**MC514**

**Sistemas Operacionais:**

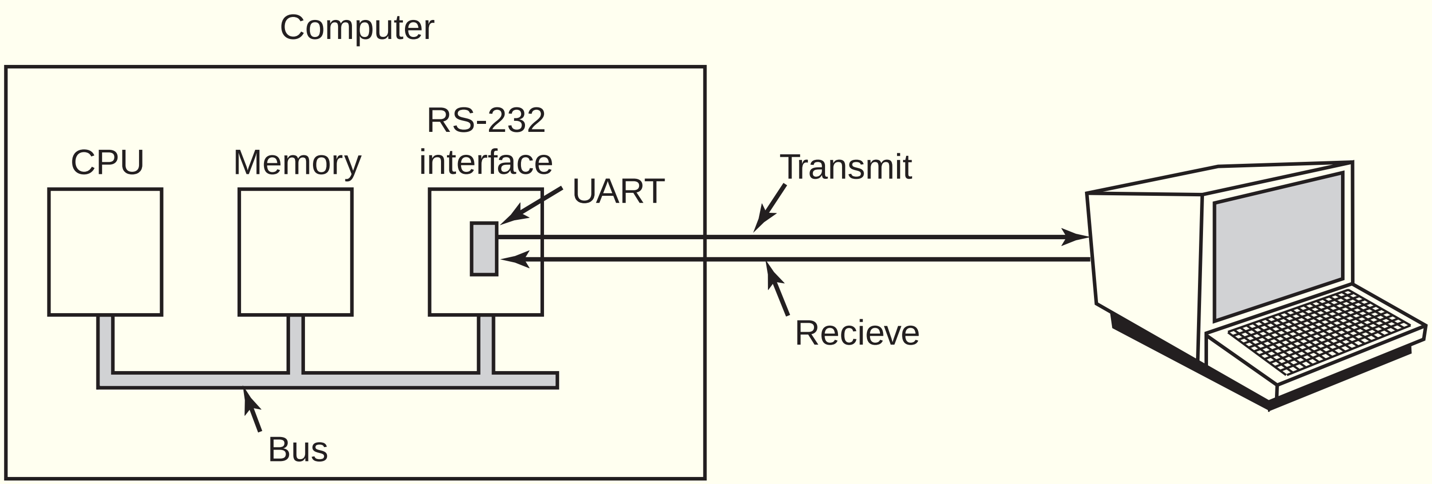
**Teoria e Prática**

1s2008

# Gerenciamento de Entrada e Saída

# Pipes

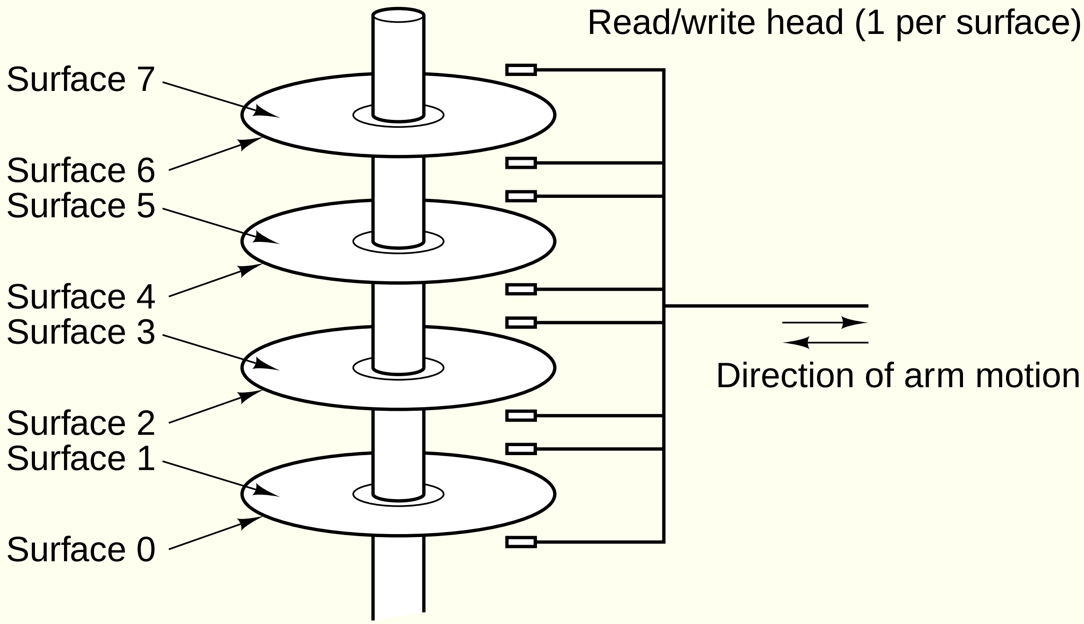
# Character device




Acesso sequencial, caracter a caracter

Execute ls -l /dev

