

① Command Line

A command line is a line of text where the first word specifies a command (a program) to execute. The rest of the line specifies arguments that are ^{passed} ~~past~~ to the program.

The tasks that can be performed are only limited to the programs that can be executed.

The command line environment differs from the normal GUI (Graphic User Interface) by the following.

- only text is entered, and mostly only text is output from the command.
- a set of commands can be connected together
- effective use of the CL environment requires more memorization. (e.g. there are no menus)
- discovering the capabilities of the CLE is harder than a GUI.

~~B9~~
B9
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Text is composed of characters.

A character is represented as a "code point".

Common

Common character sets

ASCII - 7 bit code - 128 characters

ISO-8859-1 - 8 bit code - Latin 1

Unicode, characters for most human languages

UTF-8 - 8 bit encoding of Unicode

ASCII examples

other glyphs

A - 01000001

A A A

a - 01100001

a a

ø - 00110000

o o

i - 00110001

i i

q - 00111001

newline - 00001010

tab - 00001001

carriage return - 00001101

space 00100000

Why learn the command line?

- used for system administration
 - used in software development
 - Command line scripts can be used to combine individual commands
 - used to process data from many application areas.
-

A workflow is a set of tasks performed by a person to accomplish an effect. The tasks are usually described general, but are performed with detail.

Example Workflows

Connect to internet with static IP

```
% ifconfig eth0 192.168.1.23 netmask 255.255.255.0  
% route add default gw 192.168.1.1
```

Copy files to remote machine

```
% scp -r foo rod@garfield.cs.mun.ca:
```

% Compile simple c program

```
% cat > t.c  
#include <stdio.h>
```

```
int  
main( int ac, char* ar[ ] )  
{  
    printf("hi!\n");  
    return 0;  
}
```

```
% ^D  
% gcc t.c
```

```
% ./a.out
```

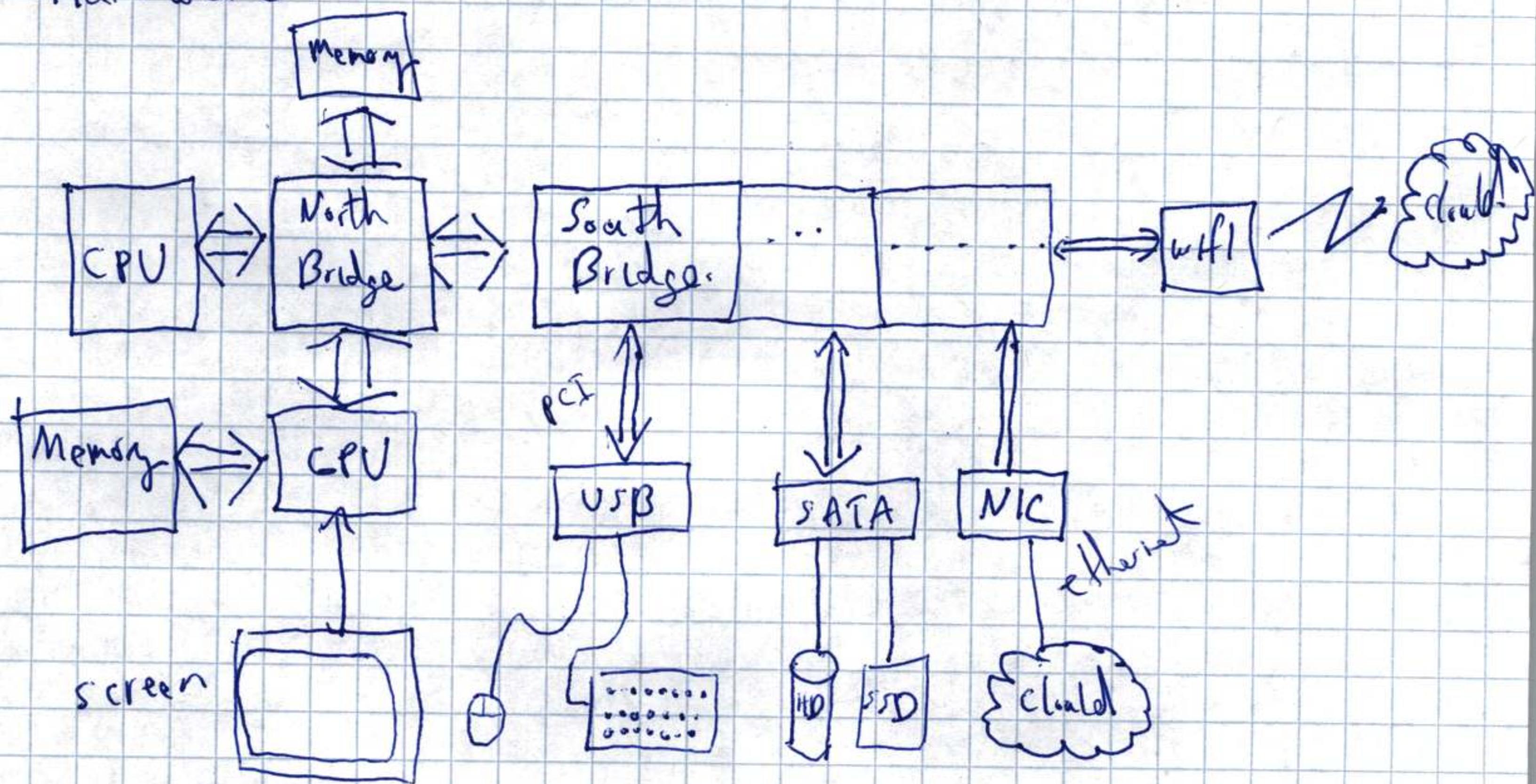
hi!

```
%
```

②

Key Concepts:

Hardware.



