Overview of Computers

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Bootstrap, Device Driver, Server

Bootstrap Loader

Bootstrap Loader

A program

In ROM, or other non-volatile memory

Power-on self-test (POST)

Reads the hard drives boot sector

Part of firmware BIOS

Master Boot Record (MBR)

MBR is also sometimes referred to as the
master boot block,
master partition boot sector, and
sector 0.

The MBR is the **first sector** of the computer hard drive that tells the computer
how the hard drive is partitioned, and
how to load the operating system.

Master Boot Record (MBR)

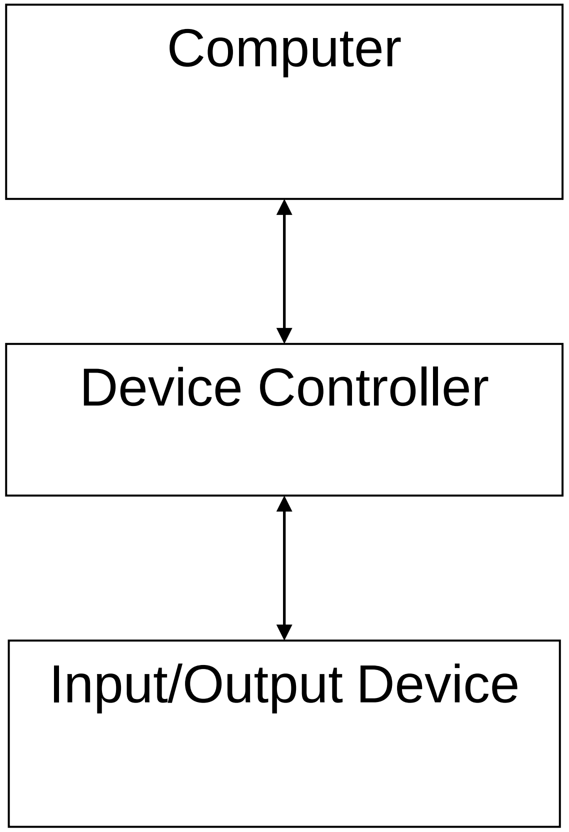
The MBR is also susceptible to boot sector viruses that can corrupt or remove the MBR,

which can leave the hard drive unusable and prevent the computer from booting up.

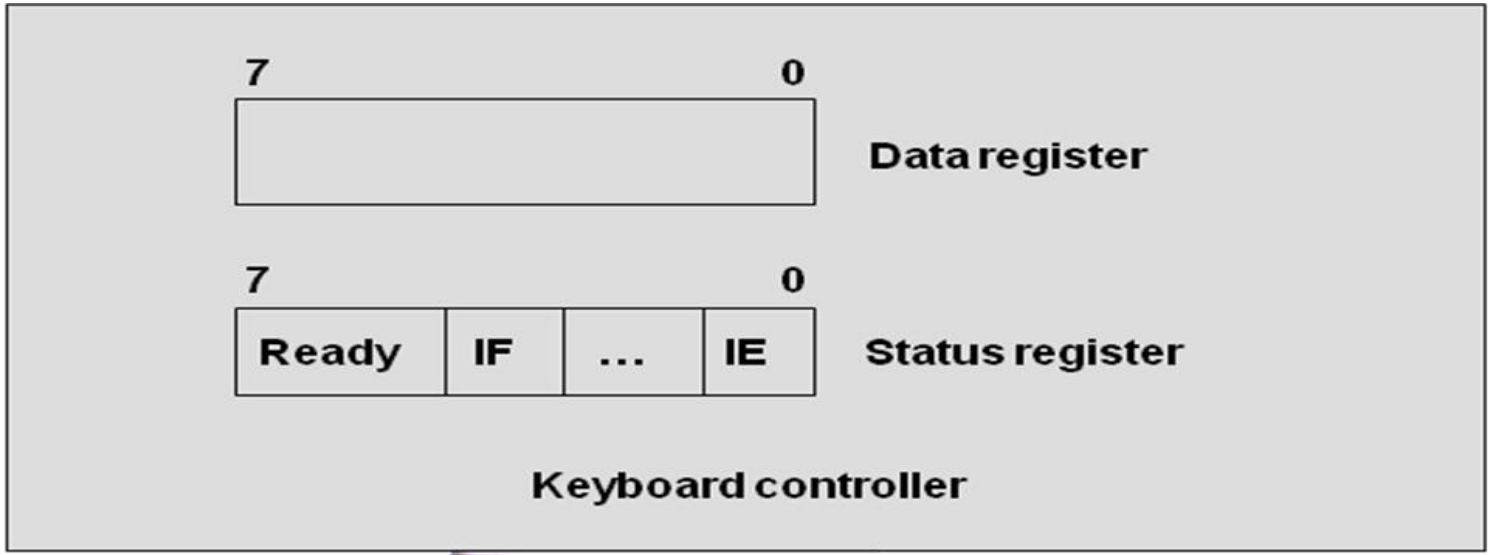
For example, the Stone Empire Monkey Virus is an example of an MBR virus.

