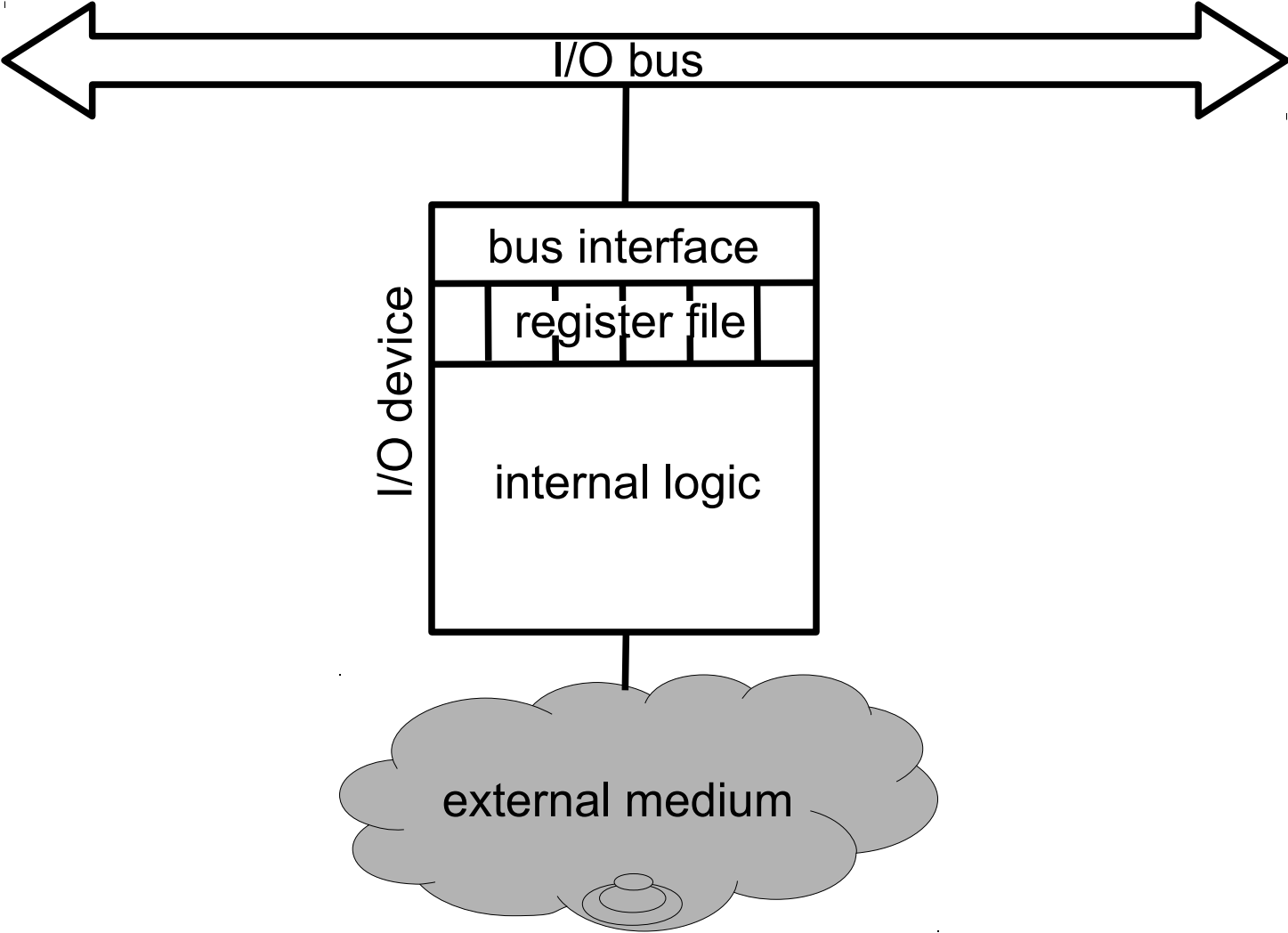