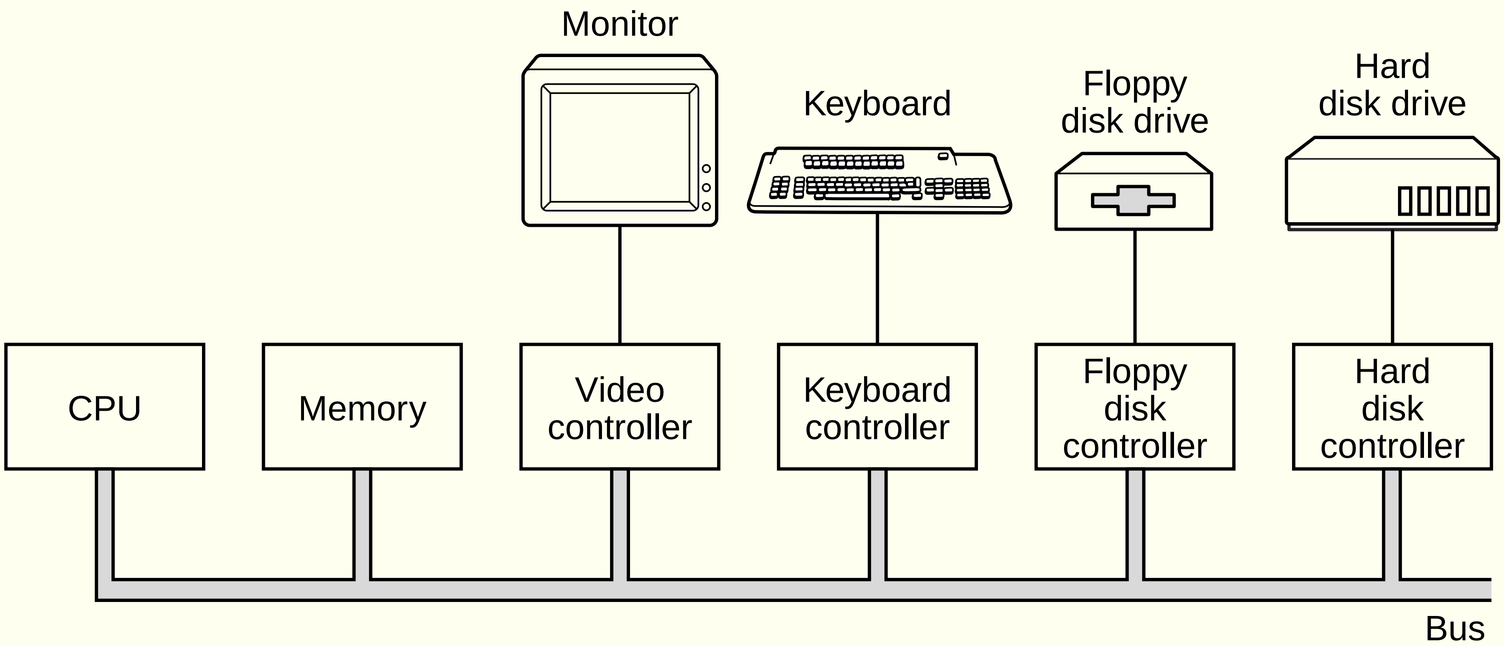
# Block device




Acesso não sequencial a blocos de informação

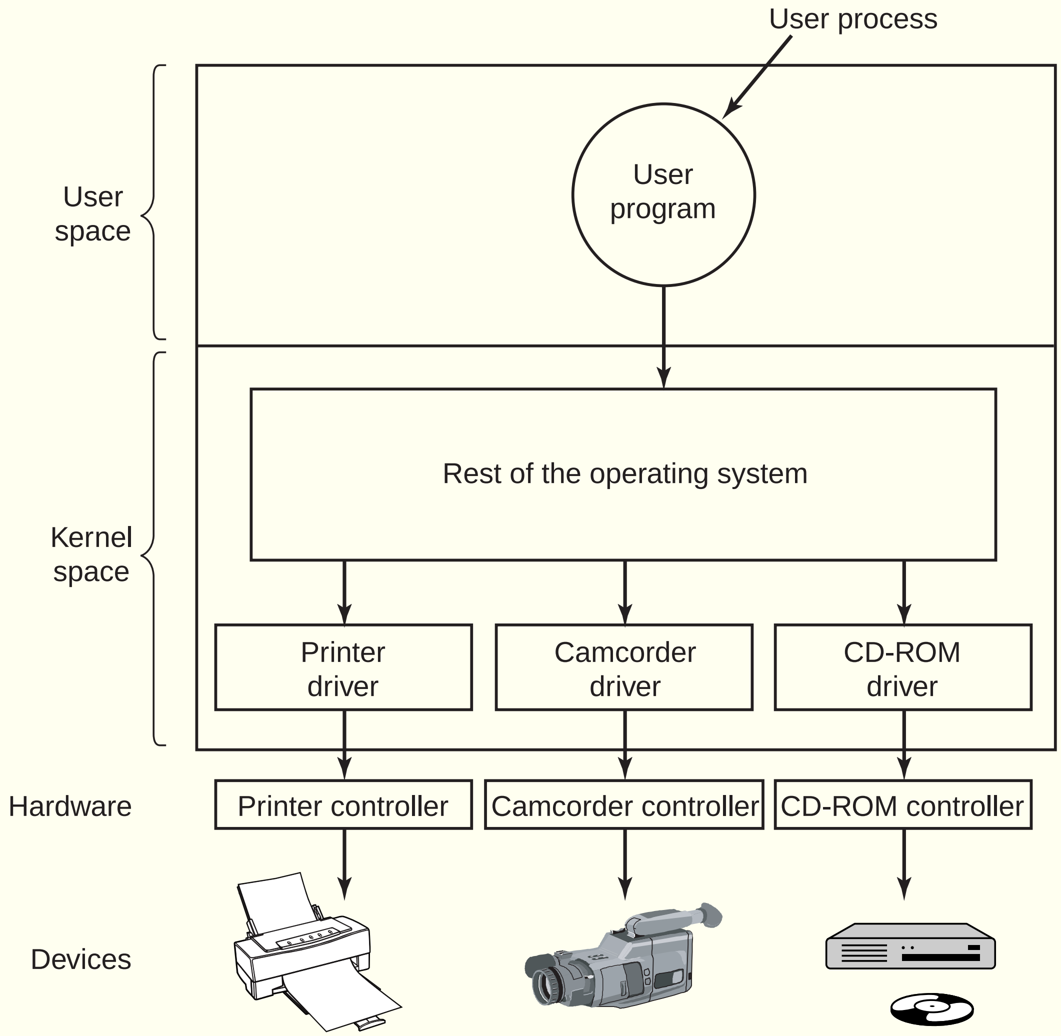
Execute ls -l /dev

# Dispositivos de I/O e controladores




O sistema operacional deve interagir com os controladores

