Introduction to Unix shell (part I)

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Contrary to popular belief, Unix *is* user friendly. It just happens to be very selective about who it decides to make friends with.

Unknown

Historical overview (kind of)

Unix is a family of multiuser, multitasking operating systems stemming from the original Unix developed in the 1970's at Bell Labs by Ken Thompson, Dennis Ritchie[1], and others.

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Initially used at Bell Labs, but soon licensed to academy (notably, U. of California, Berkeley) and commercial vendors (IBM, Sun, etc).

> There are two major products that came out of Berkeley: LSD and Unix. We don't believe this to be a coincidence.
>
> — Jeremy S. Anderson, Unix systems administrator

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GNU/Linux

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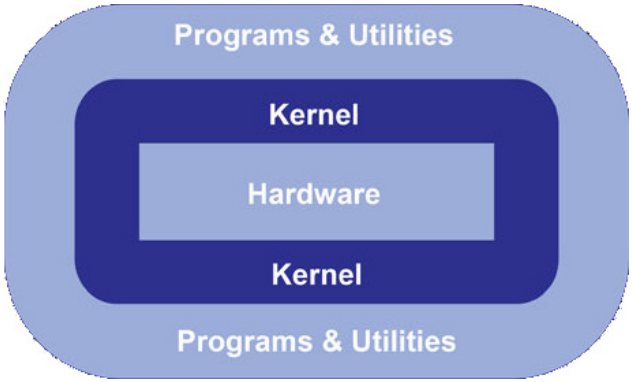
The core component—the Linux kernel—was first released in 1991 by Linus Torvalds.

Today, every Android device runs Linux kernel.
(And iOS devices run another Unix-derived kernel.)

Unix building blocks

UNIX is very simple, it just needs a genius to understand its simplicity.

Dennis Ritchie

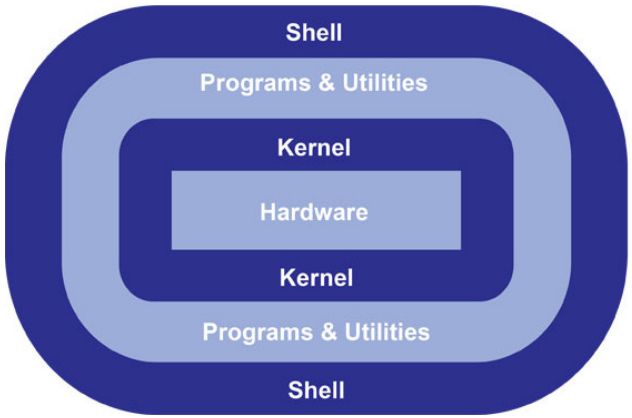


A kernel connects the application software (programs & utilities) to the hardware of a computer.

Unix shell

In fact, we started off with two or three different shells and the shell had life of its own.