Device Controller

Communication between the CPU and the I/O devices



Device Controller



AT Keyboard Status Register

Bit 7: Parity error

0: OK. 1: Parity error with last byte.

Bit 6: Timeout

0: OK. 1: Timeout on transmission from keyboard to keyboard controller.

Bit 5: Auxiliary output buffer full

0: OK. 1: Timeout on transmission from keyboard controller to keyboard. This indicates that no keyboard is present.

Bit 4: Keyboard lock

0: Locked. 1: Not locked.

Bit 3: Command/Data

0: Last write to input buffer was data. 1: Last write to input buffer was a command.

Bit 2: System flag

Set to 0 after power on reset. Set to 1 after successful completion of the keyboard controller self-test.

Bit 1: Input buffer status

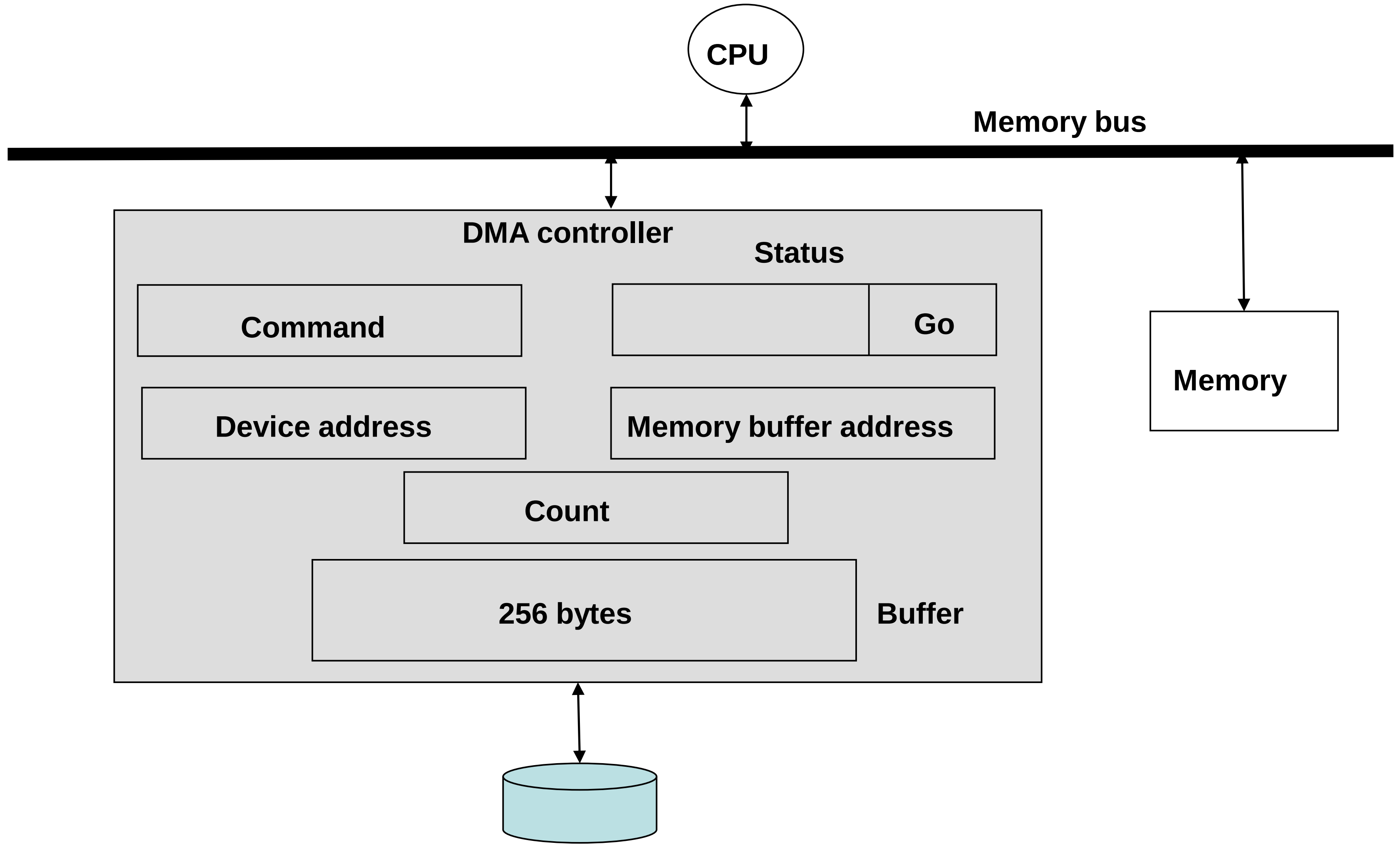
0: Input buffer empty, can be written. 1: Input buffer full, don't write yet.