# Device drivers



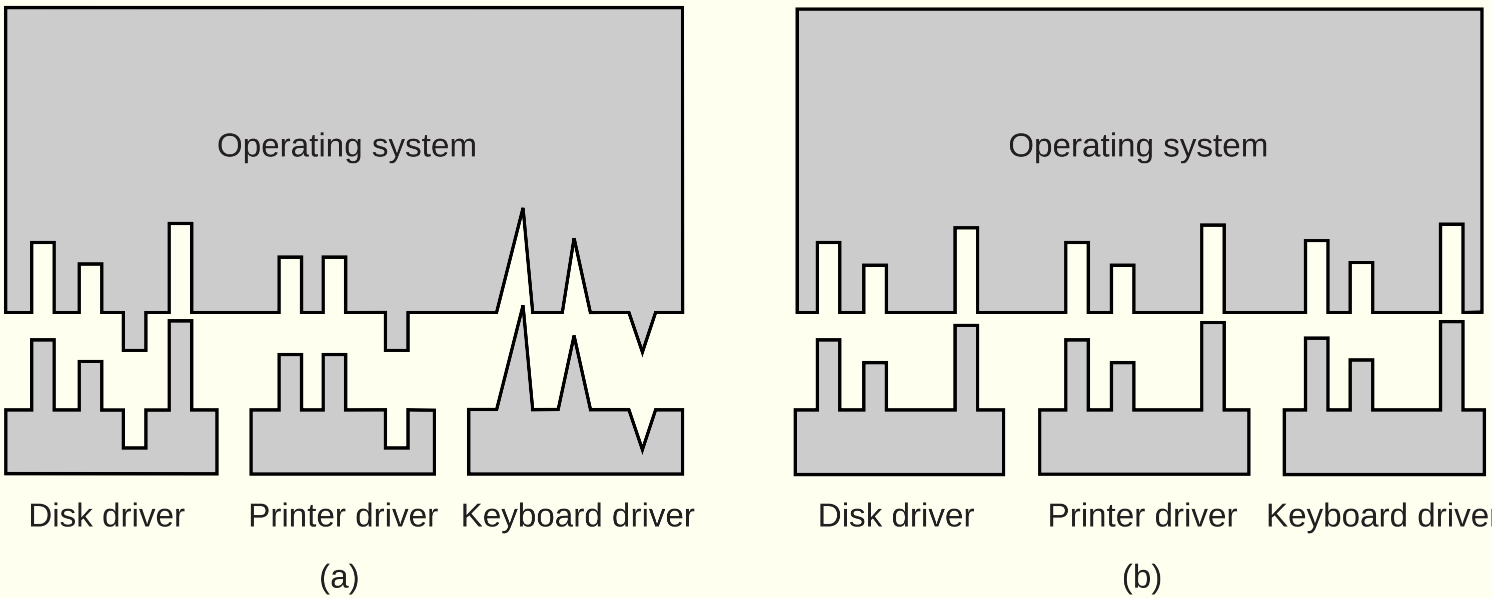
# Device drivers

- Software que “conversa” com o controlador
- Os fabricantes devem fornecer device drivers para os sistemas operacionais
- Como acoplar um device driver ao kernel:
  - relink e reboot
  - entrada em um arquivo e reboot
  - on-the-fly