Ken Thompson

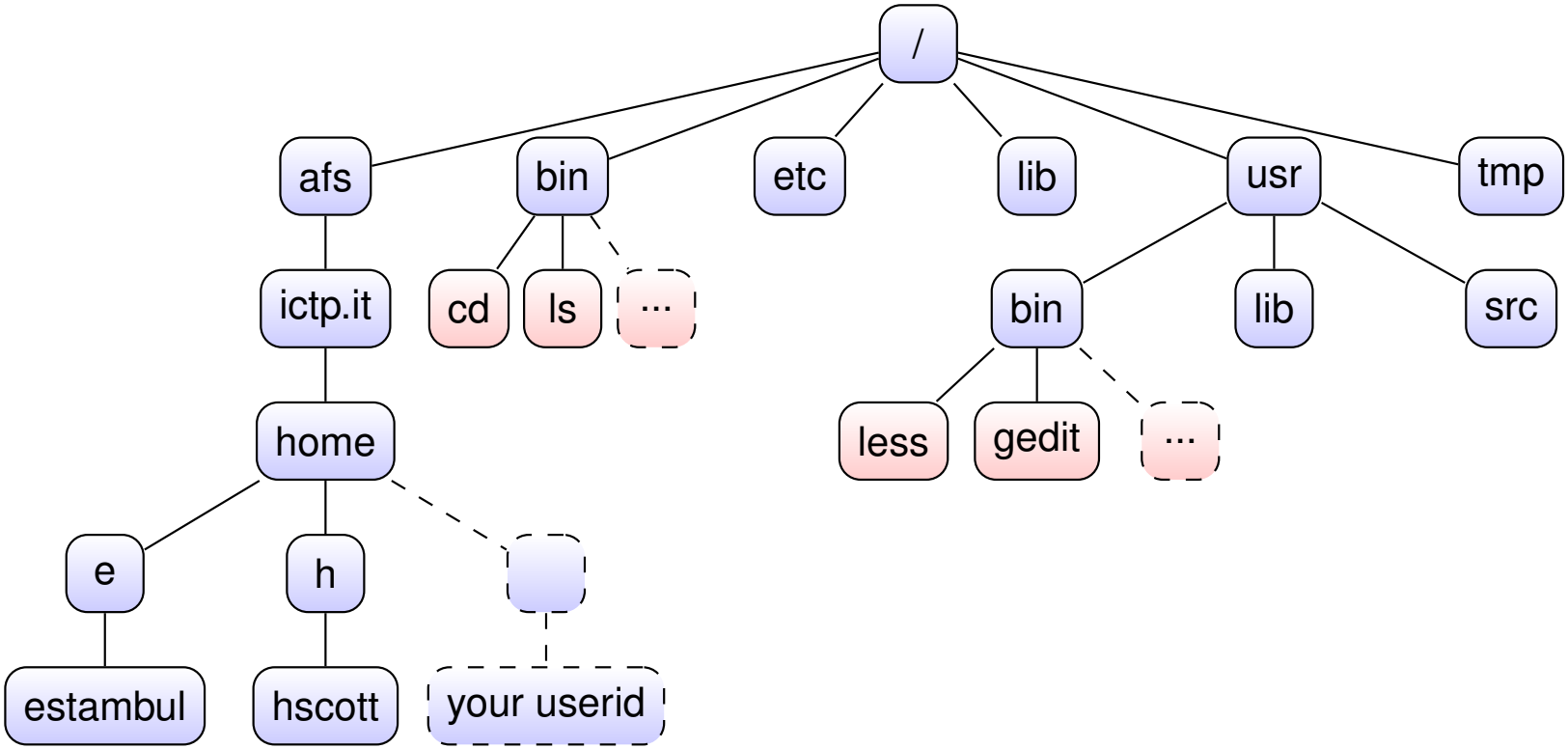


Shell is an interpreter that provides a *command-line* interface (CLI), contrary to a graphical user interface (GUI).

- For kernel, shell is just another program/utility
- For user, first among equals
- There are several shells: `bash`, `tcsh`, `zsh`,...
- We will use `bash`

File system I

> The one thing I stole was the hierarchical file system because it was a really good idea...
>
> Ken Thompson



File system II

- top-level entry = “/” (root of the file system);
- “/” (*forward* slash) is a path separator;

For example, full path to my home directory is

```
/afs/ictp.it/home/e/estambul
```

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Having said that, though...

Good practice for file naming:

- Don’t use spaces! Use _ (underscore) instead.
- Only alphanumeric characters (A–Z, a–z, 0–9).
- Use file extensions consistently.

Basic file-system navigation I

- `cd` – change directory
- `ls` – list file(s)
- `pwd` – print pathname of the working directory