Software : Layered View



File and Directories

A file contains stored data, this data is given a name, file names are stored in directories.

A directory contains a list of file names and directory names.

Data stored in a computer system is accessed using directory and file names.

Program

A file whose contents contains executable data, when run becomes a process.

Process

The dynamic information ~~accosr~~ associated with an executable program, such as, memory in use, open files, open network connections.

Operating System

A program that ~~abstrac~~^{manages} the hardware, and provides services to process.

Keyboard -

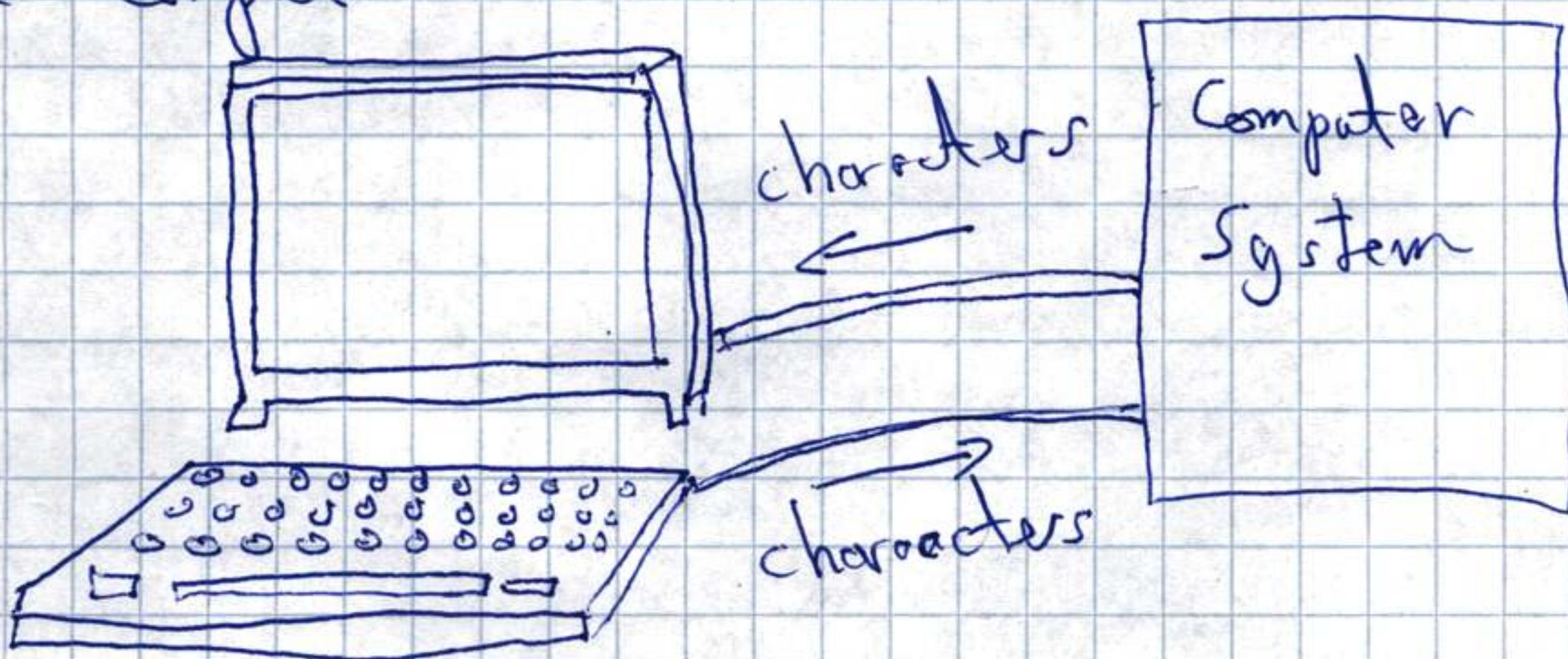
Device that accepts key presses and generates characters and control sequences.

Monitor

Device that displays a grid of characters.
Each character has a fixed size.