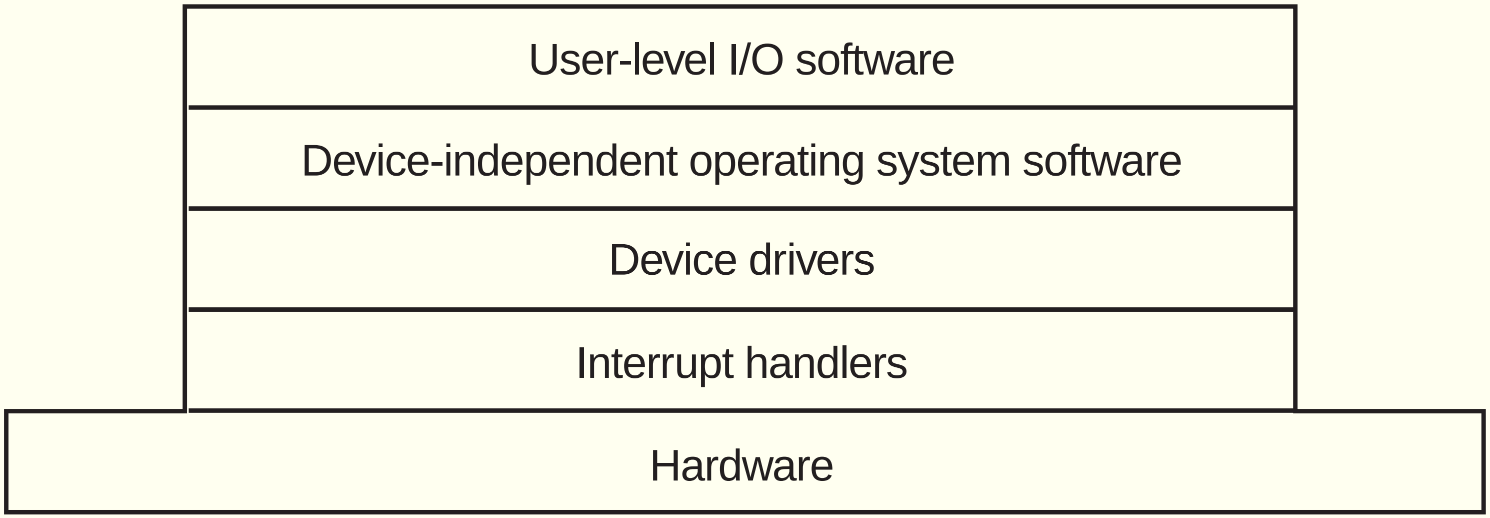
    veja os comandos `lsmod` e `modprobe`

