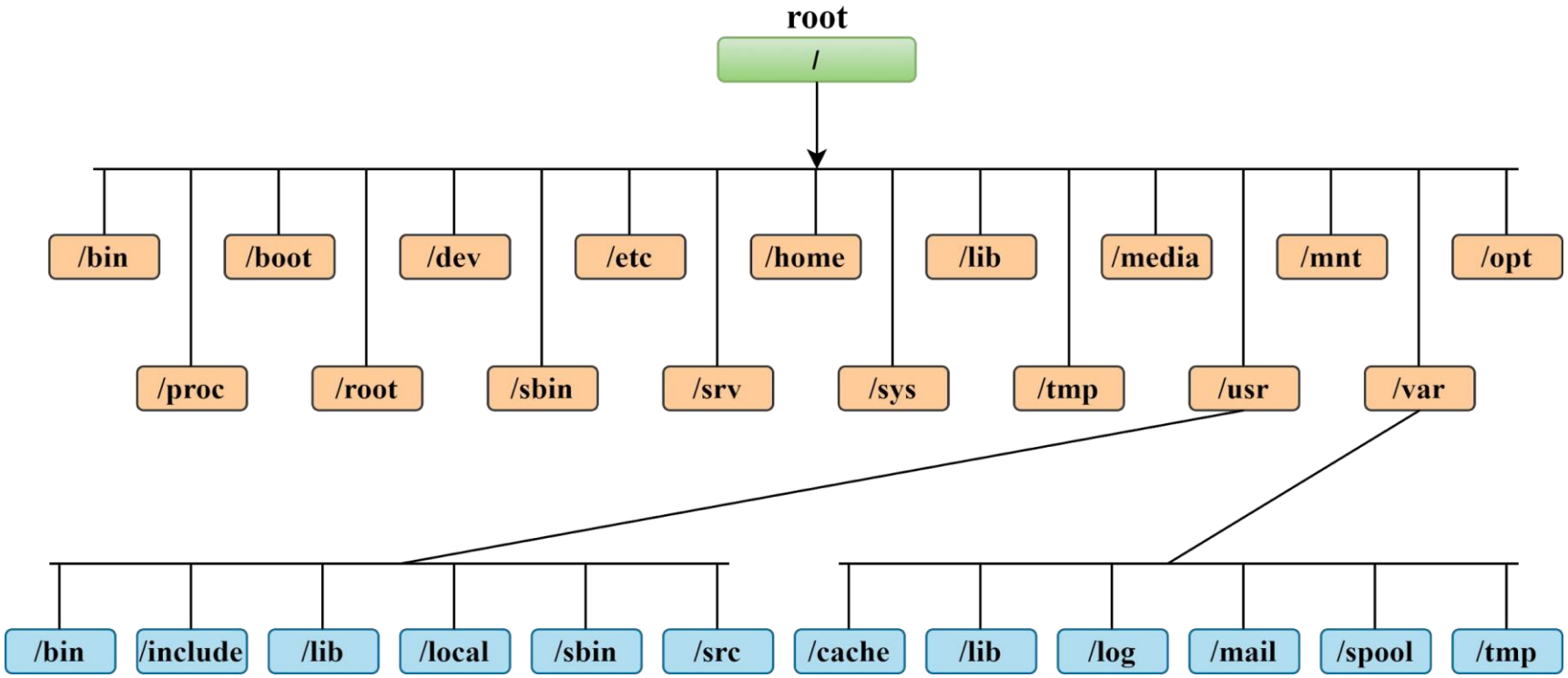
File Systems

- ext: extended file system
  - Implemented in April 1992
  - No longer used due to its limitations
- ext2: second extended file system
  - Max no. of files: 10^18
  - Max file size: 16 GiB to 2 TiB
- ext3: third extended file system
  - Used to be a default FS for many Linux distros
  - Does not support file recovery or disk snapshots

File Systems

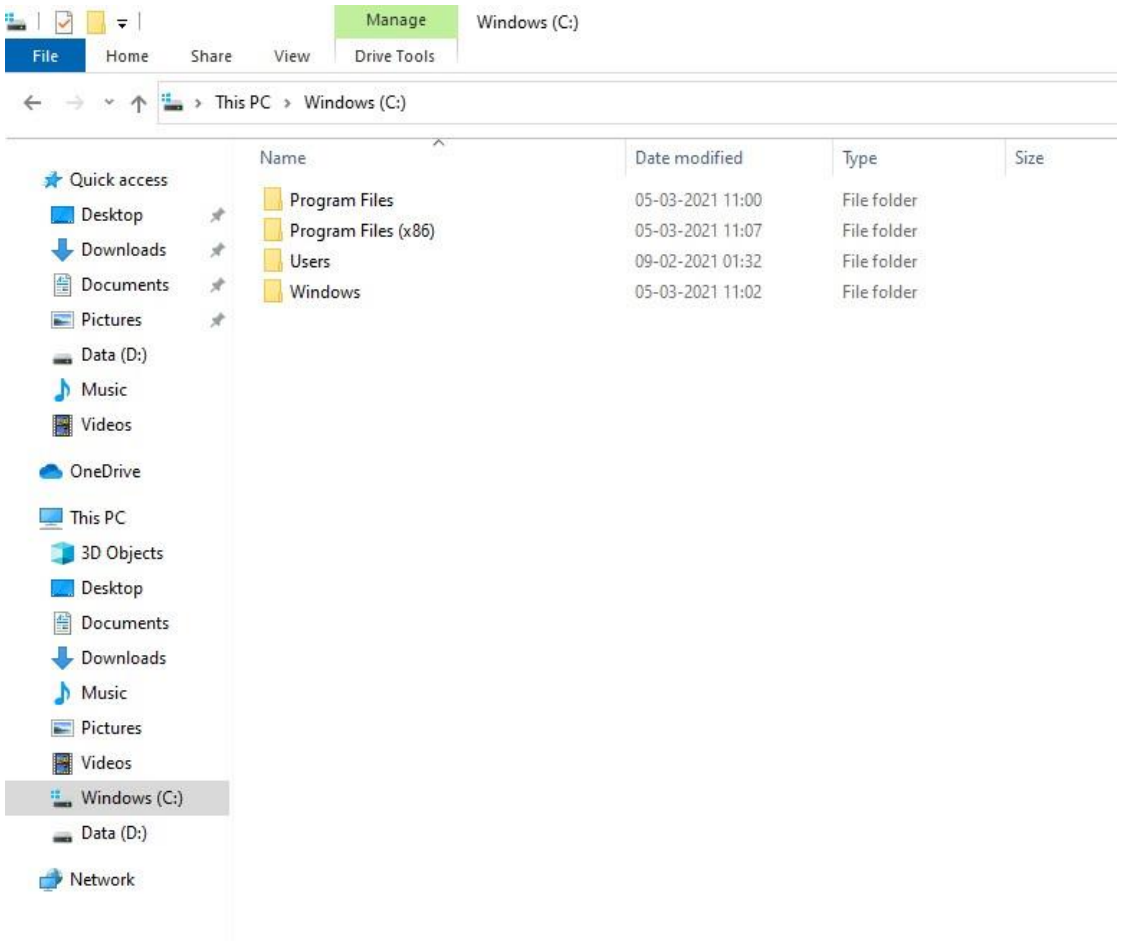
- ext4: fourth extended file system
  - Default FS for many Linux Distro (Debian and Ubuntu)
  - Max no. of files: 4B
  - Max file size: 16 TiB
  - Backward-compatible
- Alternate File Systems
  - JFS
  - Btrfs
  - SquashFS
  - tmpfs