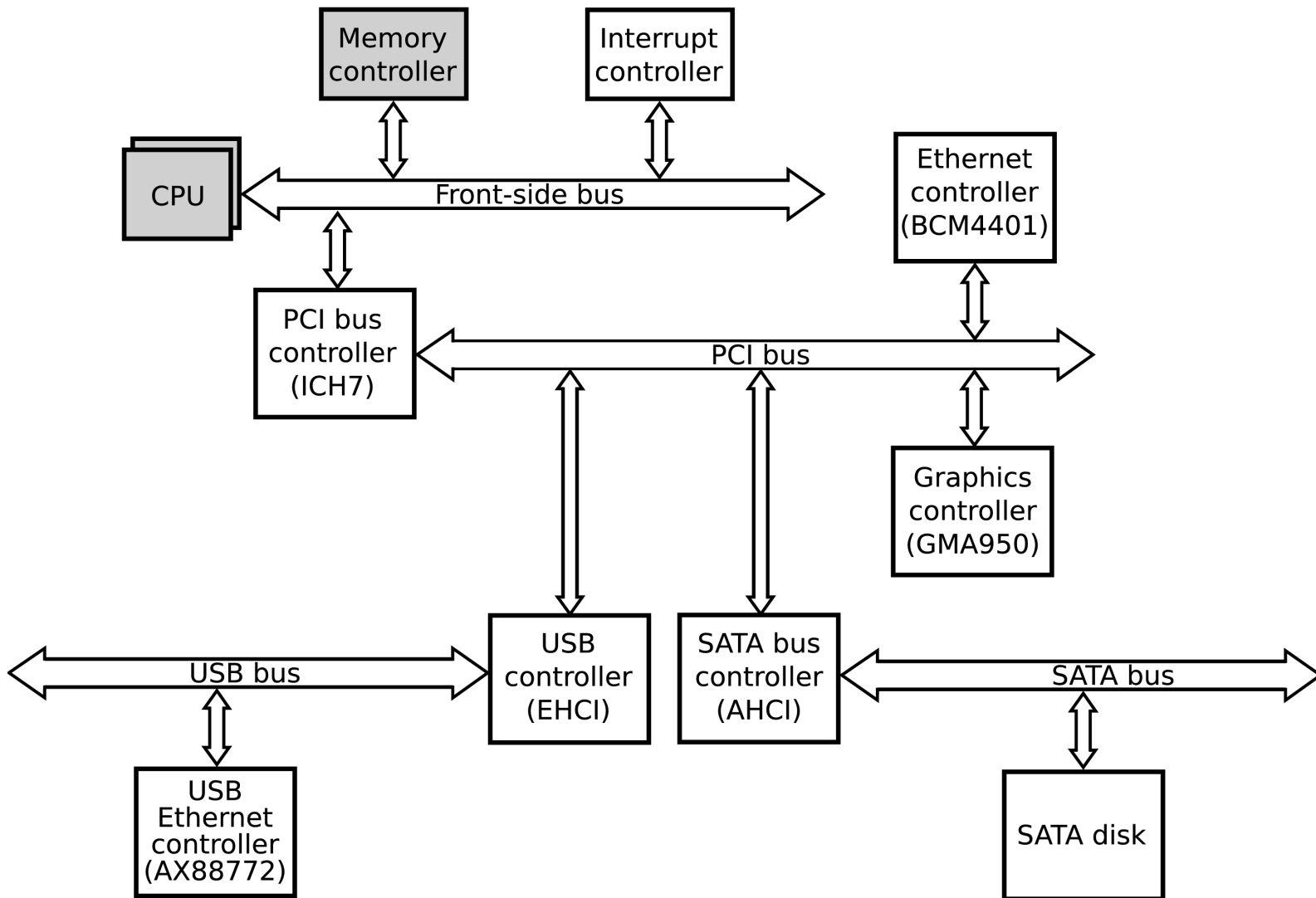