# Device drivers

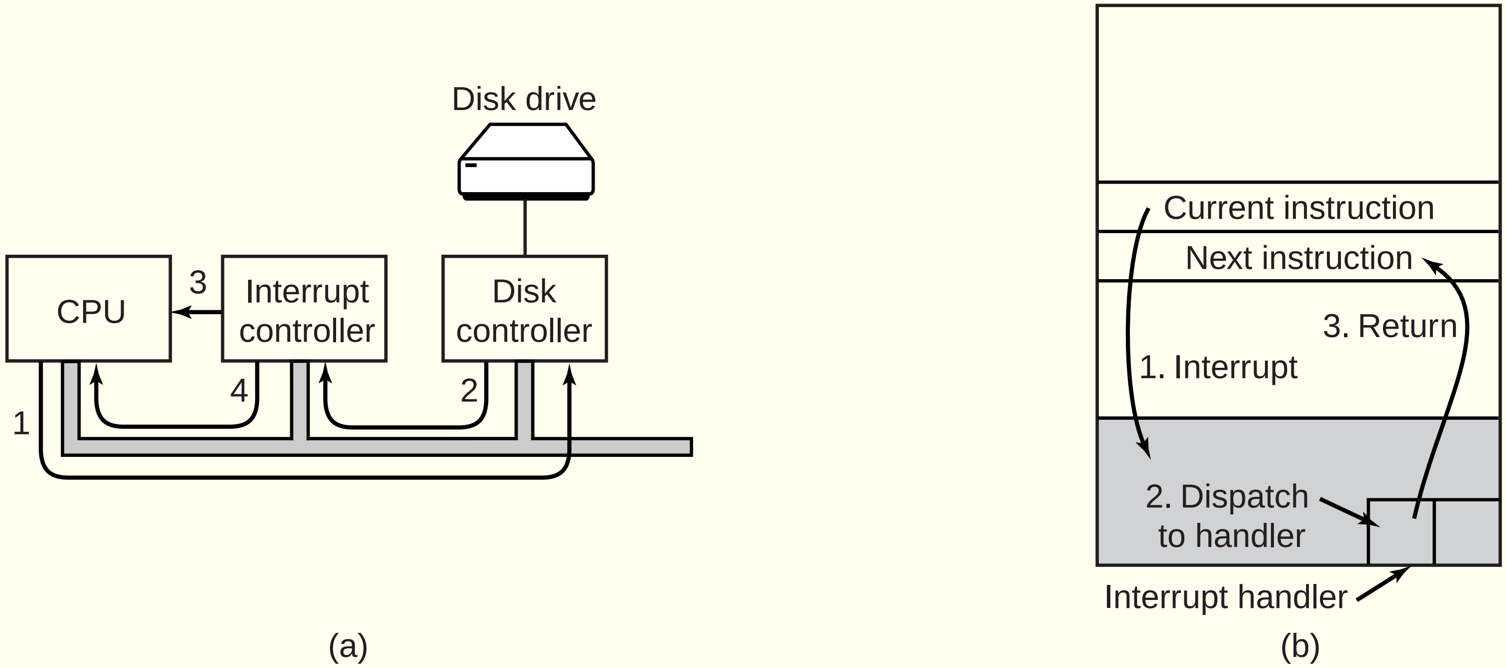
## Sem ou com uma interface padrão



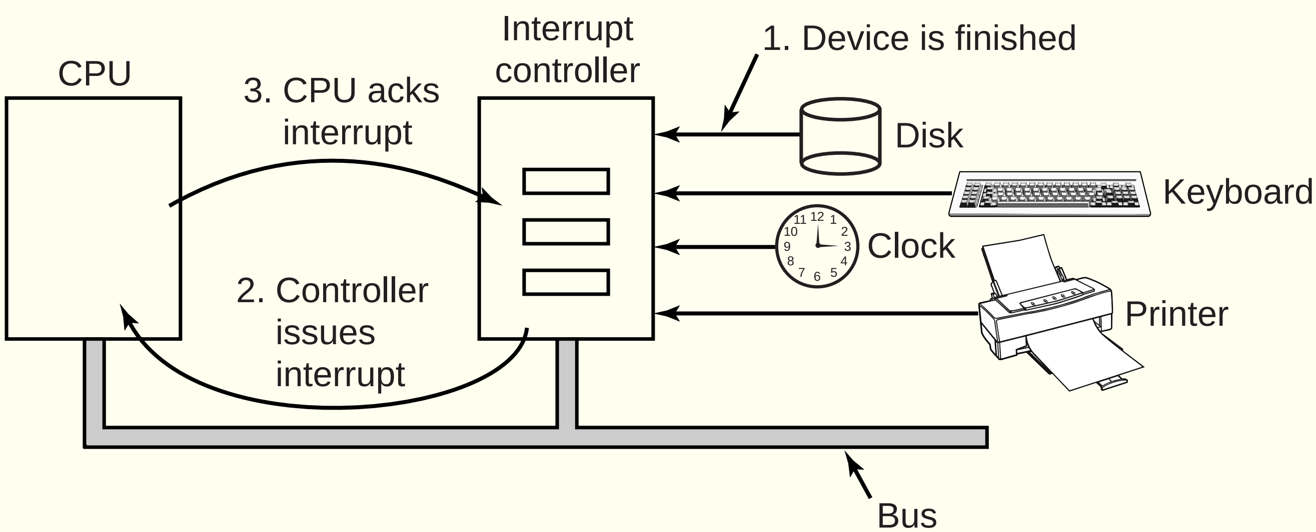
# Camadas de software



# Tratamento de interrupções



# Tratamento de interrupções



# Como programar os dispositivos?

- Instruções especiais