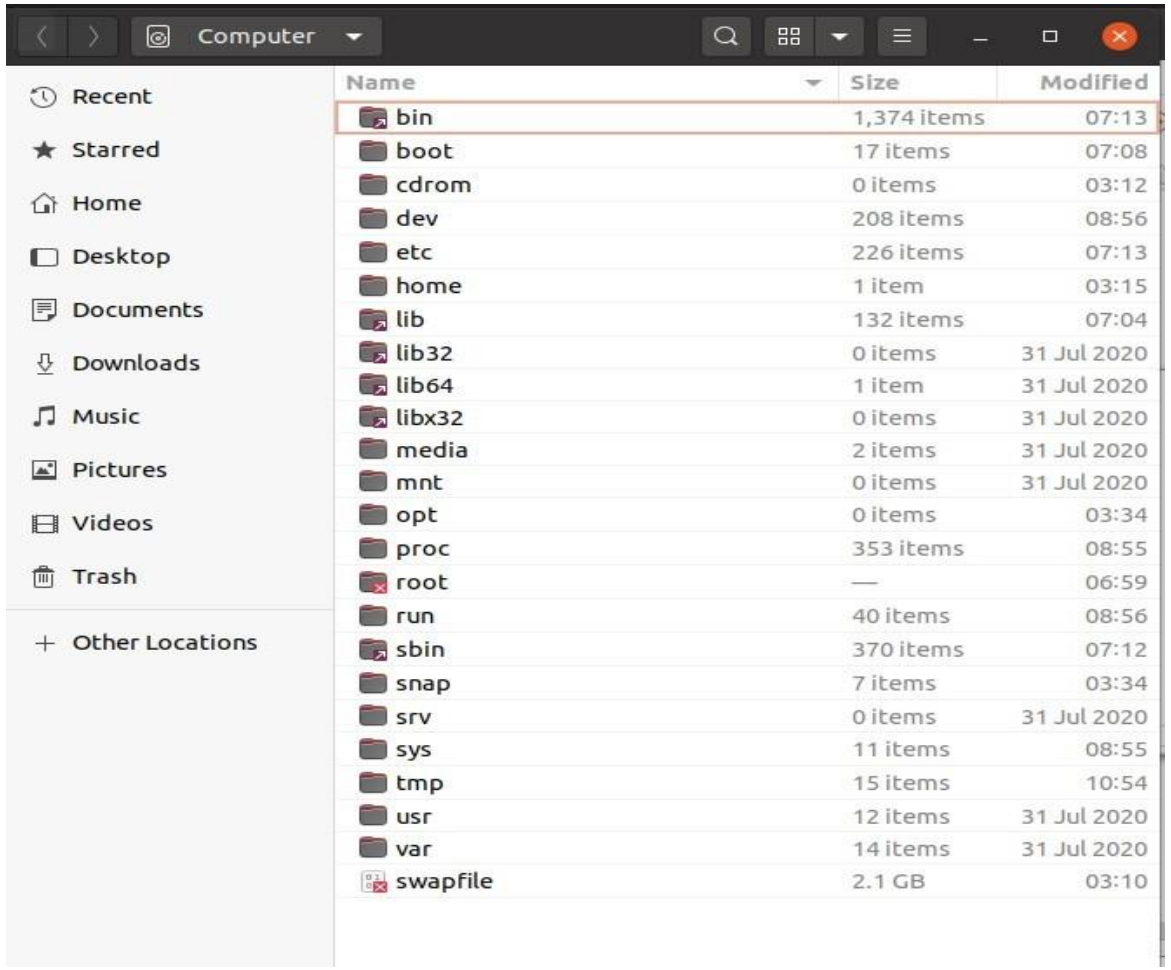
Linux File System Layout



Linux File System Layout

- Unlike Windows which has multiple roots, the Linux only allows one root



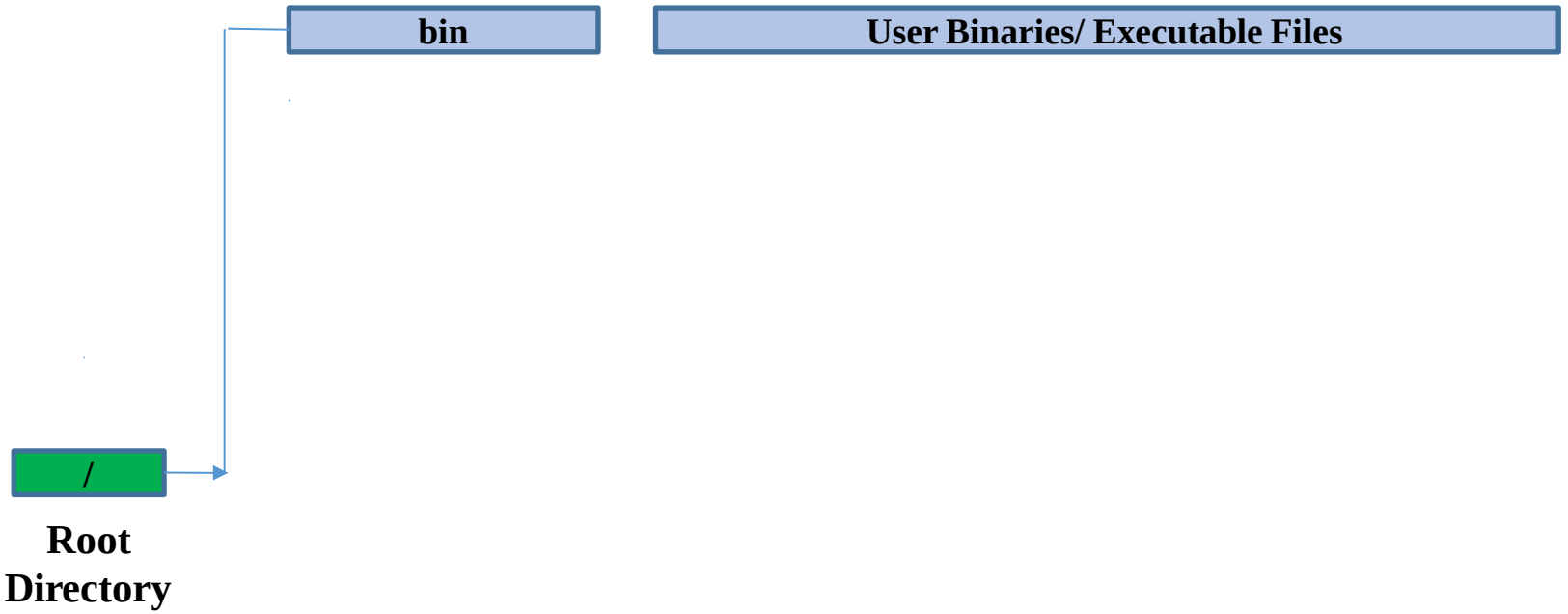


File System Layout

File System Layout

Root Directory

File System Layout



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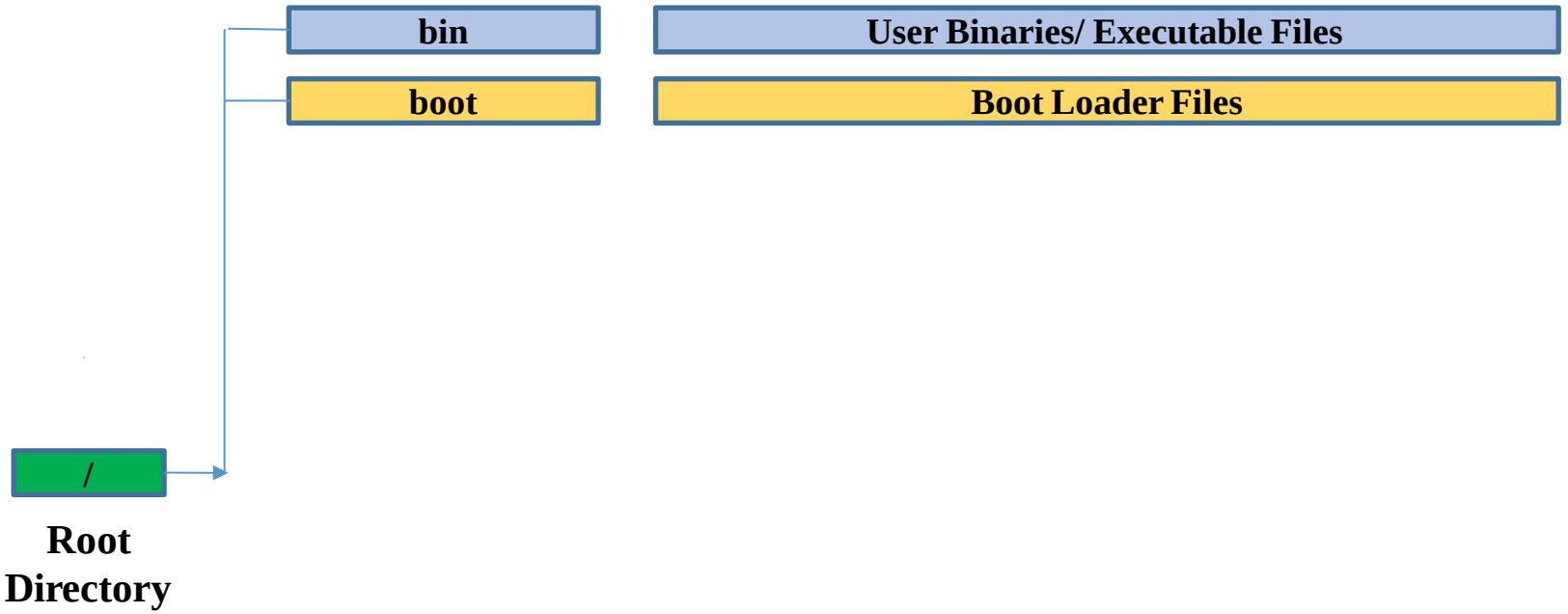

