IO management & file systems

There are many other HW components, that provide input or output capabilities: mouse, keyboard, display, network card, disk, etc.

Basic I/O device features

Any devices will have

- Set of control registers, that is accessed by CPU and permit the CPU to interact with devices:
  - command – CPU uses it to control what exactly the device will be doing
  - data – CPU uses it to control the data transfers in/out of the device
  - status – CPU uses it to find out what's happening on the device
- Microcontroller – device's CPU (optionally), it controls all of the operations that take place on the device
- On device memory
- Other logic, for ex. analog to digital converters.

CPU – device interconnect

Device interface with the rest of the system via *controller* that typically integrated as part of the device packaging, and used to connect the device with the rest of CPU complex via some device *interconnect*.

Example of this interconnect is PCI bus (peripheral component interconnect), SCSI bus (for disks), etc.

Controllers that are part of the device's HW determine what type of interconnect can a device directly attach to. But there are bridging controllerse that can handle differences in different type interconnects.

Device drivers

OS supports devices via **device drivers**, that are part of kernel I/O subsystem.

Device drivers:

- per *each device type*
- responsible for device access, management and control
- typically provided by device manufacturers per OS/version
- each OS standardizes interface for driver development (give some framework)
  - (+) device independence (OS do not required to support concrete devices)
  - (+) device diversity (devices can be easily changed, and all is needed to change drivers, all other OS components are the same)

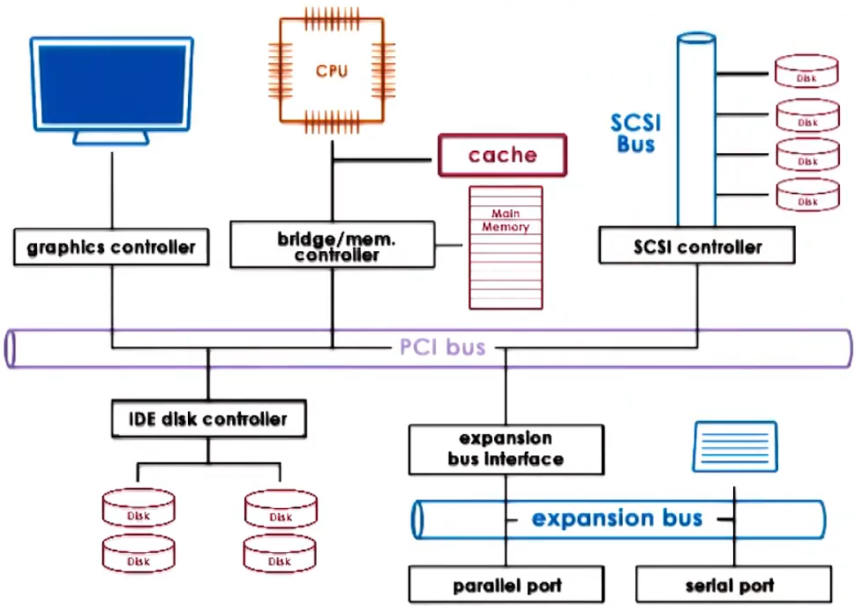

Figure 1: title

Type of devices

- Block (like disk)
  - read/write *blocks* of data
  - direct access to arbitrary block
- Character (like keyboard)
  - has functionality to get/put character
- Network devices – mean between block and character
  - they deliver not a one character, and not a block of fixed size, but flexible sized portions of data

Interfaces that OS exposes to driver developers are fixed per type of device.

OS representation of a device – special device file (in Linux in /dev, and these files treated by tmpfs or devfs filesystems)