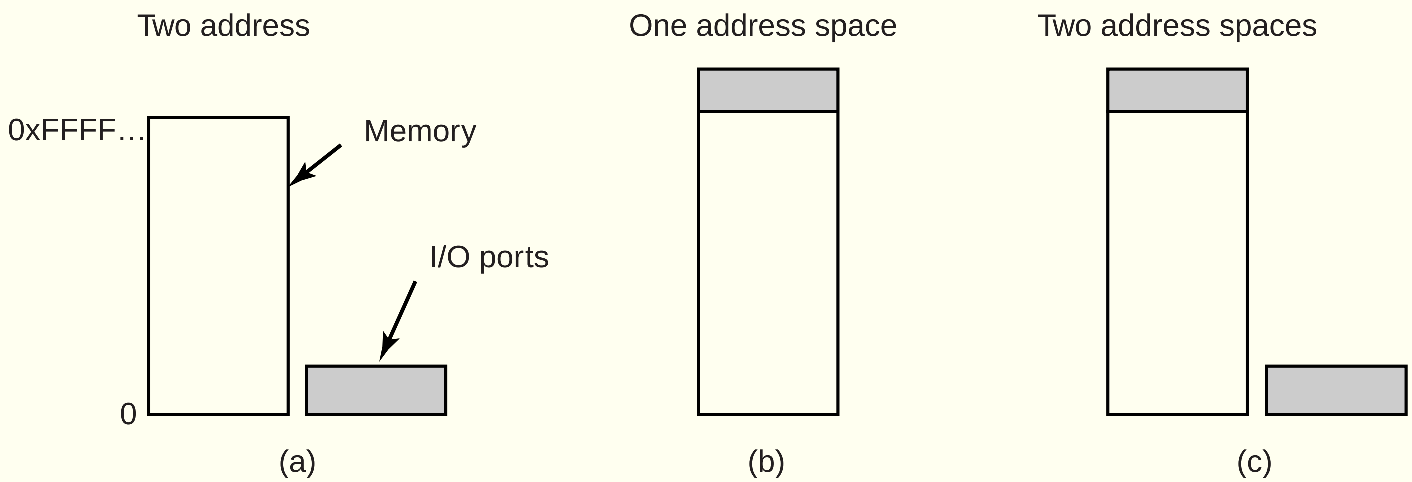
```
IN REG, PORT
OUT PORT, REG
```

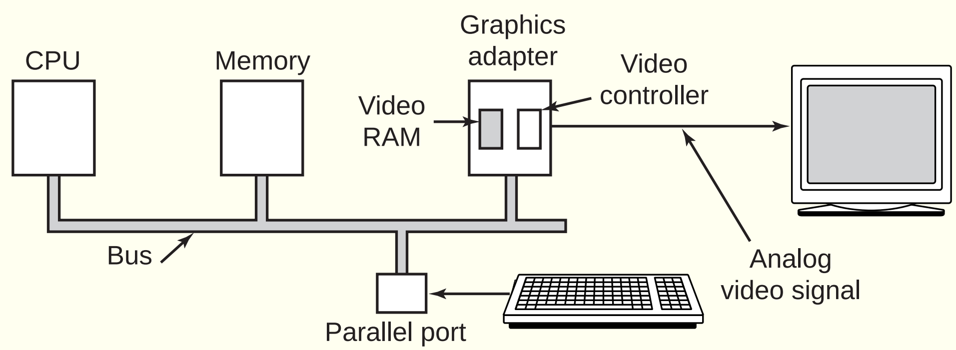
- Memory-mapped I/O

```
MOV REG, ADDR
```

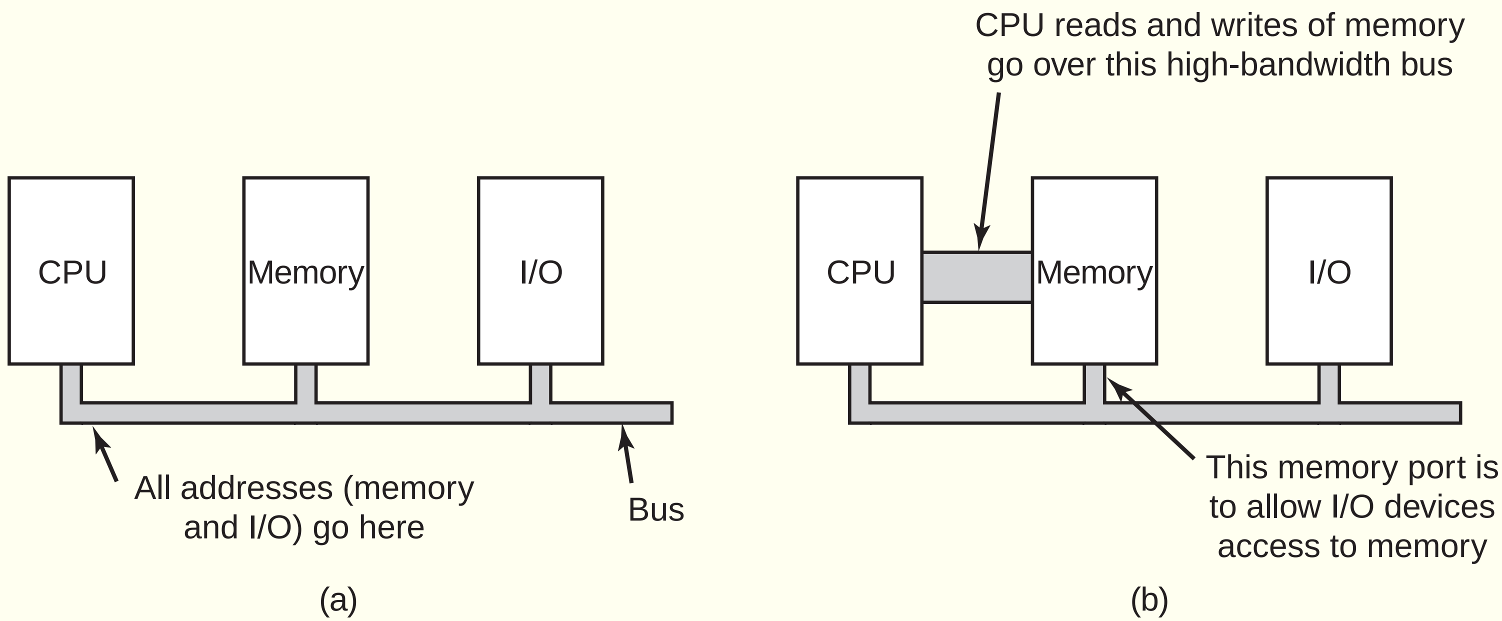
Conforme o valor de ADDR, a instrução MOV fará acesso a uma palavra de memória ou dispositivo