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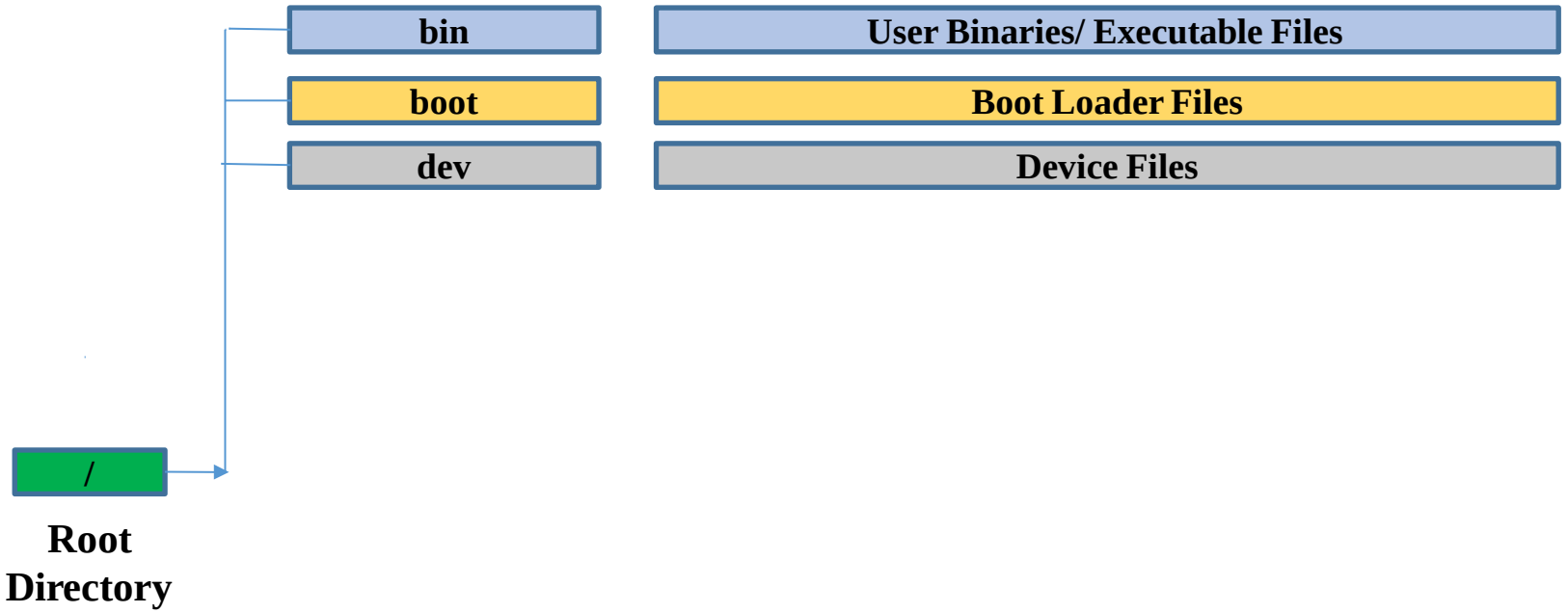

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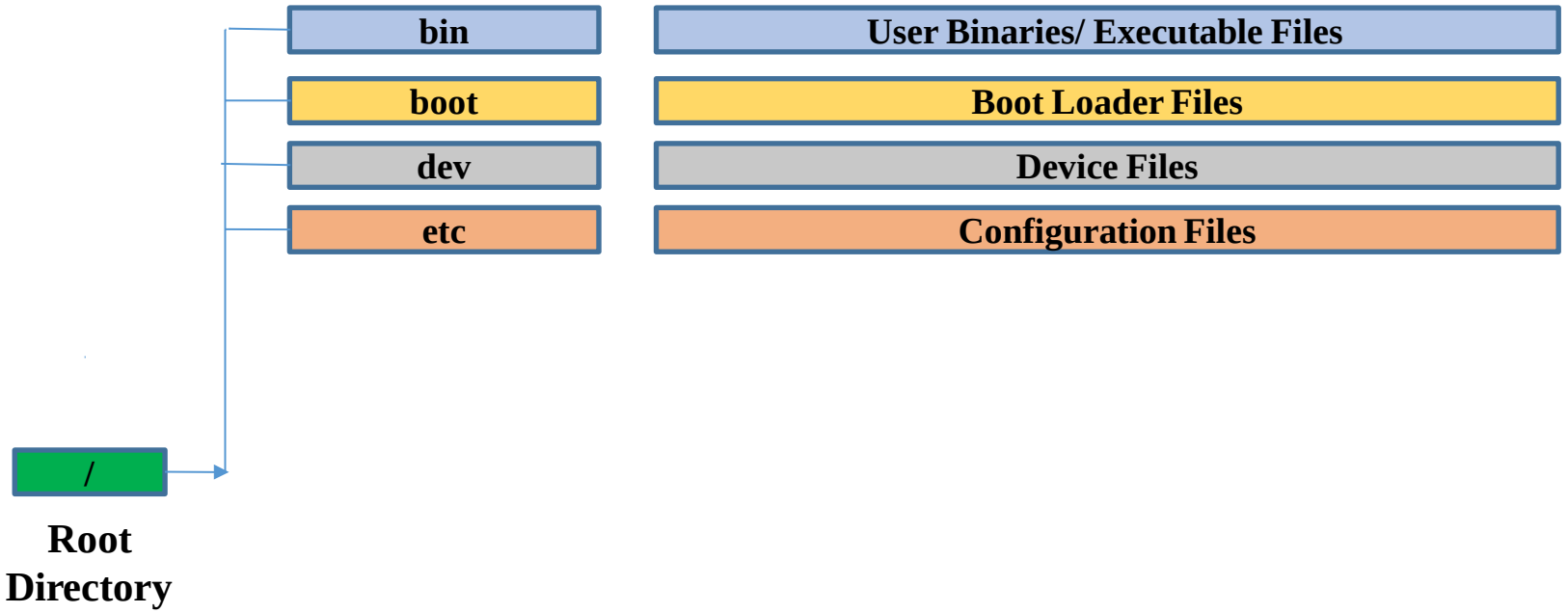

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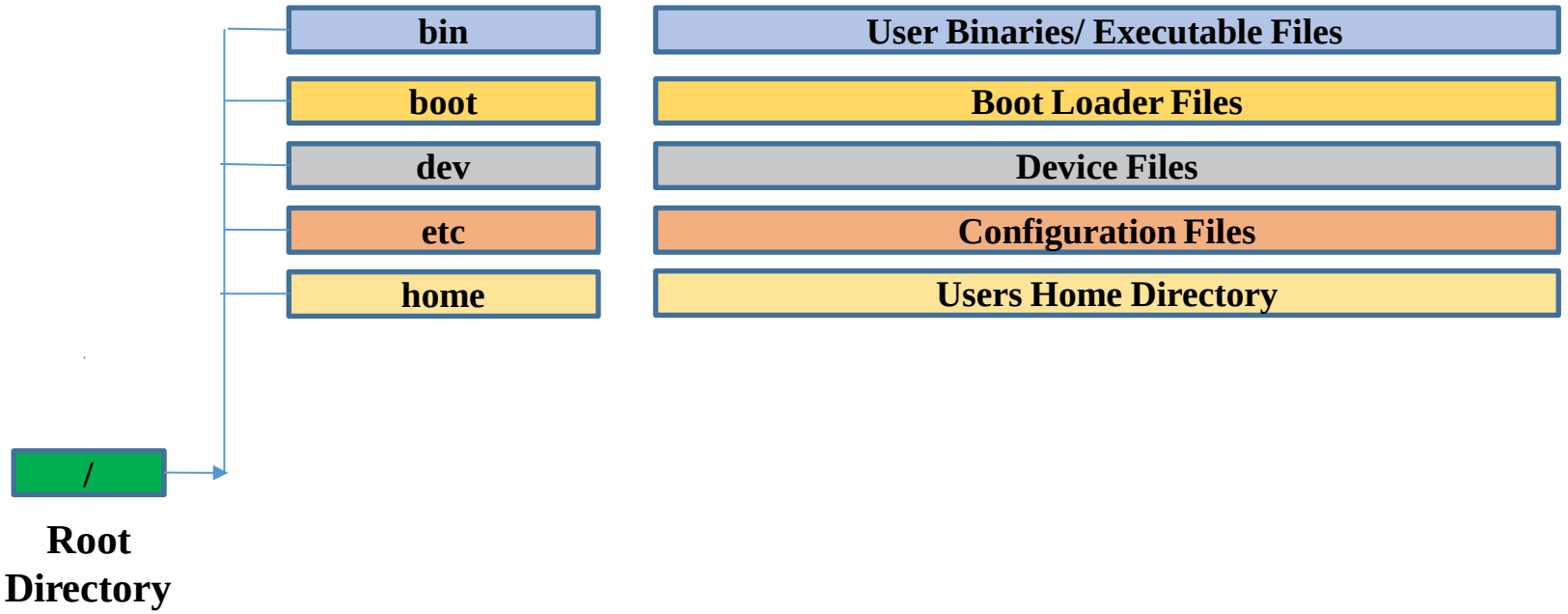