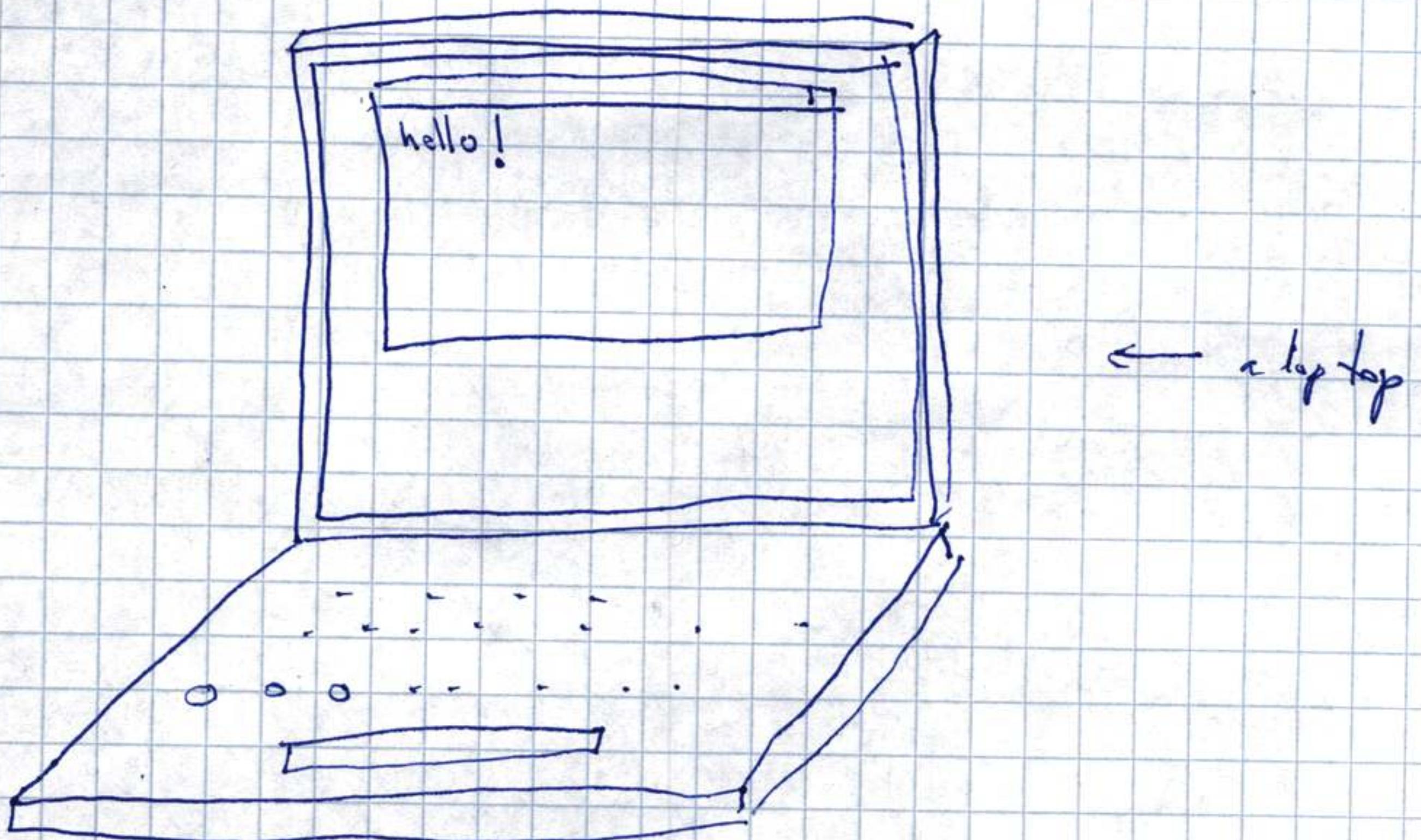
Terminal

A device that has a keyboard and monitor,
and is used by a human to interact with
a computer.



The terminal, above, is old technology and is no longer in common use.

Virtual terminal (simulated terminal in a window) (5)



All current operating systems provide a program that displays a simulated (virtual) terminal.

This virtual terminal displays a grid of characters. (glyphs)

Both the old real terminal and the virtual terminal communicate by two streams of characters, one for display and one from the keyboard.

Normal a key pressed on the keyboard is not displayed but the OS will echo the character back to the monitor.

(6)

A program interacts with a terminal with the its standard input and standard output.

In Java

```

└─ H.java
public class H {
    public static void main(String[] args) {
        java.lang.System.out.println("hi!");
    }
}

```

When compiled and run the characters.

hi! In are sent to the standard output which is connected to the terminal.