Bit 0: Output buffer status

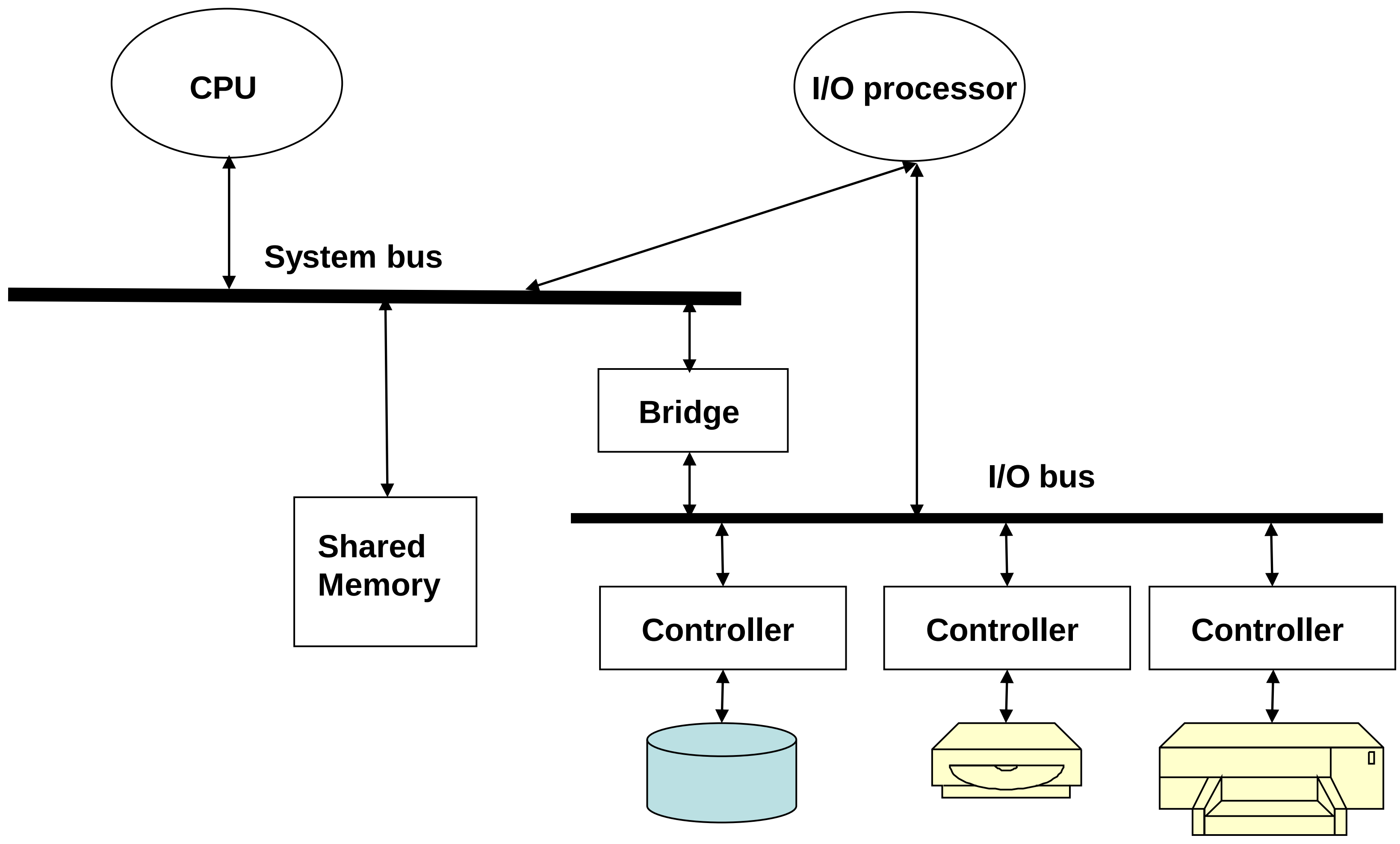
0: Output buffer empty, don't read yet. 1: Output buffer full, can be read.