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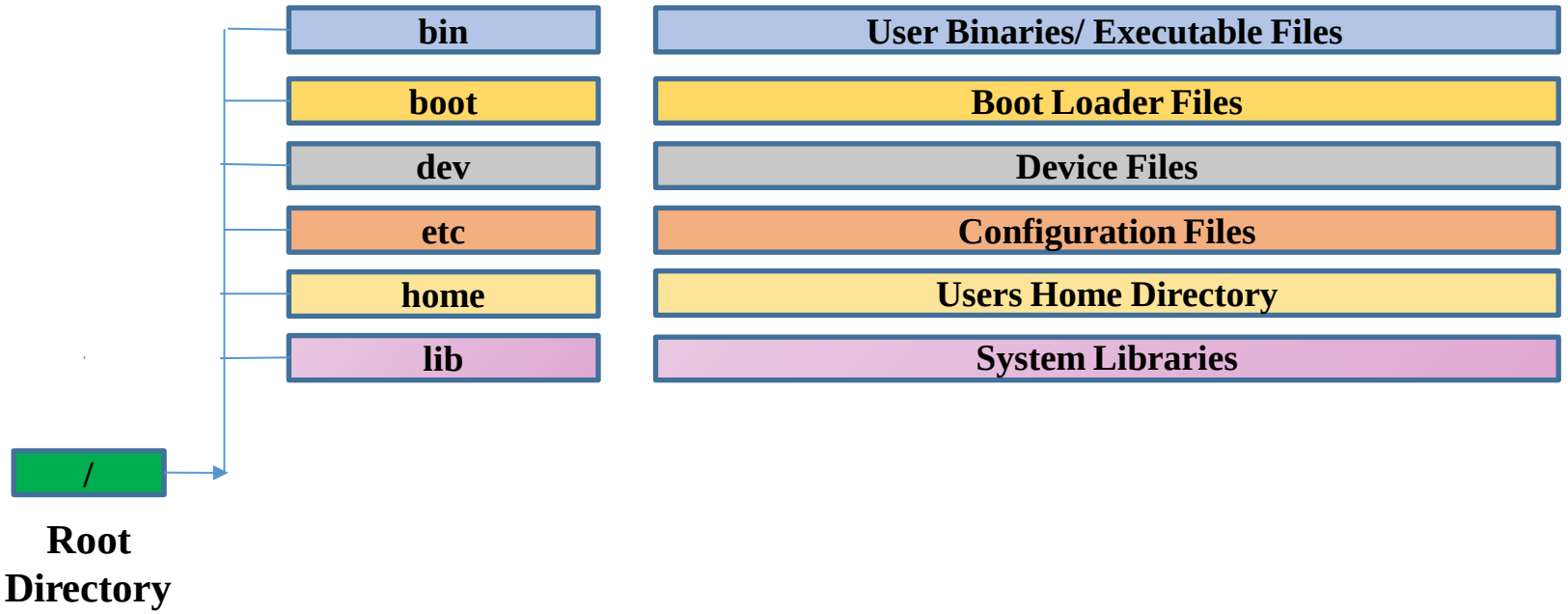

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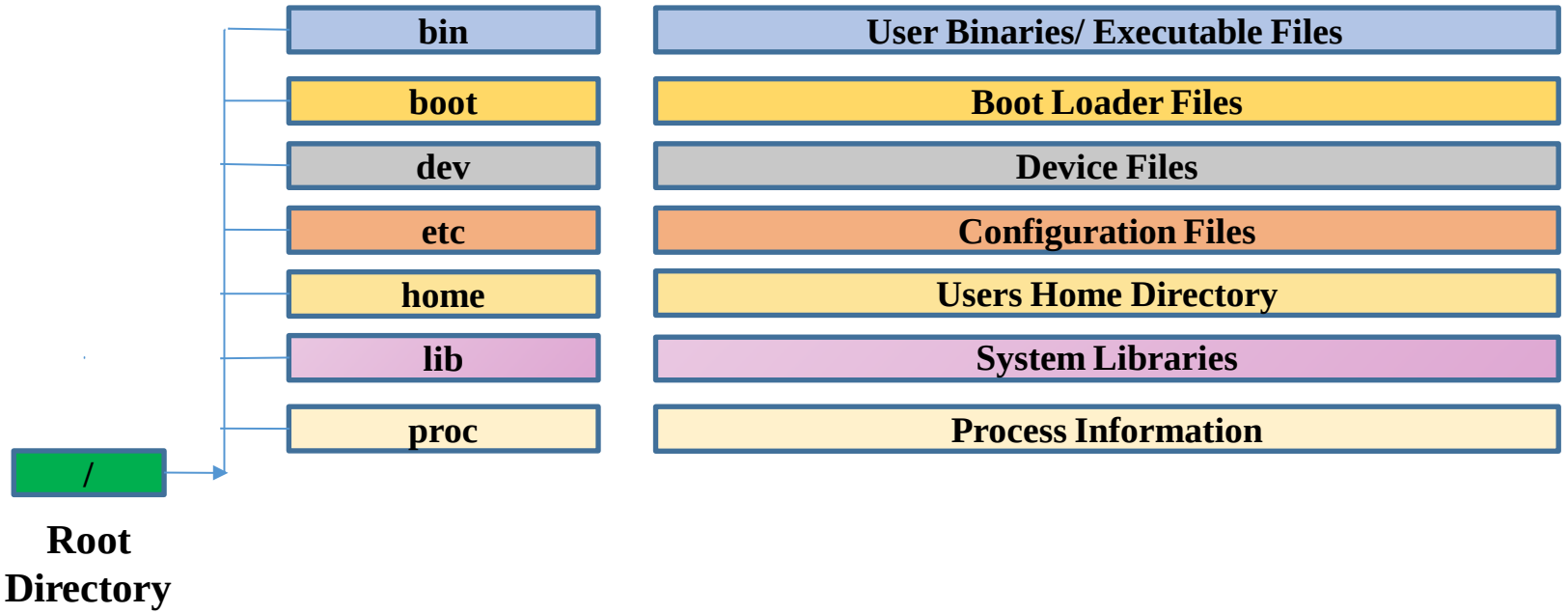