I/O In Python

```

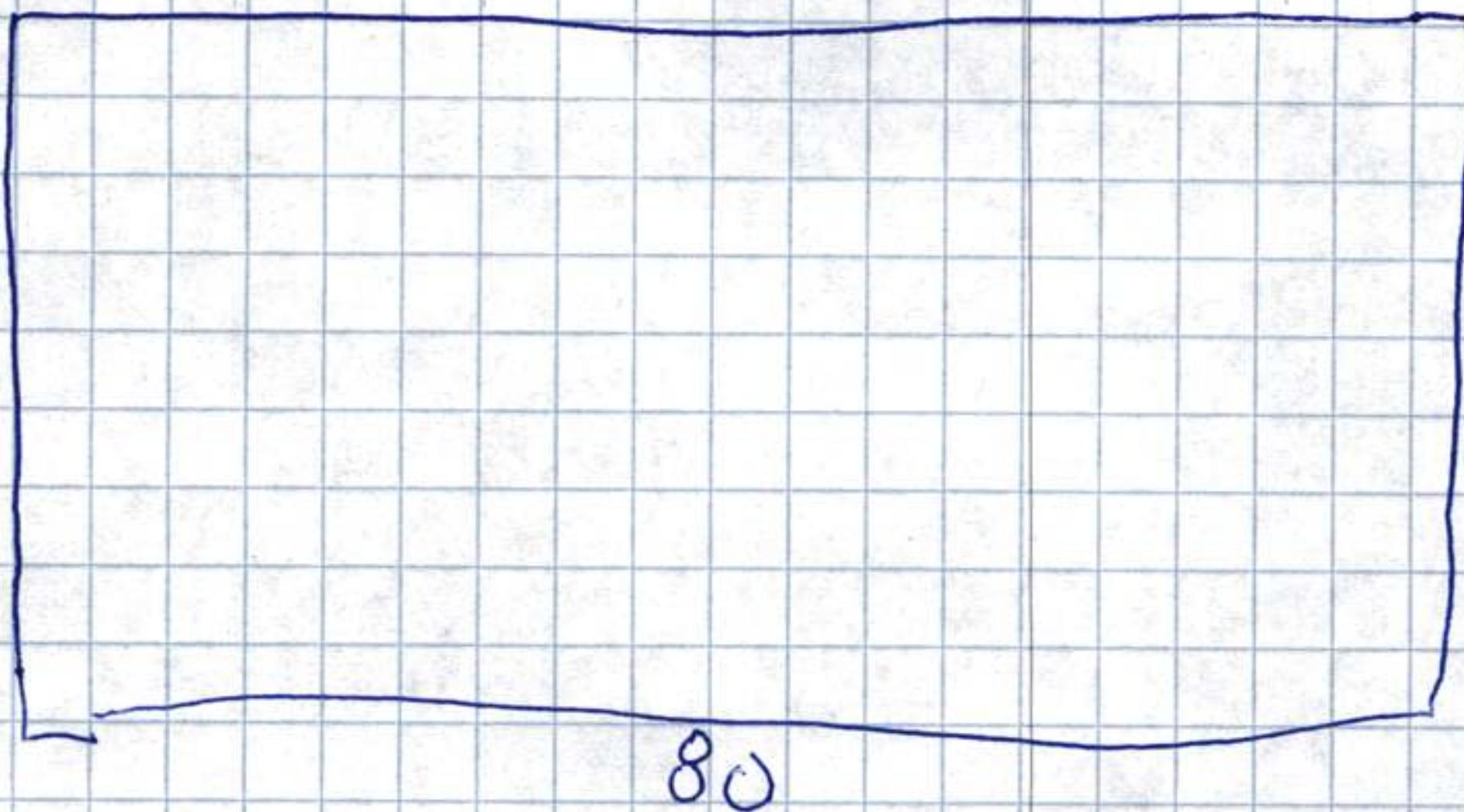
import sys
while True:
    l = sys.stdin.readline()
    print(l.upper())
    if len(l) == 0: break
    print(l.upper())

```

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Modeling the terminal.

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The standard size terminal is 24 rows by 80 columns. Each cell can contain a single glyph.

Virtual terminals can be any size.

The foreground and background can be any colour.

The cursor marks where the next character will be placed.

Certain characters just move the cursor,
(i.e. the \rightarrow cell where the next character will be placed)

\rightarrow - moves \rightarrow along a row

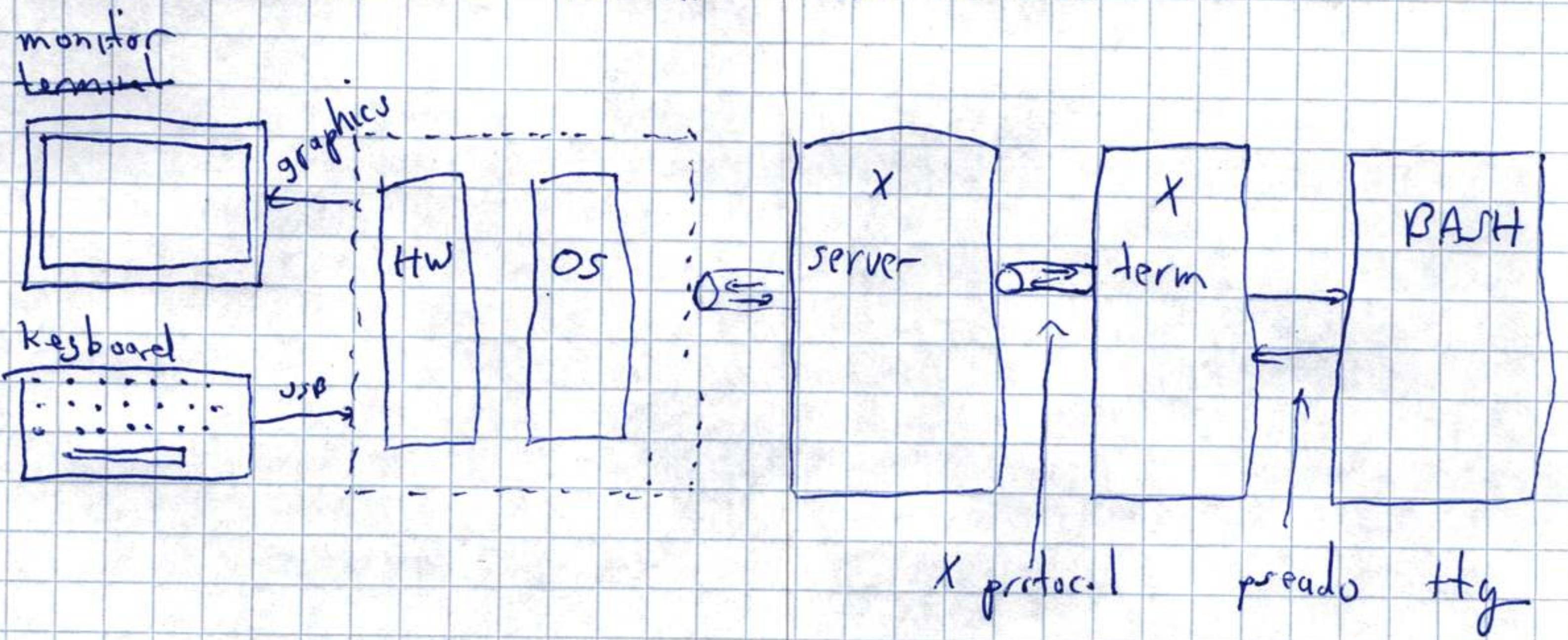
\downarrow - moves to next line, can cause a scroll