Source: https://www.win.tue.nl/~aeb/linux/kbd/scancodes-11.html

DMA (Direct Memory Access)

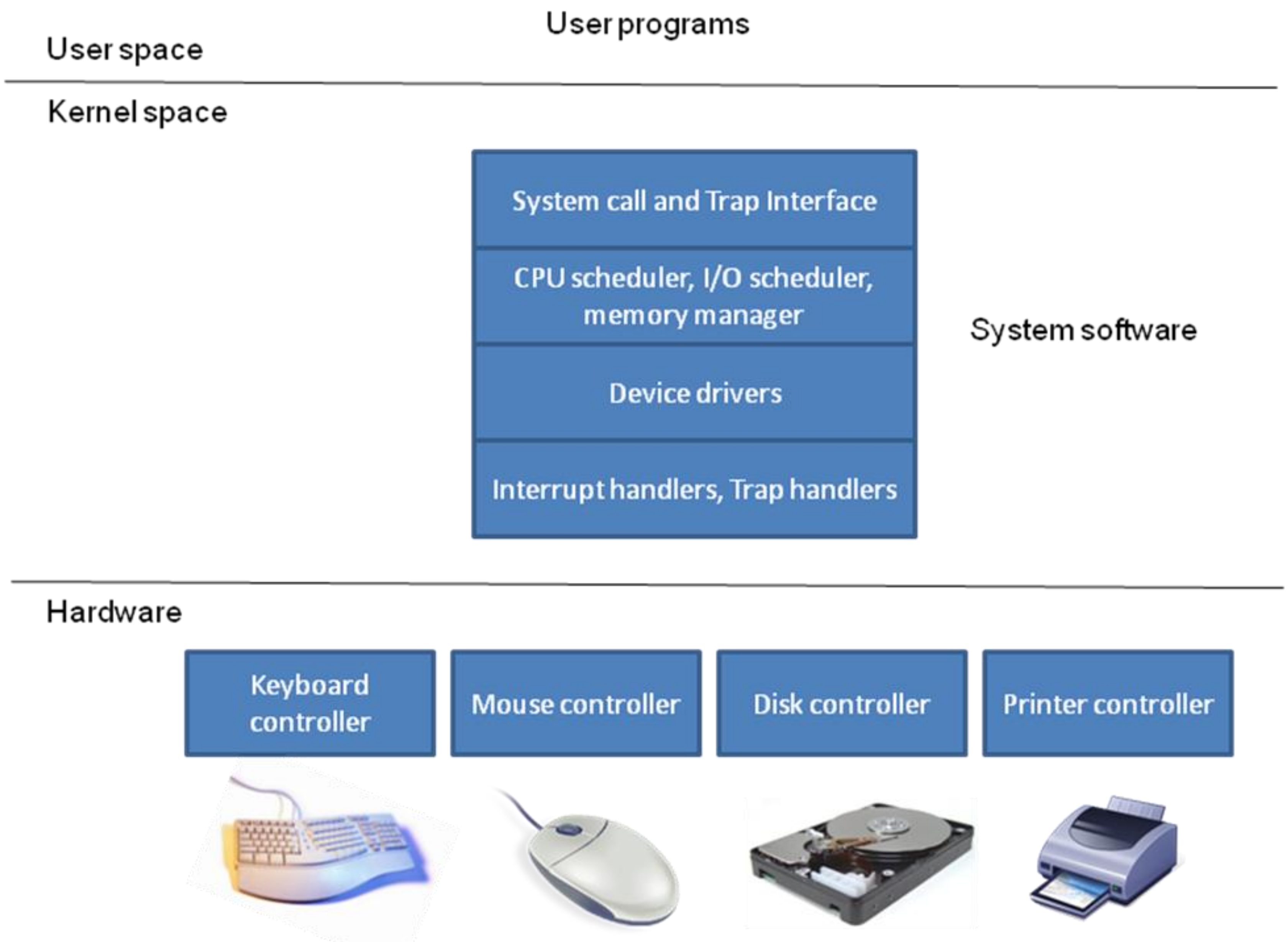


I/O Processor



Device Driver

Device Driver



An Example

Command	**Controller Action**
pan($\pm\theta$)	Pan the camera view by $\pm\theta$
tilt($\pm\theta$)	Tilt camera position by $\pm\theta$
zoom($\pm z$)	Zoom camera focus by $\pm z$
Start	Start camera
Stop	Stop camera
memory buffer(M)	Set memory buffer address for data transfer to M
number of frames (N)	Set number of frames to be captured and transferred to memory to N
enable interrupt	Enable interrupt from the device
disable interrupt	Disable interrupt from the device
start DMA	Start DMA data transfer from camera

An Example

```
// device driver: camera
// The device driver performs several functions:
//      control_camera_position;
//      convey_DMA_parameters;
//      start/stop data transfer;
//      interrupt_handler;
//      error handling and reporting;

// Control camera position
camera_position_control
   (angle pan_angle; angle tilt_angle; int z) {
   pan(pan_angle);
   tilt(tilt_angle);
   zoom(z);
}

// Set up DMA parameters for data transfer
camera_DMA_parameters(address mem_buffer;int num_frames) {
   memory_buffer(mem_buffer);
   capture_frames(num_frames);
}
```

An Example

```
// Start DMA transfer
camera_start_data_transfer() {