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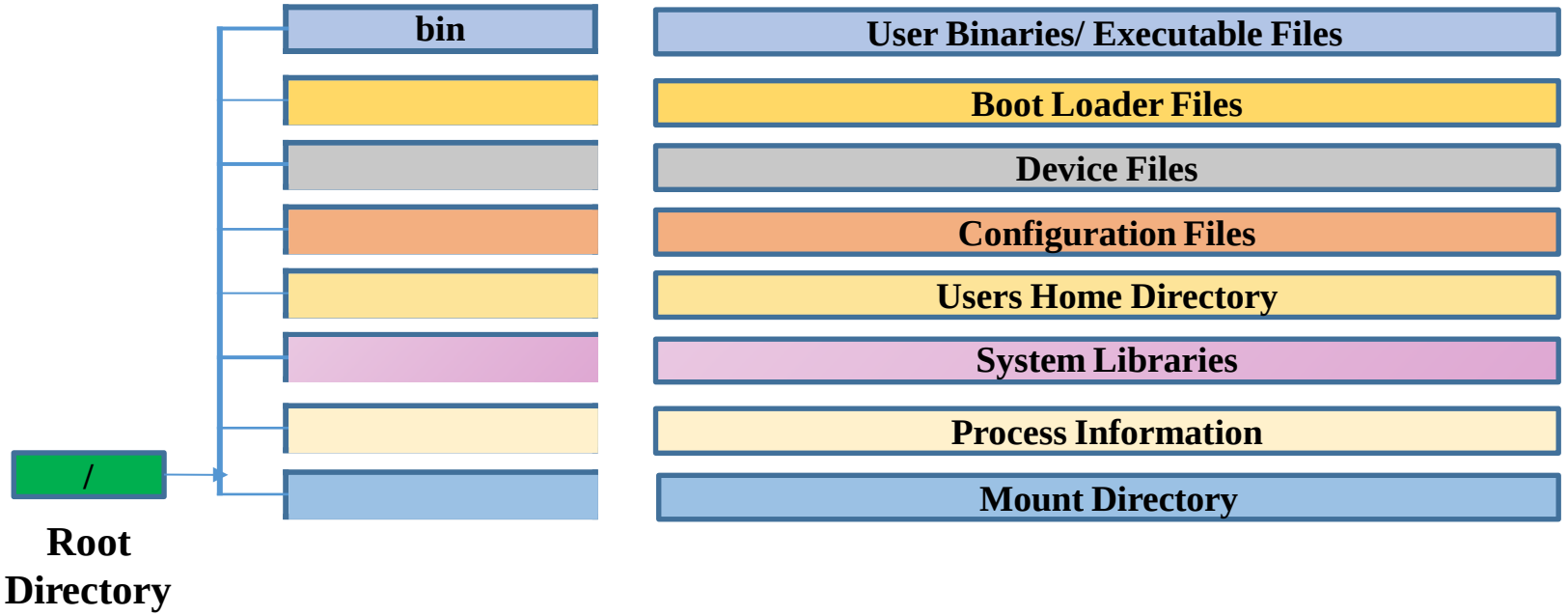

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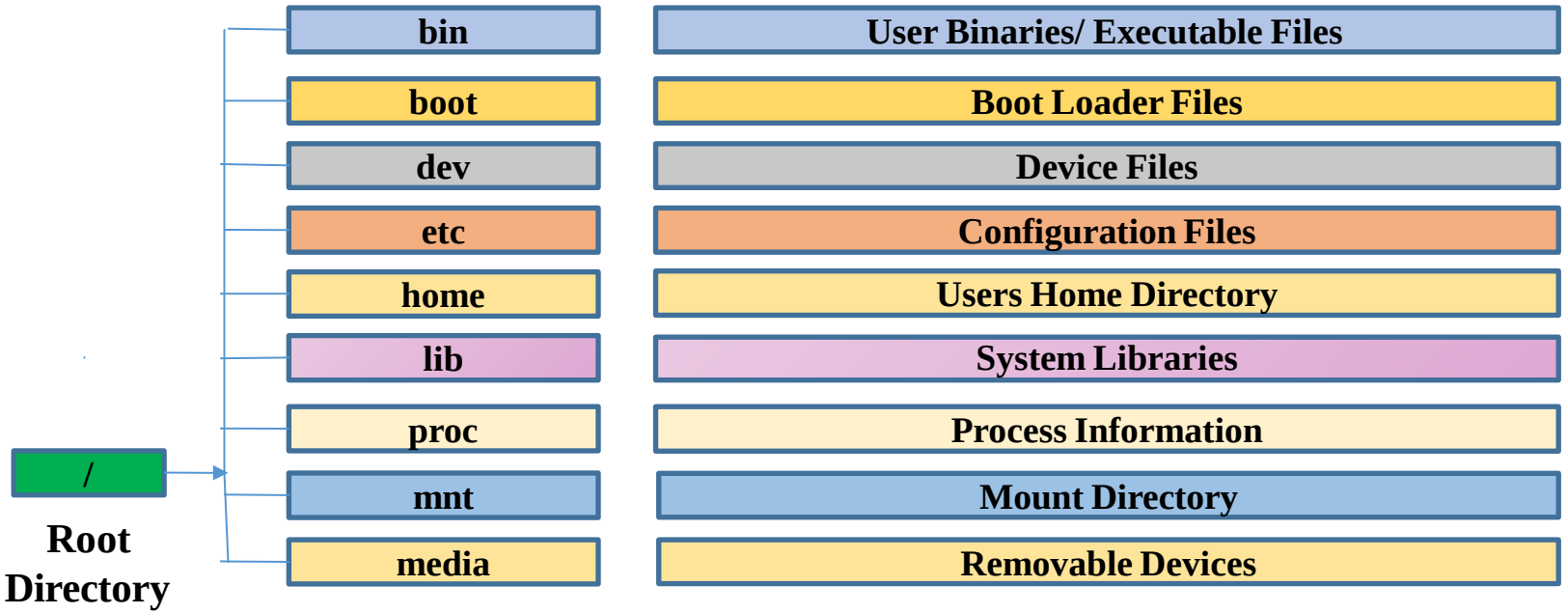

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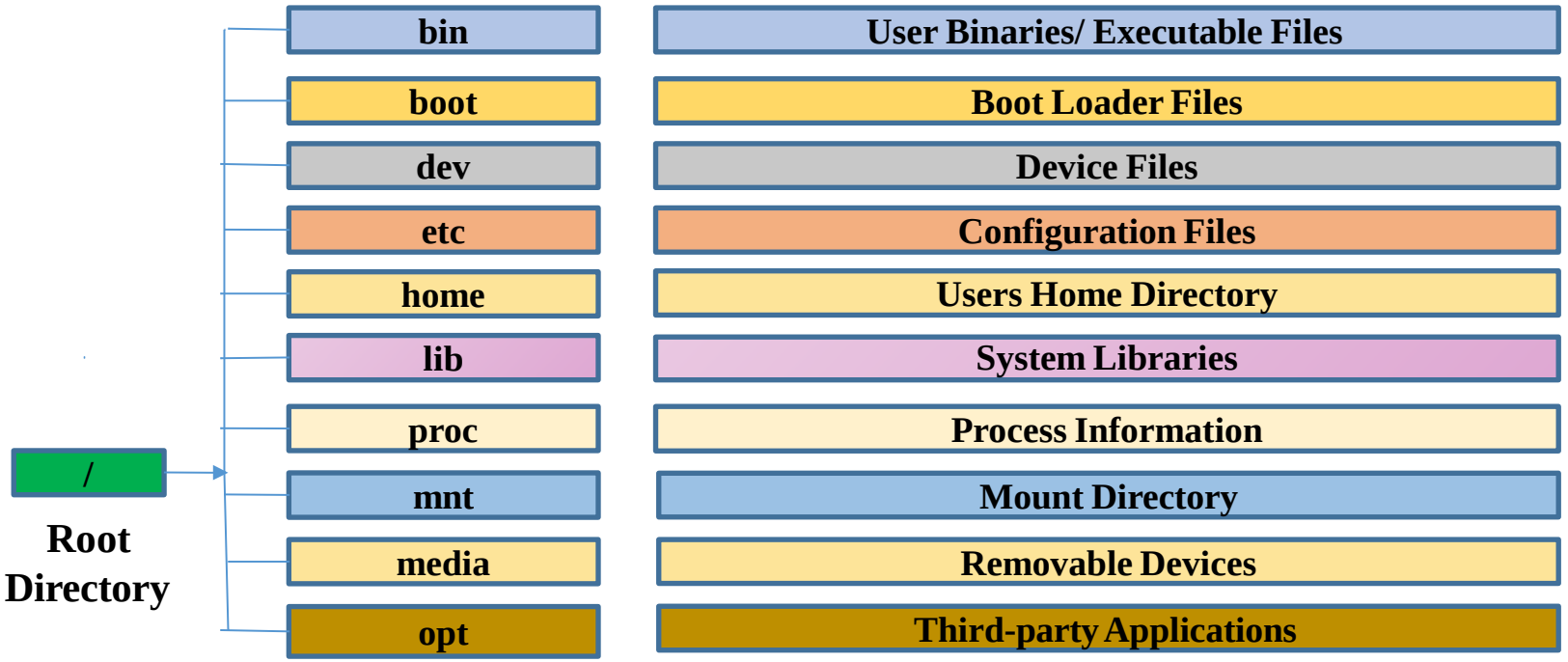