# Como programar os dispositivos?

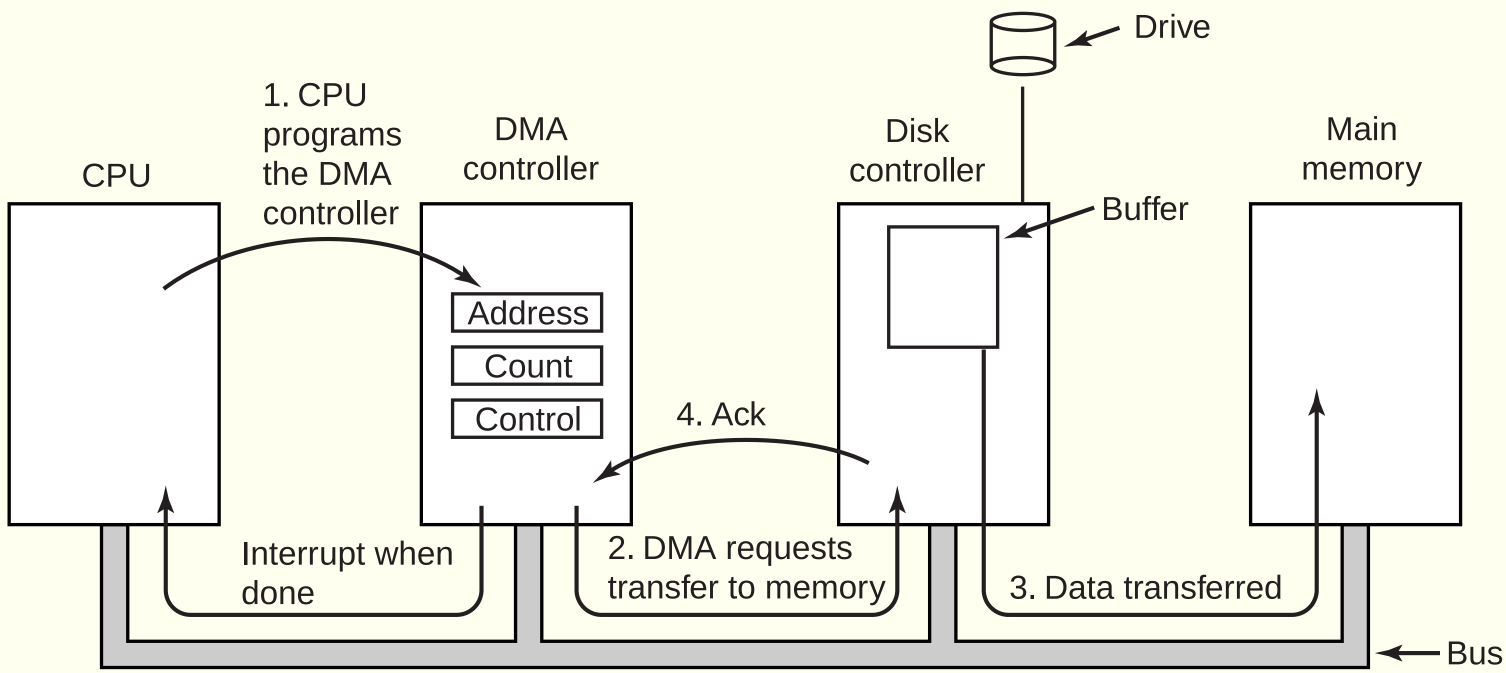


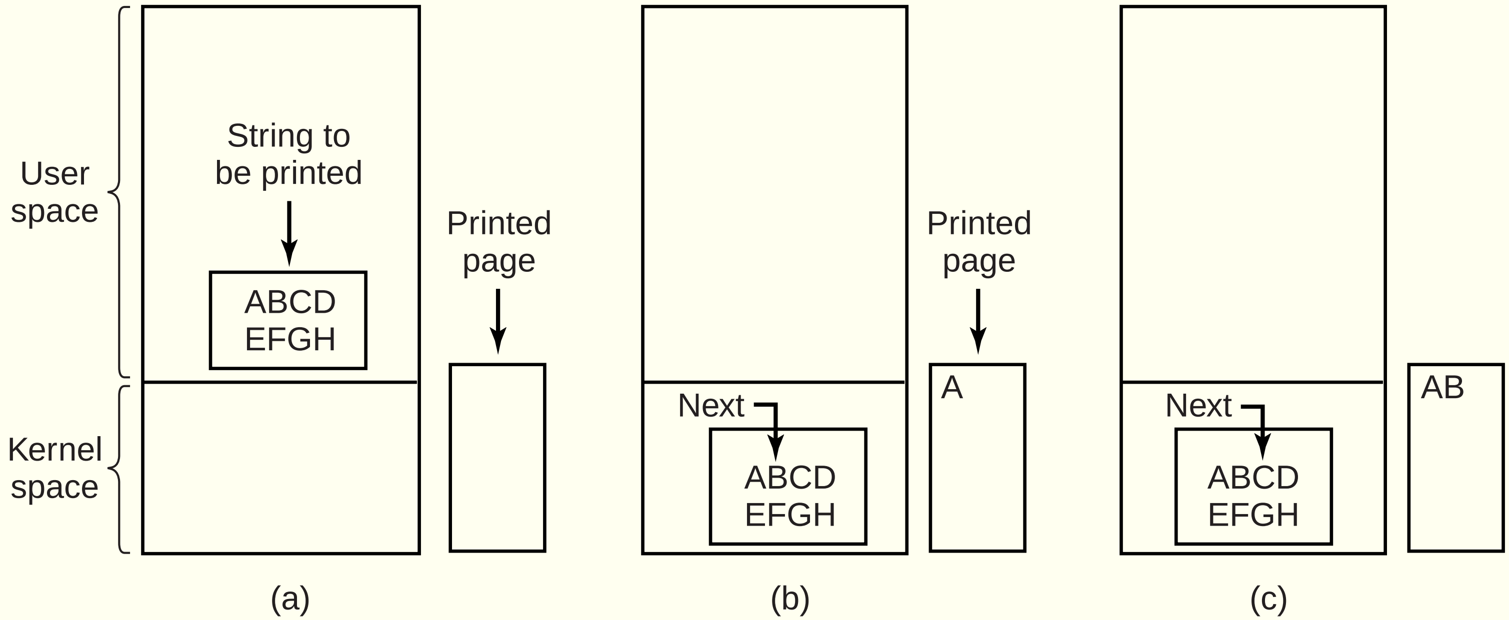
# Barramento simples e dual



# Direct Memory Access (DMA)



# Imprimindo uma string



# Imprimindo uma string

## Programmed I/O

```
copy_from_user(buffer, p, count);               /* p is the kernel bufer */
for (i = 0; i < count; i++) {                   /* loop on every character */
    while (*printer_status_reg != READY) ;      /* loop until ready */
    *printer_data_register = p[i];              /* output one character */
}
return_to_user( );
```

Trecho de código do kernel

# Imprimindo uma string

## Interrupt-driven I/O

```
copy_from_user(buffer, p, count);
enable_interrupts( );
while (*printer_status_reg != READY) ;
*printer_data_register = p[0];
scheduler( );
```

(a)

```
if (count == 0) {
    unblock_user( );
} else {
    *printer_data_register = p[i];
    count = count – 1;
     i = i + 1;
}
acknowledge_interrupt( );
return_from_interrupt( );
```

(b)

(a) Trecho de código do kernel

(b) Tratador da interrupção

# Imprimindo uma string
## DMA

```
copy_from_user(buffer, p, count);
set_up_DMA_controller( );
scheduler( );
```

(a)

```
acknowledge_interrupt( );
unblock_user( );
return_from_interrupt( );
```

(b)

(a) Trecho de código do kernel