   start_camera();
   start_DMA();
}

// Stop DMA transfer
camera_stop_data_transfer() {
   // automatically aborts data transfer
   // if camera is stopped;
   stop_camera();
}

// Enable interrupts from the device
camera_enable_interrupt() {
   enable_interrupt();
}

// Disable interrupts from the device
camera_disable_interrupt() {
   disable_interrupt();
}
```

An Example

```
// Device interrupt handler
camera_interrupt_handler() {
   // The upshot of interrupt handling may
   // to deliver “events” to the upper layers
   // of the system software
   // which may be one of the following:
   //   - normal I/O request completion
   //   - device errors for the I/O request
   //
   // code will perform the interrupt handling
}
```

Peripheral Devices

Device	Input/output	Human in the loop	Data rate (by 2008)	PIO	DMA
Keyboard	Input	Yes	5-10 bytes/sec	X	
Mouse	Input	Yes	80-200 bytes/sec	X	
Graphics display	Output	No	200-350 MB/sec		X
Disk (hard drive)	Input/Output	No	100-200 MB/sec		X
Network (LAN)	Input/Output	No	1 Gbit/sec		X
Modem	Input/Output	No	1-8 Mbit/sec		X
Inkjet printer	Output	No	20-40 KB/sec	X	X
Laser printer	Output	No	200-400 KB/sec		X
Voice (microphone/speaker)	Input/Output	Yes	10 bytes/sec	X	
Audio (music)	Output	No	4-500 KB/sec		X
Flash memory	Input/Output	No	10-50 MB/sec		X
CD-RW	Input/Output	No	10-20 MB/sec		X
DVD-R	Input	No	10-20 MB/sec		X