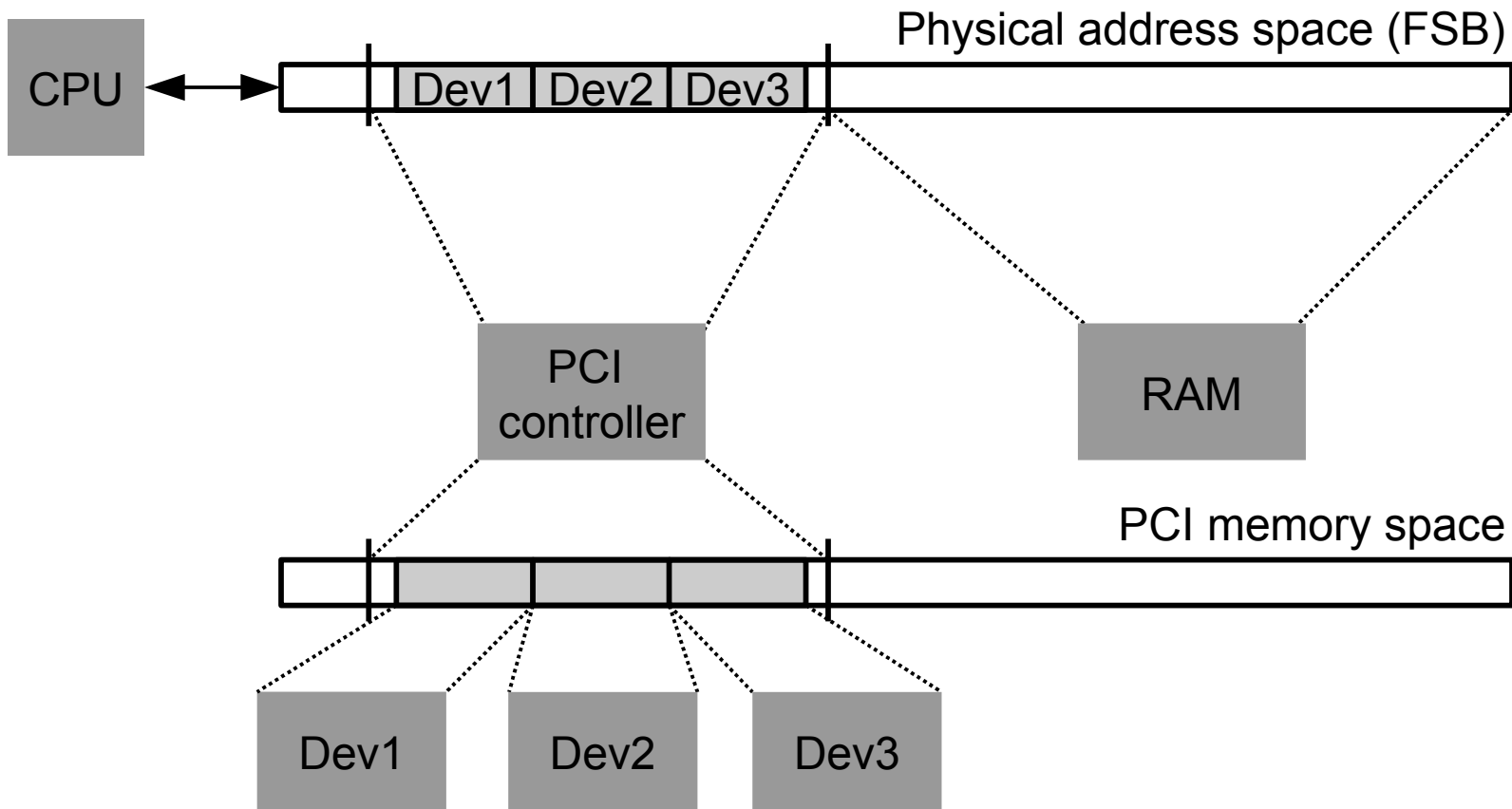