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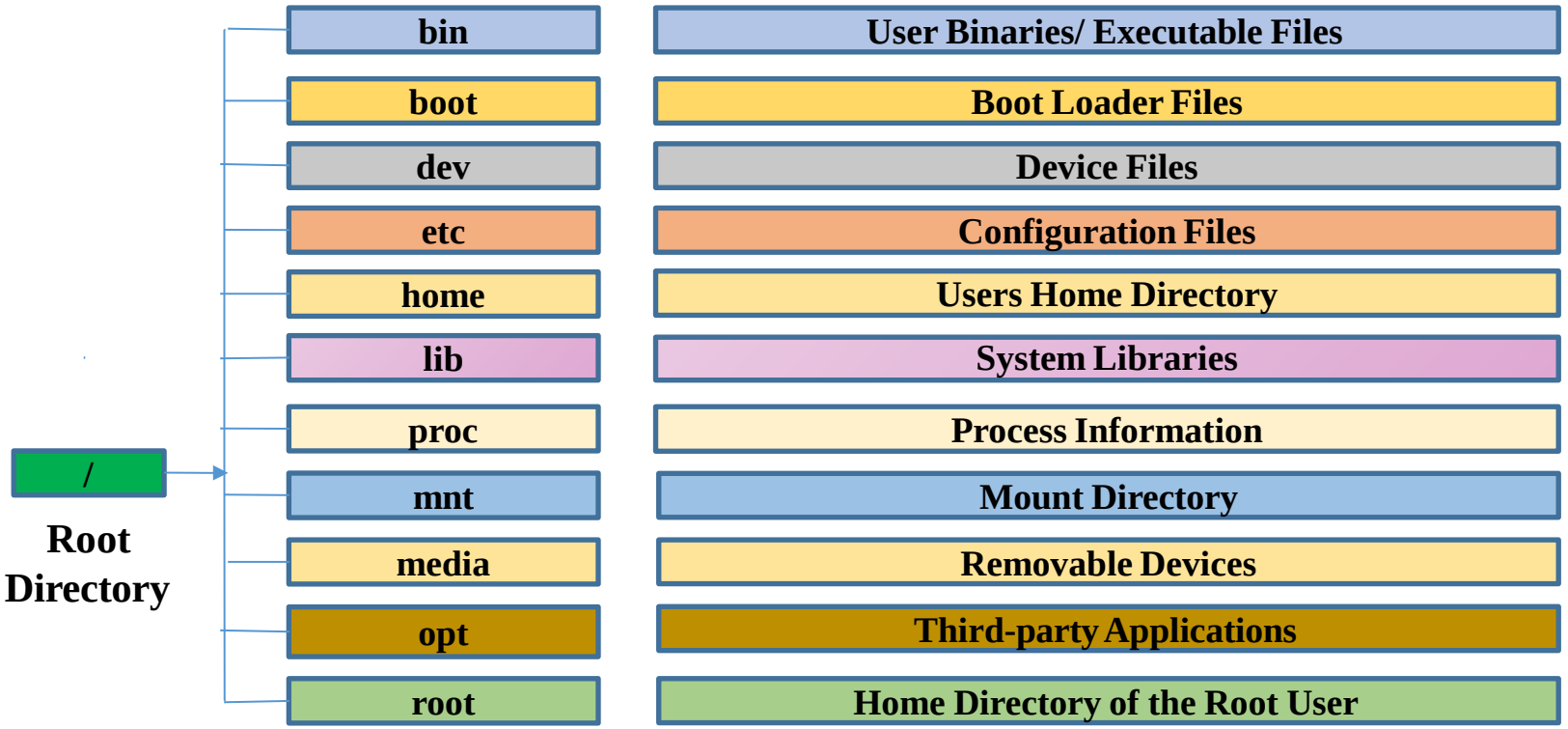

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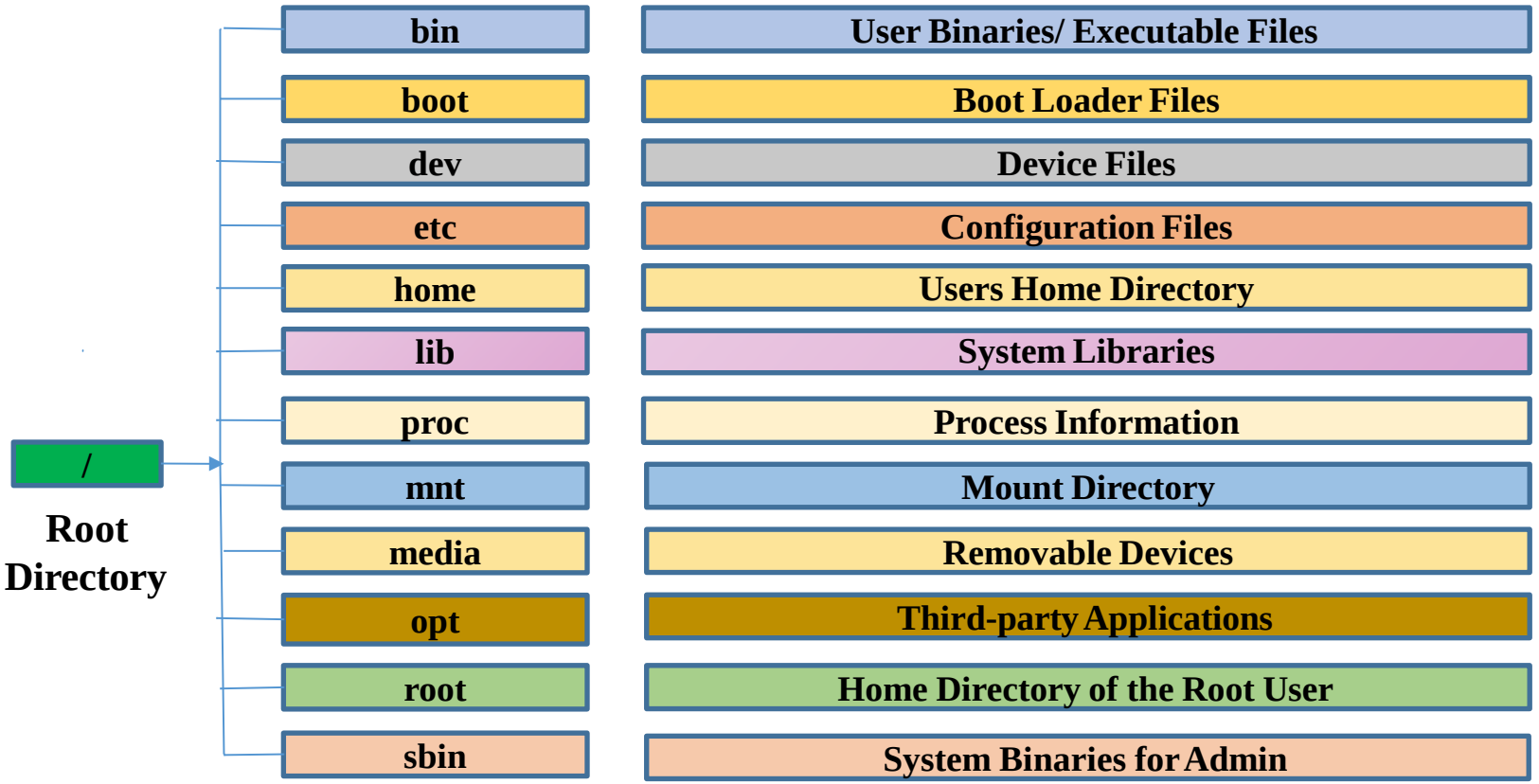

