



Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich
Spring Term 2014

Operating Systems and Networks

Assignment 10

Assigned on: **4th May 2014**

Due by: **9th May 2014**

1 I/O Systems

1.1 General Questions

- a) State three advantages and disadvantages of placing functionality in a device controller, rather than in the kernel.
- b) Why might a system use interrupt-driven I/O to manage a single serial port, but polling I/O to manage a high performance network interface card?
- c) Polling for an I/O completion can waste a large number of CPU cycles if the processor iterates a busy-waiting loop many times before the I/O completes. But if the I/O device is ready for service, polling can be much more efficient than is catching and dispatching an interrupt. Describe a hybrid strategy that combines polling, sleeping and interrupts for I/O device service. For each of these three strategies (pure polling, pure interrupts, hybrid), describe a computing environment in which that strategy is more efficient than is either of the others.
- d) The Linux operating system differentiates between character and block devices. What is the difference between them?
- e) What is the purpose of an IOMMU?

1.2 DMA

- a) How does DMA increase system concurrency? How does it complicate hardware design?
- b) Although DMA does not use the CPU, the maximum transfer rate is still limited. Consider reading a block from disk. Name three factors that might ultimately limit the file transfer
- c) A DMA controller has four channels. The controller is capable of requesting a 32-bit word every 100 nsec. A response takes equally long. How fast does the bus have to be to avoid being a bottleneck?