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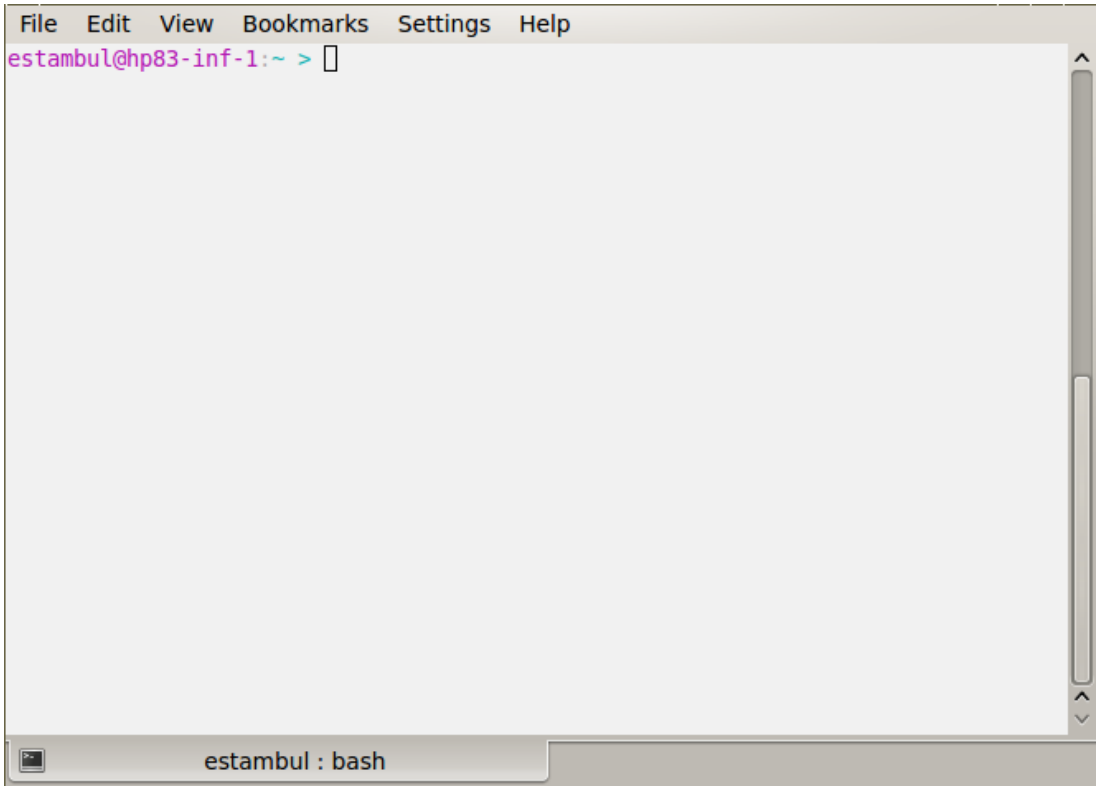
OK, let's get our hands dirty... Open a terminal emulator:



Basic file-system navigation II

Special directory names:

- `/` – file-system root
- `.` – current directory
- `..` – parent directory (up one level)
- `~` – home, ~~sweet home~~ directory
- `-` – previously visited directory (only for `cd`)

Basic file-system navigation II

Special directory names:

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- `~` – home, ~~sweet home~~ directory
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Wildcards:

- `*` – any number of any characters
- `?` – a single character (any)

Shell movie making. Part I – write your script

- `script` – make typescript of terminal session

Try:

```
% script lesson1.out
Script started, file is lesson1.out
% (now play with the commands learned so far - ls, cd, etc)
% ...
% (at the end, type exit):
% exit
Script done, file is lesson1.out
%
```

Note: here and below, “%” denotes the shell prompt - don’t type it!

Shell movie making. Part II – review the script

- `more` – a simple text pager

```
% more lesson1.out
```

Hint: Ctrl + L to clear the screen.

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While in `less`:

- Ctrl+F or Space – move forward
- Ctrl+B – move backward
- / (followed by a pattern) to search forward; ? – backward
- n to repeat a previous search;
- q to quit.

Shell movie making. Part III – the real thing

```
% script --timing=lesson1.tm lesson1.out
Script started, file is lesson1.out
% (make some fun again with ls, cd, etc)
```

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% (make some fun again with ls, cd, etc)
```

Note: most shell commands accept various options (here, `--timing=<filename>`). For basic usage, try the `--help` flag with a command you know, e.g.:

```
% script --help
```

or

```
% more --help
```

Shell movie making. Part IV – the final cut

OK, time to finish shooting:

```
% exit
Script done, file is lesson1.out
%
```

Hint: you could hit Ctrl+D instead of `exit`.

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- `scriptreplay` – play back typescripts, using timing information