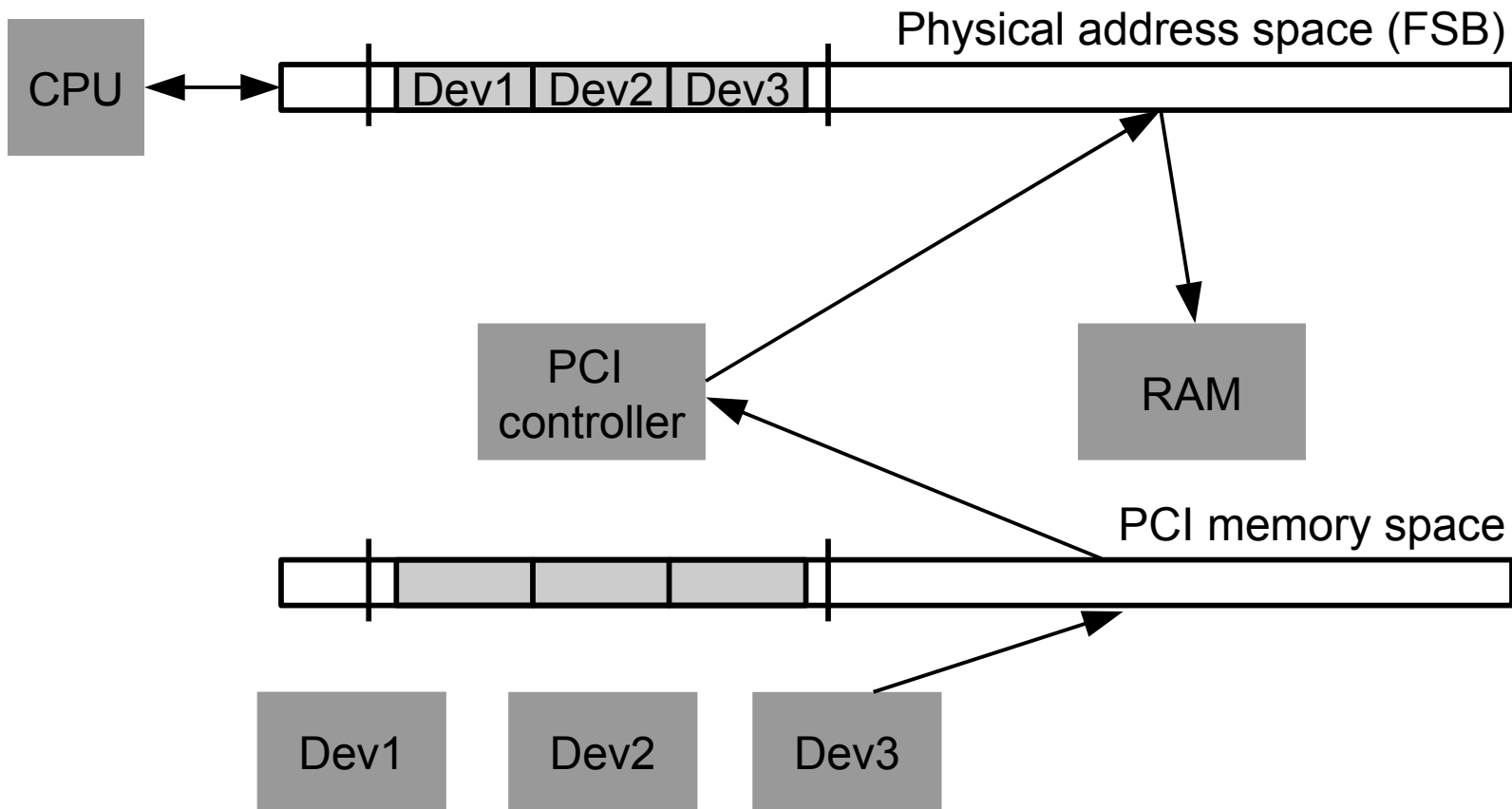
- Encapsulation
 - Hides low-level device protocol details from the client
- Unification
 - Makes similar devices look the same
- Protection (in cooperation with the OS)
 - Only authorised applications can use the device
- Multiplexing (in cooperation with the OS)
 - Multiple applications can use the device concurrently