\uparrow - moves to start of row

space - makes the cell empty (only background).

A \downarrow at row 24 causes line 2 to move to line 1, and so on, (to scroll).

Command / Process Runtime Environment



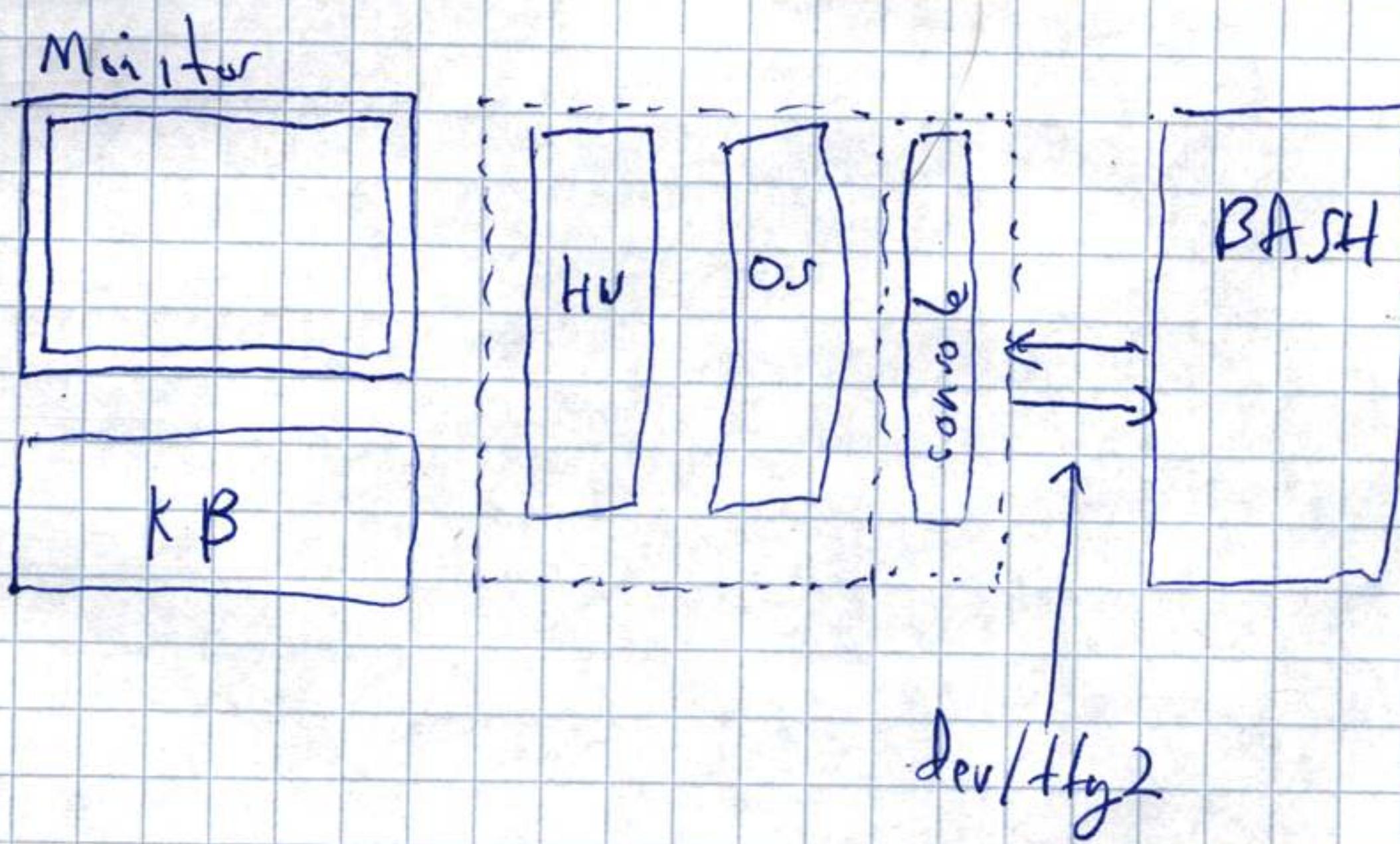
Standard input

key press → USB packet → OS → keycode to X-server
 → X protocol to xterm → pty to bash, standard input