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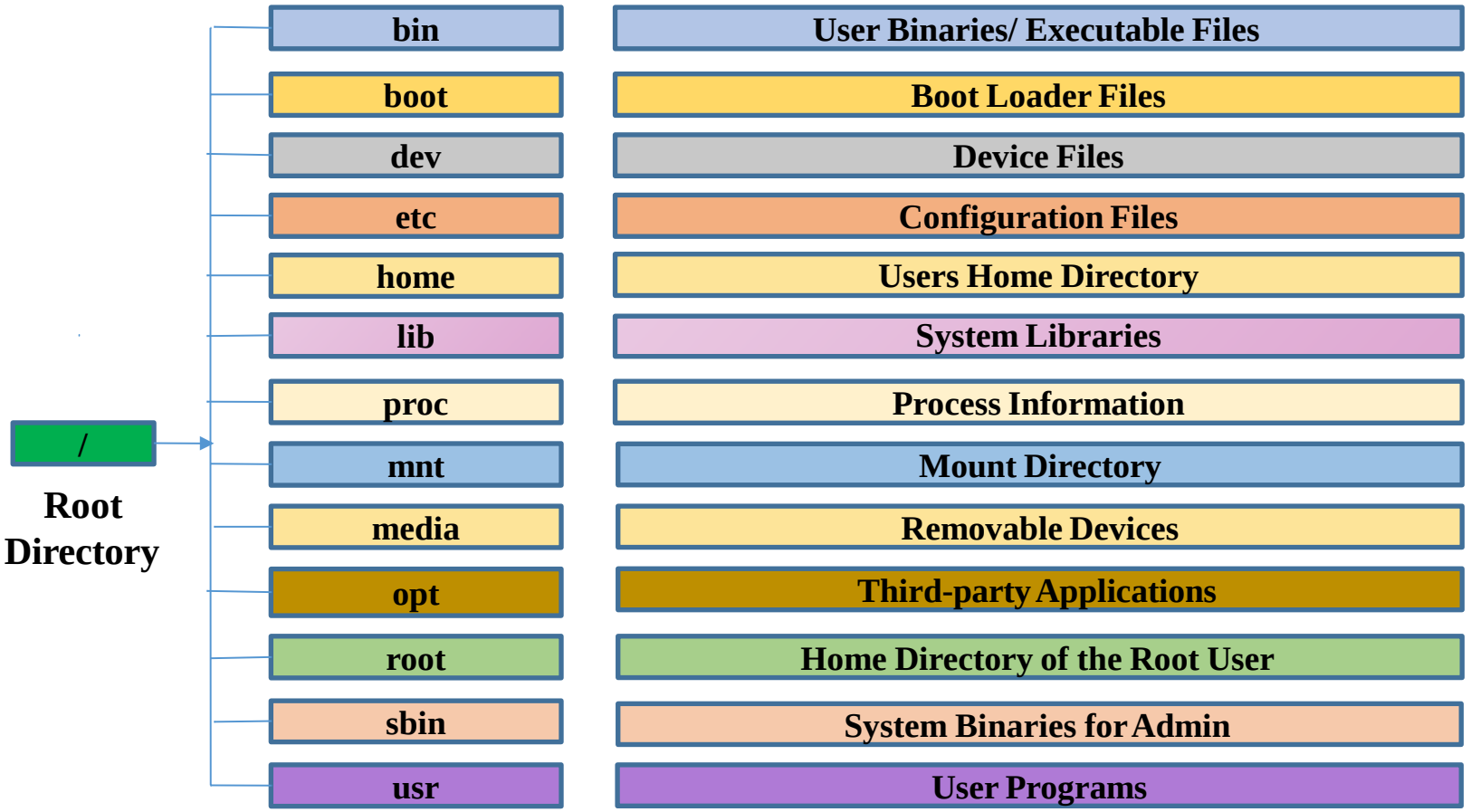

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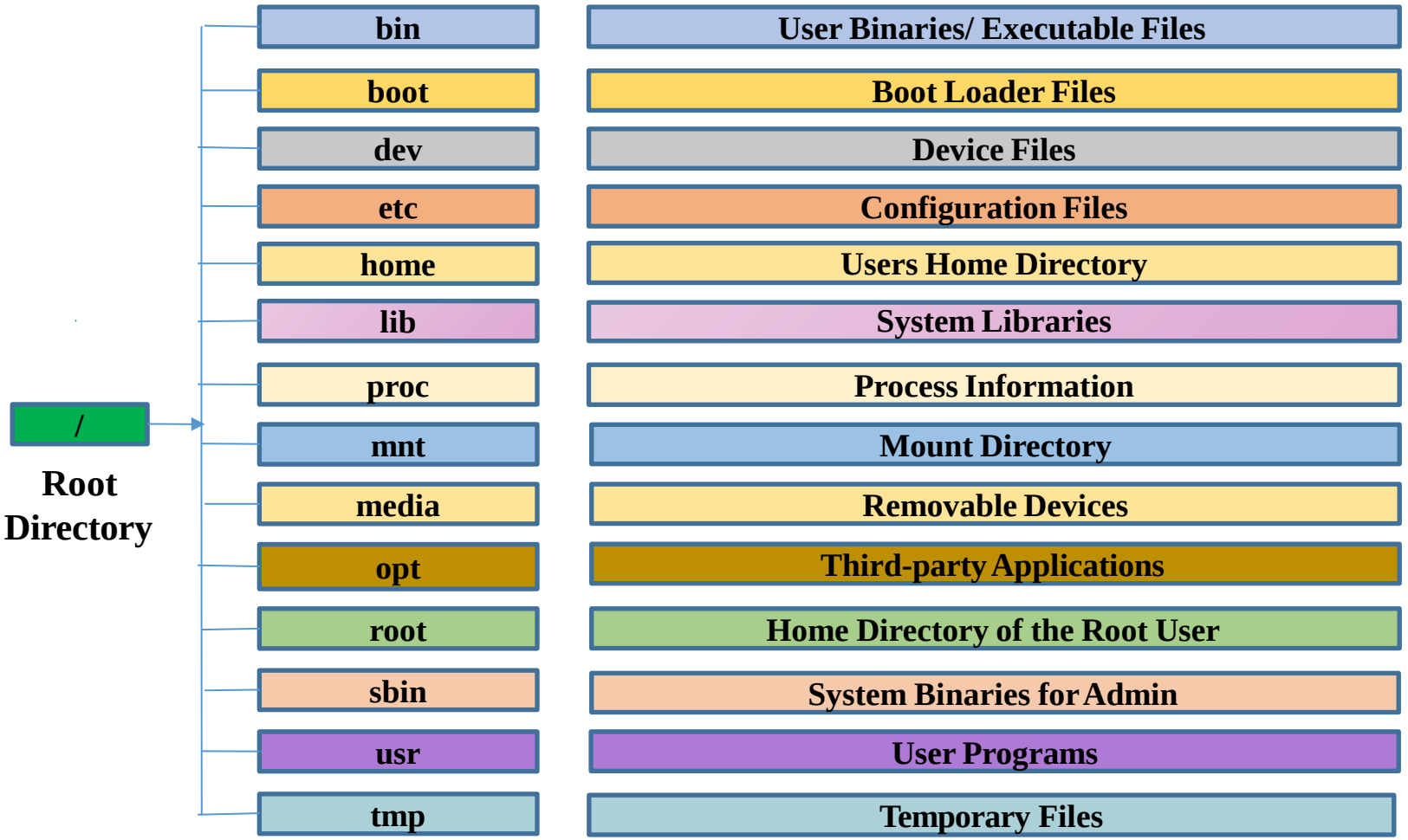

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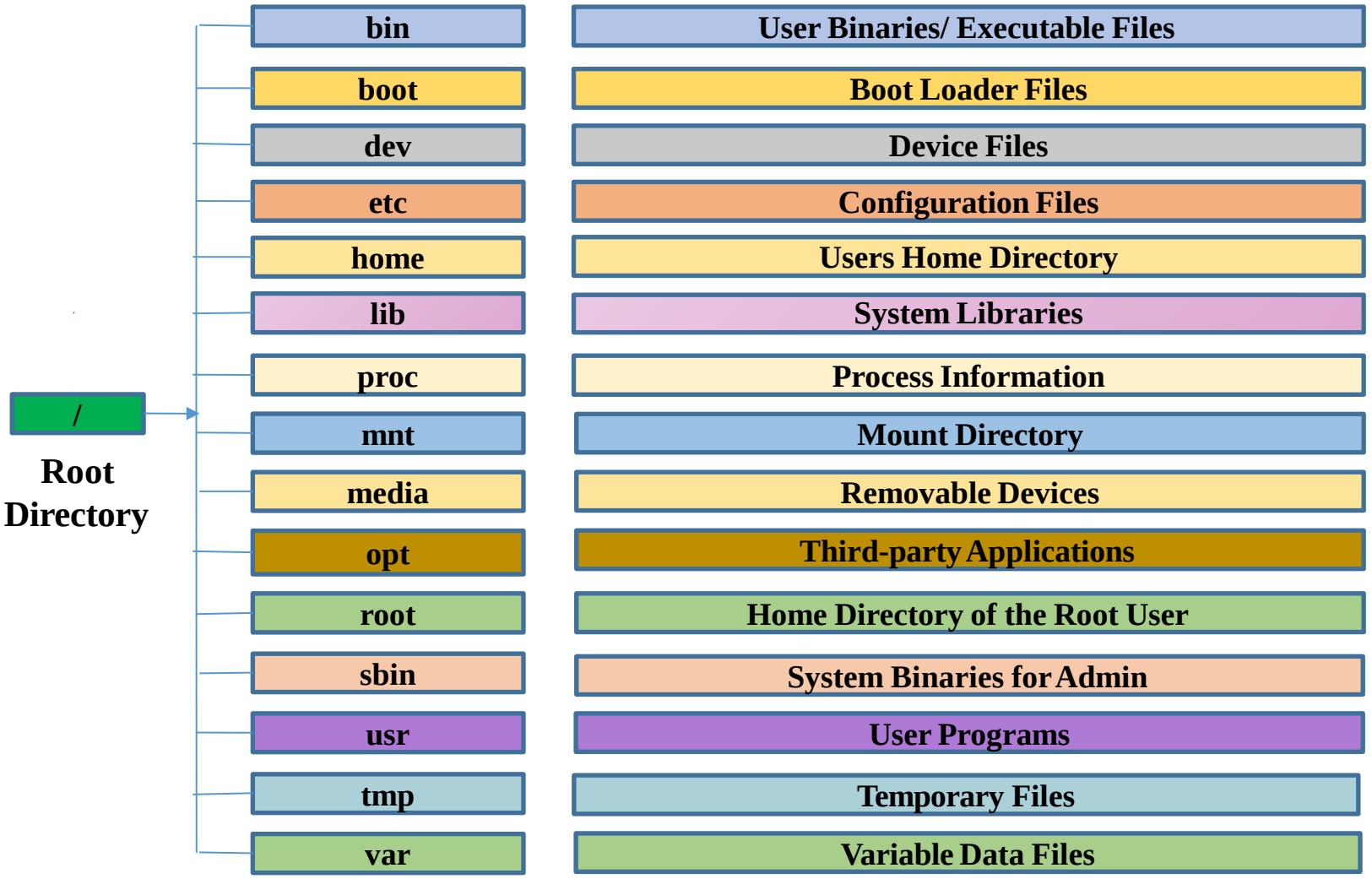