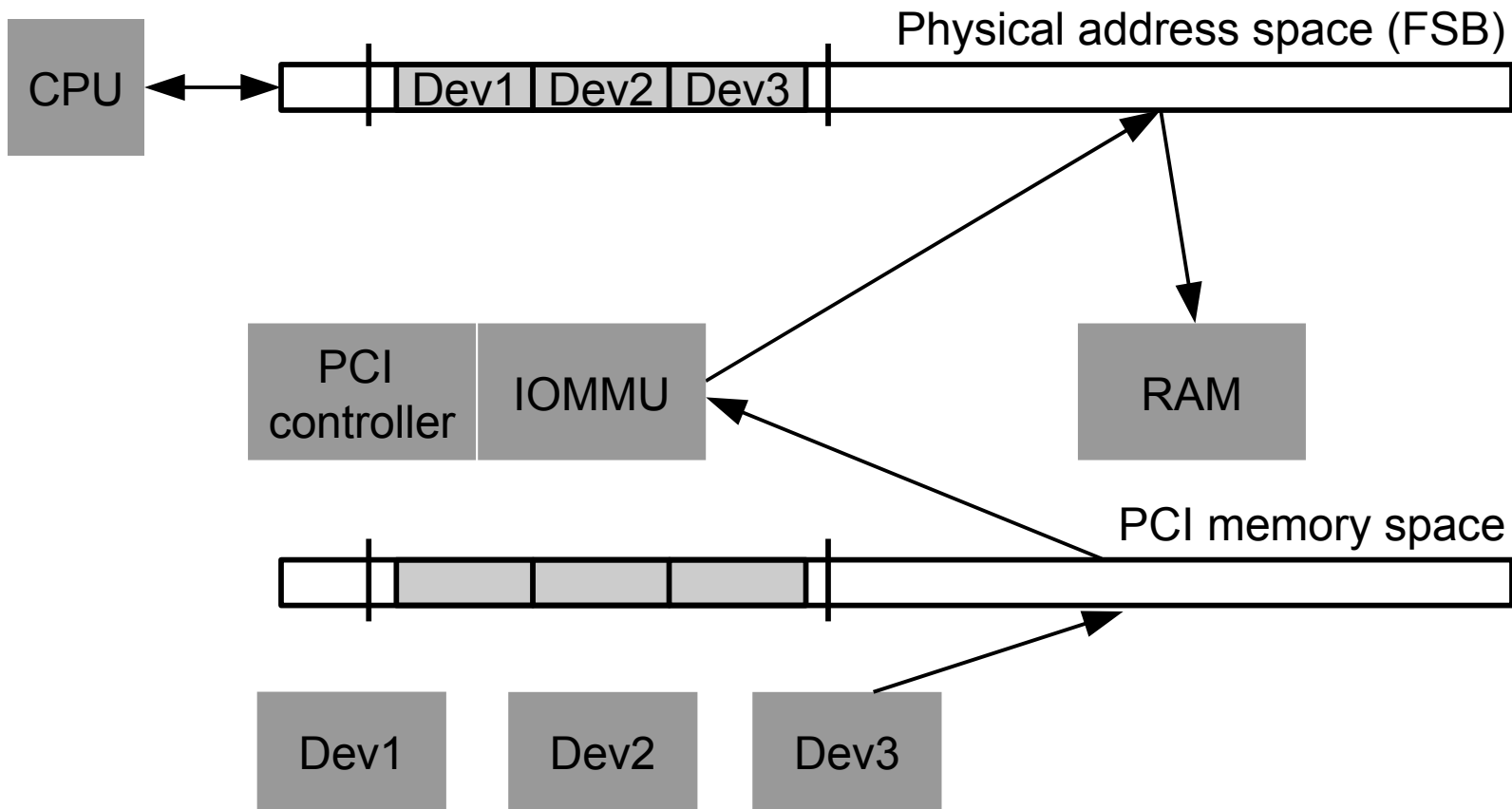




- PCI bus
 - Conventional PCI
 - Developed and standardised in early 90's
 - 32 or 64 bit shared parallel bus
 - Up to 66MHz (533MB/s)
 - PCI-X
 - Up to 133MHz (1066MB/s)
 - PCI Express
 - Consists of serial p2p links
 - Software-compatible with conventional PCI
 - Up to 16GB/s per device