```
% scriptreplay --timing=lesson1.tm lesson1.out
```

Enjoy!

Creating and modifying files and directories

- `mkdir` – make directory/ies
- `rmdir` – remove directory/ies
- `cp` – copy file(s) or directory/ies
- `mv` – move file(s) or directory/ies
- `rm` – remove file(s) or directory/ies

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Note 1: `cp`, `mv`, and `rm` are dangerous commands – by default, overwrite/delete files without warning.

Note 2: There is no “undelete” command...

Hint: Use `cp -i`, `mv -i`, `rm -i` for safety.

Aliases

Instead of typing "`rm -i`" etc everytime, one can use aliases:

- `alias` – define or display alias(es).
- `unalias` – remove alias(es).

```
% alias rm='rm -i'
% alias mv='mv -i'
% alias cp='cp -i'
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In fact, you've used some "aliased" commands unknowingly:

```
% alias ls
alias ls='ls --color=auto'
```

Hint: to invoke a "pristine" command, prepend it with a backslash:

```
% \ls
```

Editing files

Good old times: Church of Emacs vs. Cult of vi...

> There are more things that vi can do, Horatio, than are dreams in your philosophy.
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> Vimlet, prince of Benchmark

> Even though I no longer use Emacs regularly, I'm still on the side of good in the editor wars.
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In fact, you can invoke GUI programs from the shell prompt. Try

```
% gedit
```

Executing programs & job control

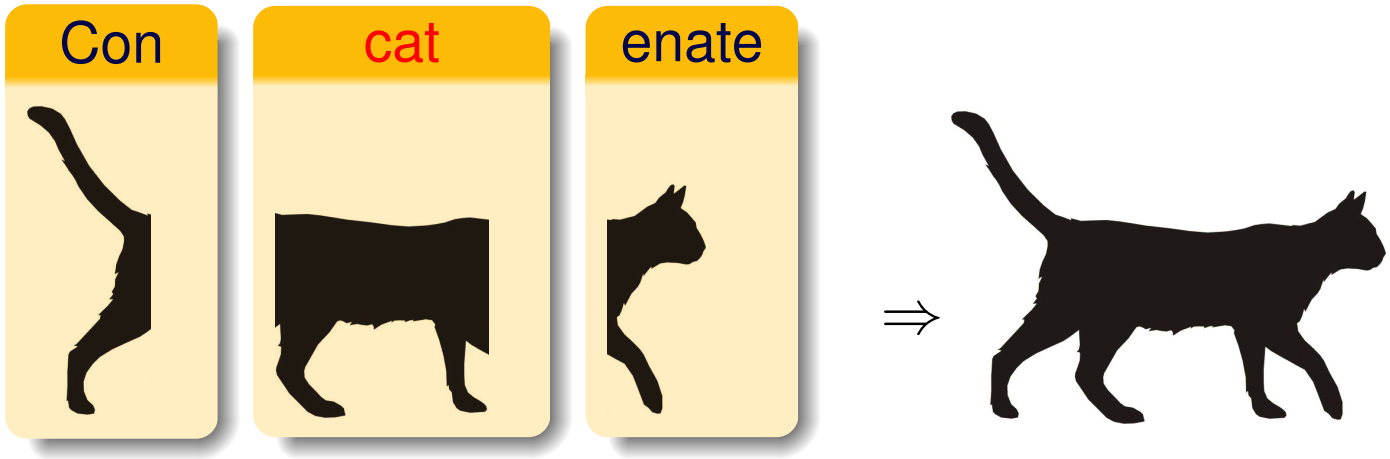
While gedit is running, try using the shell. What happens?

Executing programs & job control

While gedit is running, try using the shell. What happens?

- Ctrl+Z – suspend the current job
- `bg` – send a suspended job to background
- `fg` – send a job to foreground
- ... `&` – execute a command in the background
- `jobs` – list jobs
- Ctrl+C – stop the current job
- `kill` – stop (send a signal to) a job (or process)

Cat superpowers & redirections



- `cat` – concatenate[2] files and print on the standard output

Redirections: of standard output (> and >>) and standard input (<).

[2] No animals were harmed in the making of this slide.

References and further reading (and watching)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