File Types

- Ordinary Files
  - Text Files
  - Binary Files
- Directory Files
  - Does not contain any data
  - Store Filename & Unique number
- Device Files
  - Character Devices
  - Block Devices

File Types

File Type	Symbol
Regular File	-
Directory	d
Link	l
Character Device	c
Block Device	b
Socket	s
Named Pipe	p

File Ownership

- It facilitates sharing of data among the users
- Types of Owners in Linux
  - Owner/User
  - Group
  - Others
- File Access Modes

Mode	File	Directory
read (r)	read or view files	list the files present
write (w)	change or delete the file content	create or remove directory
execute (x)	to run the file	to access the directory

File Permissions

- - - - - - - - - -

Number	Octal Permissions	
0	No permission	---
1	Execute permission	--x
2	Write permission	-w-
3	Execute and Write permission 1 (execute) + 2 (write)	-wx
4	Read permission	r--
5	Read and execute permission: 4 (read) + 1 (execute)	r-x
6	Read and write: 4 (read) + 2 (write)	rw-
7	All permissions: 4 (read) + 2 (write) + 1 (execute)	rwx

File Permissions

Letter	Represents
u	User
g	Group
o	Other
a	All

Letter	Owner
r	Read
w	Write
x	Execute
s	Sticky bit

Symbol	Represents
+	Add a permission to a file
-	Remove a permission to a file
=	Set the given permission

Linux Commands

Pathnames

- Path
  - is a unique location of a file or directory in a file system of the OS
- Absolute Path
  - The location of a file or directory from the root directory (/)
  - Complete path
- Relative Path
  - Path related to the current working directory

Symbol	Description
/	root directory
.	current directory
..	Parent directory
~	User home directory

Command?

- Syntax: command option1 option2 arg1 arg2
  - argument - Is the input to the command on which it acts
  - options – Modify the behavior of the o/p
- Running Multiple Commands
  - ;
  - &&
  - ||

Directory & File Related Commands

- Present working directory (pwd)
- Change directory (cd)
- Listing the directory entries (ls/dir)
- Copying file and directories (cp)
- Moving or renaming a file or directory (mv)
- Display the content of a file (cat)
- Creation & deletion of file (touch/rm)
- Creation & removing a directory (mkdir/rmdir)
- Locate the command (Which)
- Count no. of words and line in a file (wc)

Linux Commands: Directory

- pwd: Present working directory
  - syntax: pwd
- mkdir: Create a new directory
  - syntax: mkdir <dir name> [options]
- rmdir: Delete a present directory (if empty)
  - syntax: rmdir <dir name> [options]
- cd: Change directory
  - syntax: cd <dir name>
  - cd
  - cd -
  - cd ..
  - cd ../.

Linux Commands: Directory

- ls: Lists directory contents of files and directories
  - ls
  - ls -l
  - ls -d */
  - ls -ax
- dir
  - dir
  - dir -d */

Linux Commands: File

- touch: Create empty files
  - syntax: touch <filename1> <filename2> [options]
- cat: Concatenate | Multipurpose utility
  - syntax: cat <file name> [options]
- rm: Delete a file / directory
  - syntax: rm <file name> [options]
  - rmdir <directory name> [options]
  - rm -rf
- cp: Copy a directory/ file
  - syntax: cp <source> <destination>
  - syntax: -r cp <source> <destination>
- mv: Move file or directory from one location to another
  - syntax: mv <source> <destination> [options]

Linux Commands: File

- head: Displays first 10 lines of a file
  - syntax: head <filename> [options]
- tail: Displays last 10 lines of a file
  - syntax: tail <filename> [options]
- more: Displays the content of a file page by page
  - syntax: more <filename> [options]
- less: Displays the content of a file with navigation
  - syntax: less <filename> [options]

Linux Commands: User

- su: Switch User
  - Gives administrative access to the user
  - syntax: su [options] [arguments]
- id: Displays user id (UID) and group id (GID)
  - syntax: id [options]
- useradd: Create a new user
  - syntax: sudo useradd <username> [options]
- passwd: Create and update password for a user
  - syntax: passwd <username> [options]

Linux Commands: Filter

- cat
- cut: Select a specific column of a file
  - syntax: cut -d <delimiter> -f <columnNo> <filename>
  - delimiter: space(‘ ’), a slash(/), a hyphen (-)
- wc: Count the words, lines and characters in a file
  - syntax: wc <filename> [options]
- od: Octal dump
  - displays the content of a file in different formats
  - octal, hexadecimal, ASCII
  - syntax: od -b | -t | -c < filename >

Linux Commands: Filter

- grep: global regular expression print
  - search the content from a file
  - syntax: command |grep < search string>

options	Description
-c	Count no. of matches
-i	Ignore case
-n	Line number
-r	Recursively search sub directories also
-v	Select non matching lines
-w	Select only those lines containing matches that form whole words
-x	Select only those matches that exactly match the whole line

Linux Commands: Utility

- find: search the particular file in a directory
  - search the content from a file
  - syntax: find [search location] [expression] [-options] [what to find]
- locate
  - syntax: locate [Option] <Pattern>
- date: display the date, time, timezone
  - syntax: date [options]
- cal: Displays the current month calendar
  - syntax: cal [options]
- time: Display the time required to execute a command
  - syntax: time [options]

Linux Commands: Utility

- which: Locate the executable file for a given command
  - syntax: which -a filenames
- df: disk filesystem
  - Display the disk space used in the file system
  - syntax: df [options]
- exit: Exit from the current shell
  - syntax: exit [options]
- clear: Clears the terminal screen
  - syntax: clear [options]
- sleep: Holds the terminal by the specified amount of time
  - syntax: sleep <time> [options]

Linux Commands: Networking

- ip: Internet Protocol
  - syntax: ip [options]
- ping: Packet Internet Groper
  - Check the connectivity between two nodes
  - syntax: ping <destination>
- ssh: Create a remote connection using ssh protocol
  - syntax: ssh user_name#host(IP/domain_name)
- host: Display the IP address for a given domain name / IP
  - syntax: host < domain_name> | < IP address>
- scp: Secure copy
  - Copy the files securely between the servers
  - Syntax: scp [options] [username@]source_host:]file1 [user@]destination_host:]file2

Linux Commands: Archiving

- Archive ?
- tar: tape archive
  - Syntax: tar [options] <destination file name> [<source file1>, <source file2>]
  - Options:

    -c : create archive

    -x : extract archive

    -f : creates archive with given filename

    -t : lists files in archived file

    -u : archives and adds to an existing archive file

    -v : displays verbose Information

    -A : concatenates the archive files

    -z : zip, tells tar command that create tar file using gzip

    -r : update or add file or directory in already existed .tar file

Linux Commands: Compress/Decompress

- Compress ?
- Decompress ?
- gzip
  - Compress:
    - Syntax: gzip [options] <filename>
  - Decompress
    - Syntax: gzip [options] <filename>
    - Syntax: gunzip [options] <filename>

Linux Commands: Compress/Decompress

- bzip
  - Compress:
    - Syntax: bzip2 [options] <filename>
  - Decompress
    - Syntax: bzip2 [options] <filename>
    - Syntax: bunzip2 [options] <filename>

Thank You