Standard output

character sent to std::cout in BASH →
 character sent via pty to xterm →
 xterm draws glyphs via message to X-server →
 X-server talks to graphic HW → video to monitor

Runtime Environment without X-windows



Standard input

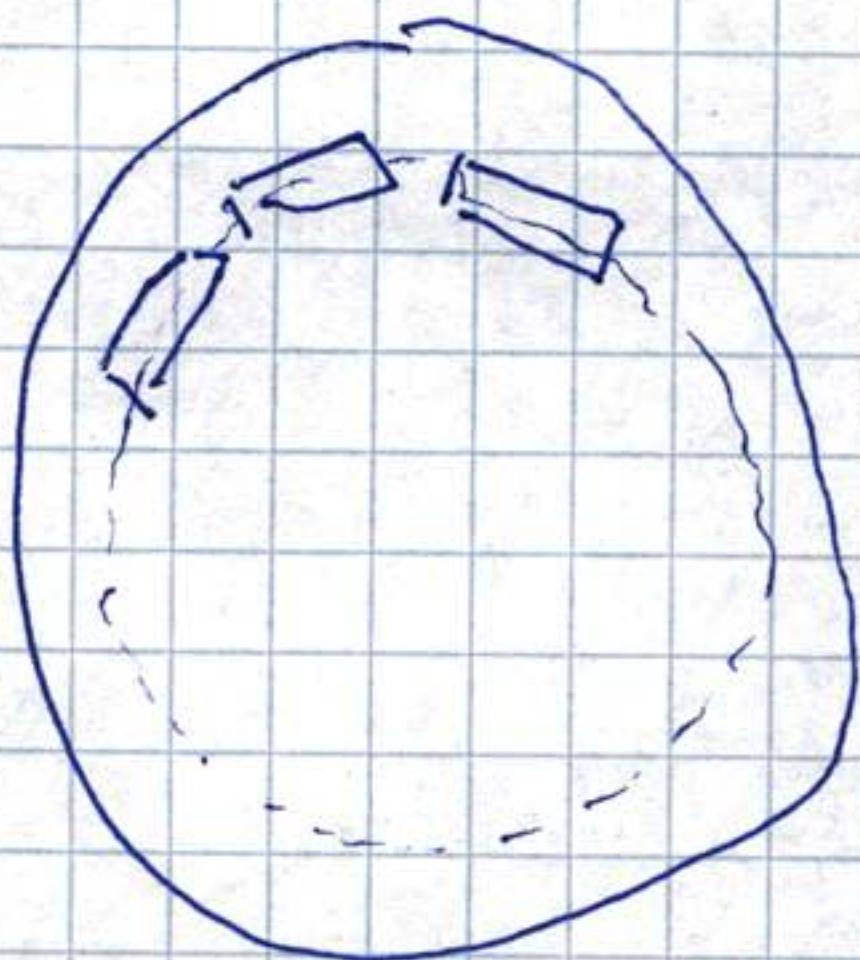
key press → USB → OS → log dev/ttys → BASH std.in