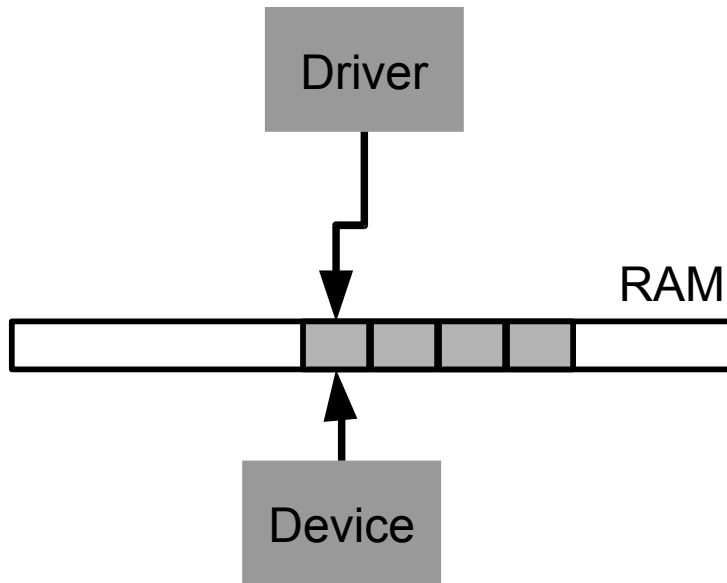






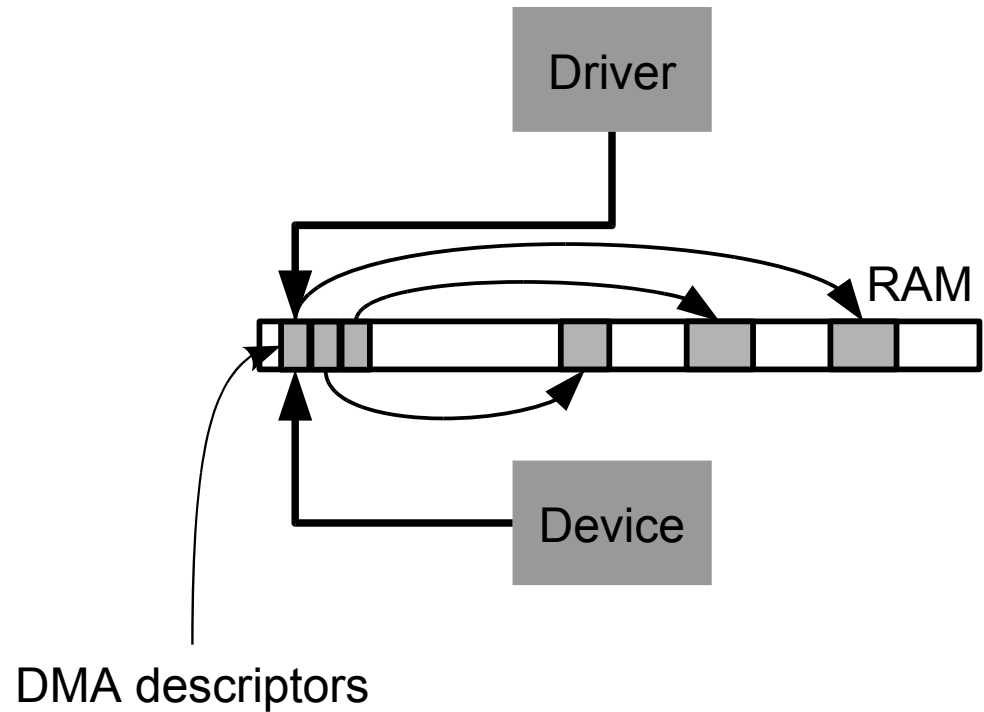
Permanent DMA mappings

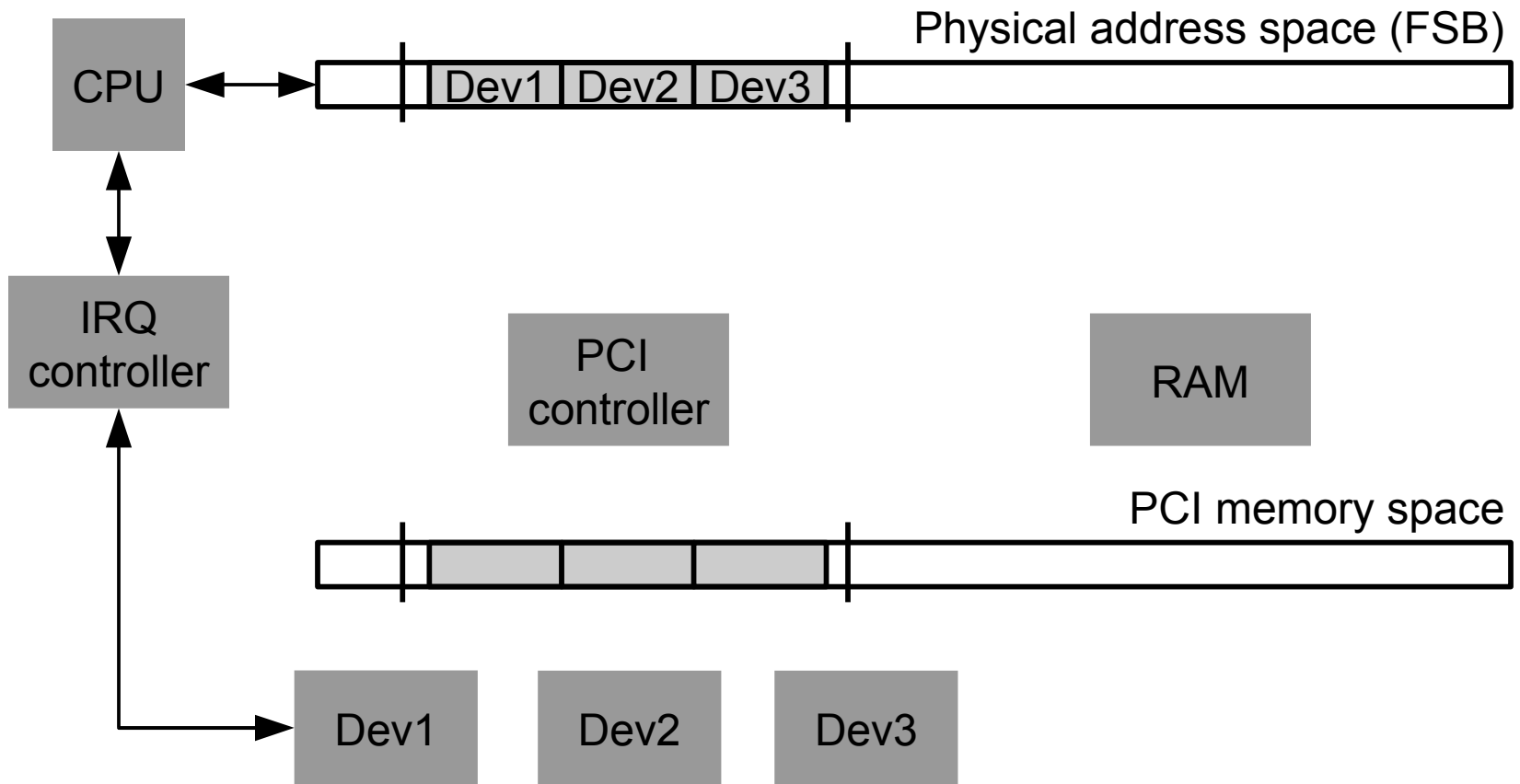
- Set up during driver initialisation
- Data must be copied to/from DMA buffers



Streaming mappings

- Created for each transfer
- Data is accessed in-place





- PCI configuration space
 - Used for device enumeration and configuration
 - Contains standardised device descriptors

31		16 15		0		
Device ID		Vendor ID				00h
Status		Command				04h
Class Code			Revision ID			08h
BIST	Header Type	Lat. Timer	Cache Line S.			0Ch
Base Address Registers						10h 14h 18h 1Ch 20h 24h
Cardbus CIS Pointer						28h
Subsystem ID			Subsystem Vendor ID			2Ch
Expansion ROM Base Address						30h
Reserved				Cap. Pointer		34h
Reserved						38h
Max Lat.	Min Gnt.	Interrupt Pin	Interrupt Line			3Ch

- Registration
 - Tell the OS which PCI device ID's the driver supports
- Instantiation
 - Done by the OS when it finds a driver with a matching ID
- Initialisation
 - Allocate PCI resources: memory regions, IRQ's
 - Enable bus mastering
- Power management
 - Prepare the device for a transition into a low-power state
 - Restore device configuration during wake-up

Writing a driver for a PCI device



- Interrupt handler
 - Return *ASAP* to re-enable interrupts; perform heavy-weight processing in a separate thread
- DMA
 - Permanent mappings: disable caching
 - Streaming mappings: may require bounce buffers
 - Returns buffer address in the bus address space