(b) Tratador de interrupção

# Pipes

```
$ grep xxx log.txt > log-xxx.txt
$ wc -l log-xxx.txt
$ rm log-xxx.txt

$ grep xxx log.txt | wc -l
```

## pipe()

```
int pipe (int FILEDES[2])
```

> The ‘pipe’ function creates a pipe and puts the file descriptors for the reading and writing ends of the pipe (respectively) into ‘FILEDES[0]’ and ‘FILEDES[1]’.

Veja o código: mypipe.c

# Pipe com entrada e saída padrão?

```
int dup2(int oldfd, int newfd);
```

> dup2 makes newfd be the copy of oldfd, closing newfd first if necessary. After successful return of dup or dup2, the old and new descriptors may be used interchangeably.

Veja o código: mypipe2.c

# Processos conectados de maneira transparente

```
$ cm1 <args1> | cmd2 <args2>
```

- A modificação da entrada e saída padrão deve ser feita antes da chamada a execve().
- Veja o código: minishell.c

# popen()

```
FILE *popen(const char *command,
            const char *type);
int pclose(FILE *stream);
```

The popen() function opens a process by creating a pipe, forking, and invoking the shell. Since a pipe is by definition unidirectional, the type argument may specify only reading or writing, not both; the resulting stream is correspondingly read-only or write-only.

Veja o código: mypopen.c e mypopen2.c