Standard output

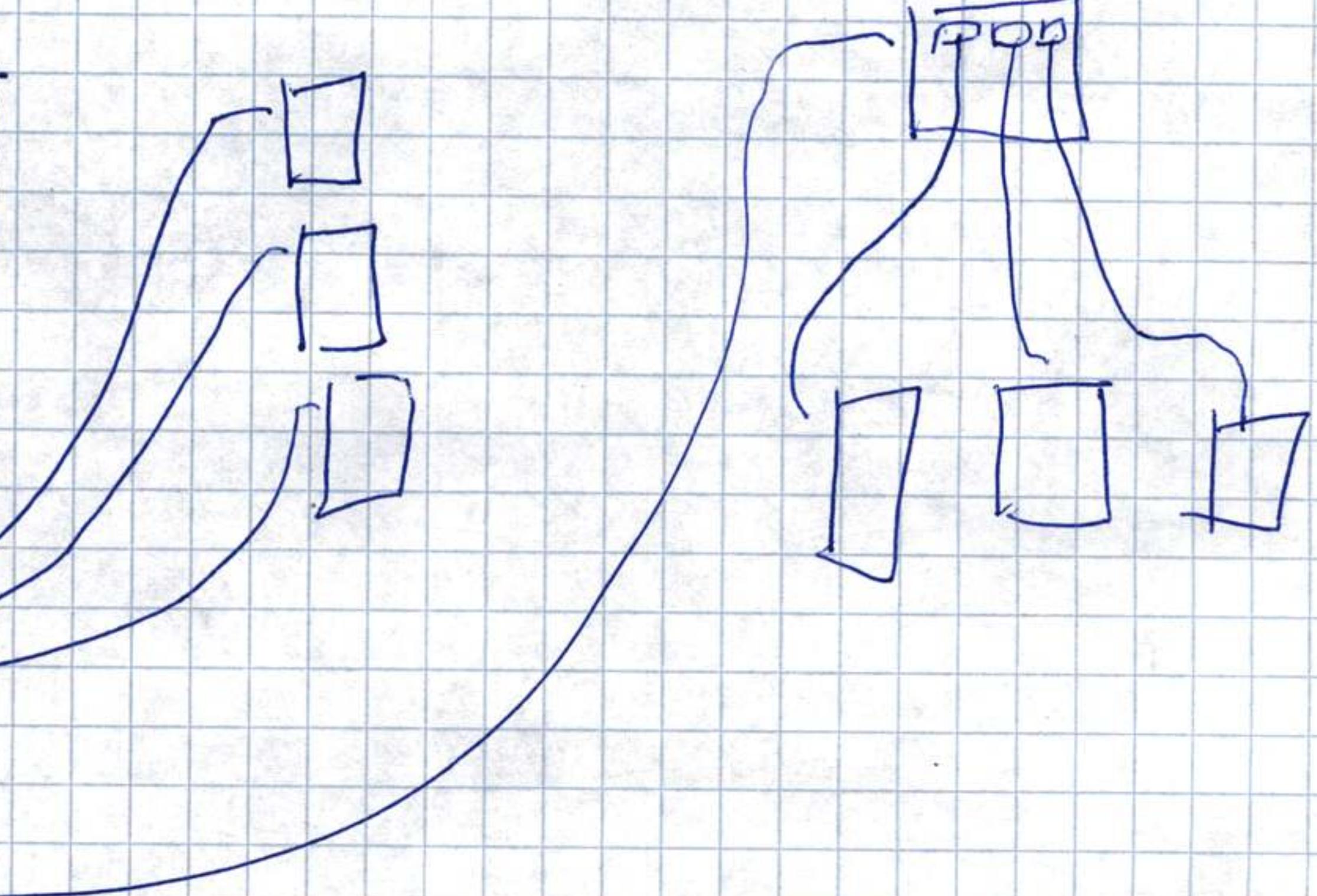
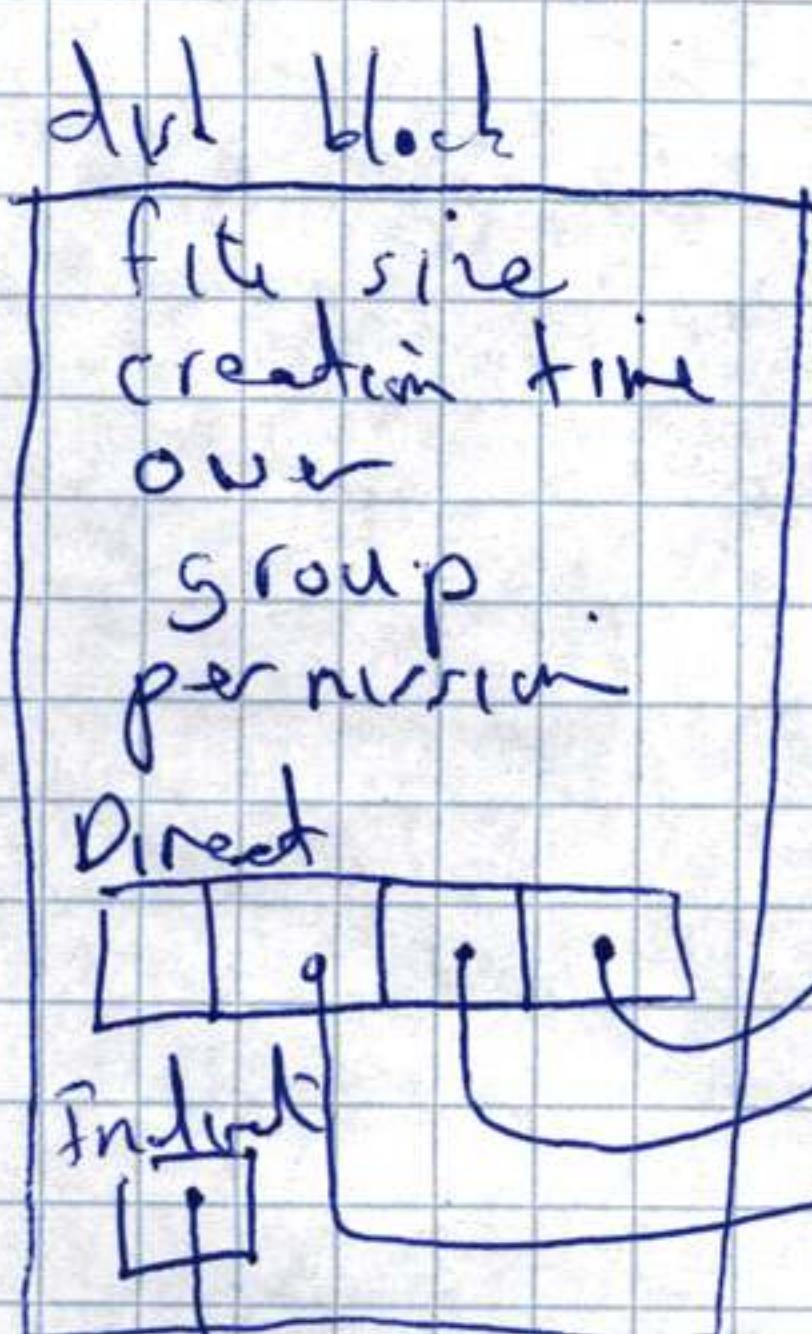
char to std.out → dev/ttys → OS-graphics → monitor

File Systems: How user data is organized.