PIO: Programmed Input/Output, **DMA:** Direct Memory Access

Dynamic Loading of Device Drivers

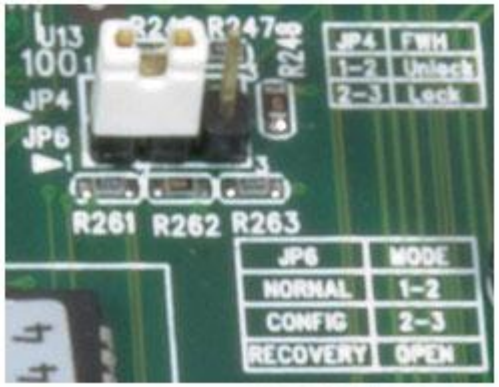
- Device drivers can be Plug and Play
- New device is connected, generates interrupt
- OS looks through its list of device drivers and finds correct one*
- Dynamically Loads and links driver into memory

*If no driver found has to request user supply driver

Jumpers

- Jumpers are used to **configure the settings** for **computer peripherals** such as the motherboard, hard drives, modems, sound cards, and other components.

- For example, if your motherboard supported **intrusion detection**, a jumper can be set to **enable or disable** this feature.

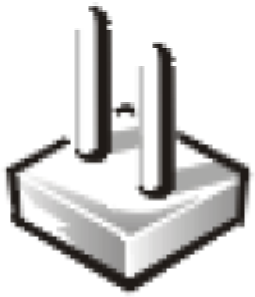


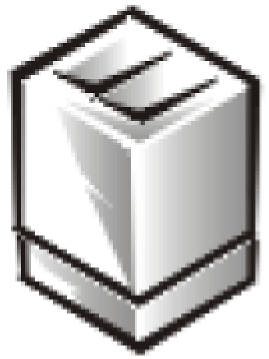
JP4	FWH
1-2	Unlock
2-3	Lock

JP6	MODE
NORMAL	1-2
CONFIG	2-3
RECOVERY	OPEN

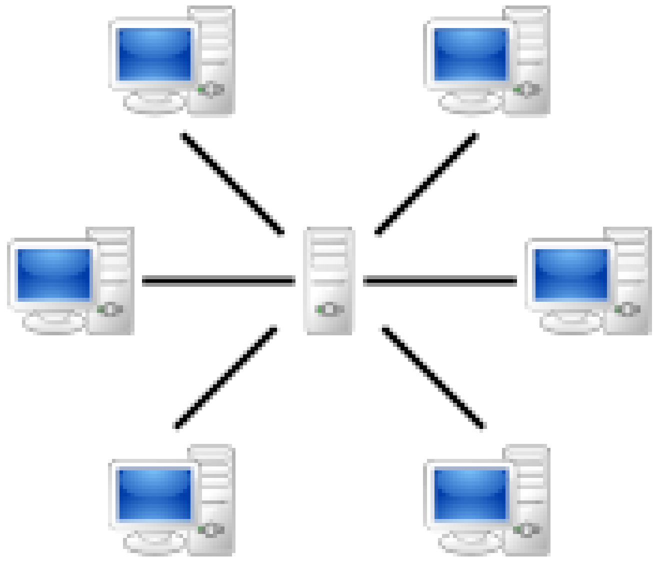
Jumpers

NOTICE: Make sure the system is turned off before you change a jumper setting. Otherwise, damage to the system or unpredictable results may occur.





Servers



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- This architecture is called the client–server model
  - a single overall computation is distributed across multiple processes or devices

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- Typical servers are
  - database servers, file servers,
  - mail servers, print servers,
  - web servers, game servers,
  - computing servers, etc.

IIITS GPU Server