Data on a hard disk is stored in blocks (512 - 8192 bytes) arranged in a circle (cylinder).



Files and directories are managed with a data structure. A classic data structure is UNIX v6 mode.



A directory contains a list of file names with inode index and directory names with inode index.

| name | inode |
|------|-------|
| | |
| | |
| | |
| | |
| : | : |
| : | : |
| : | : |

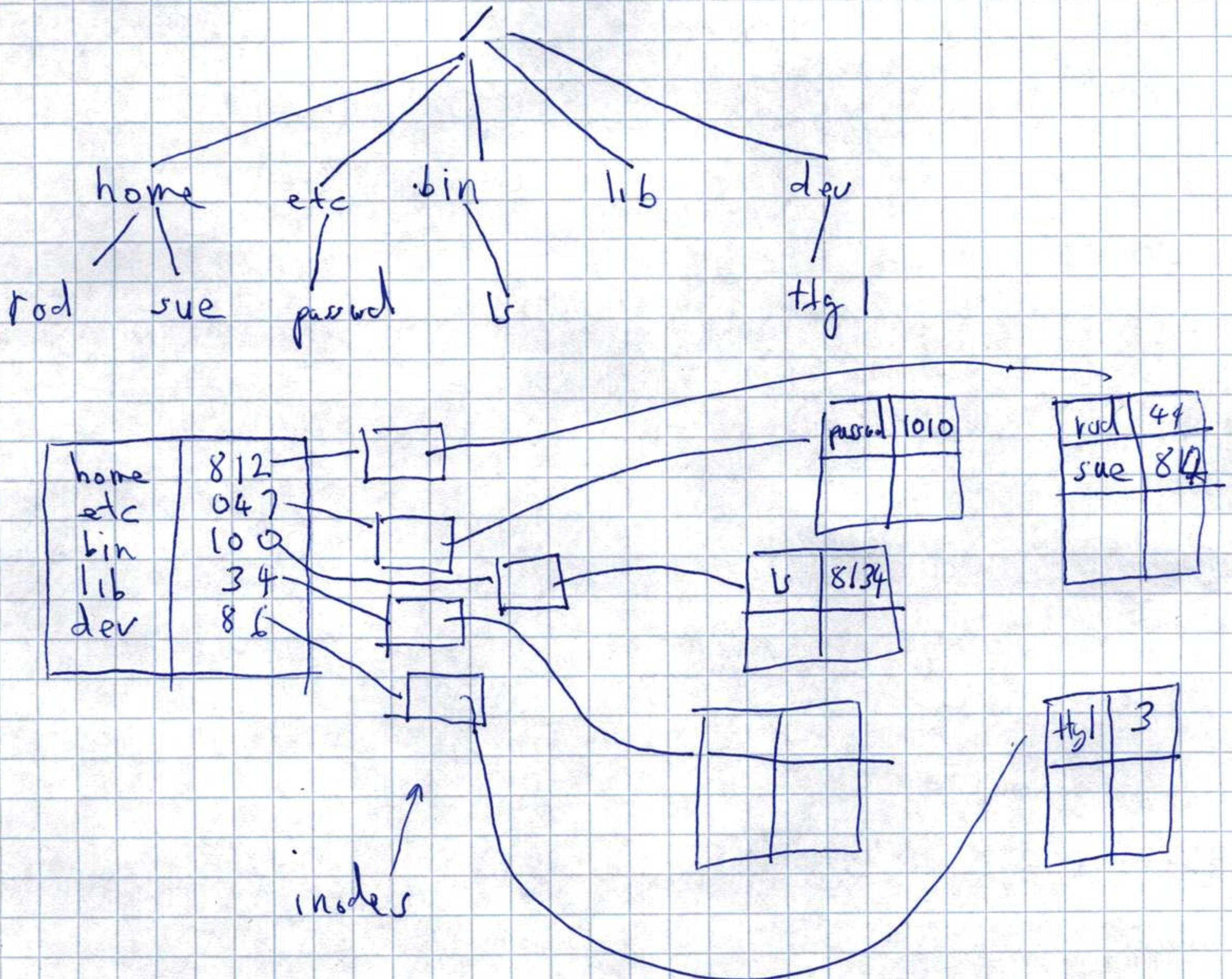
A file system is stored on a "physical" disk..

A file system is created with a root directory.

In VNX, this directory is named /.

All other files and directories are created by users.

A picture of a standard Linux file system.



The first diagram shows the logical structure,
the second diagram shows part of the data
structures. A name must be
Every name in a directory must be distinct.

File System Navigation. (Chapter 2)

Set the current working directory,

% cd /

Print the current working directory

% pwd
/

List the entries (names) of the current working directory

% ls

bin dev etc home lib

Any file or directory can be accessed with a path name.

A path name is a list of directories separated by /, containing name at the end.

Ex:

/home/rod /bin/ls /etc/password.

/home/rod/cs2718

In Windows, a \ is used.

A path name can be absolute, starting from the root, or relative, starting from the current working directory.