ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Operating Systems and Networks	Spring 2015
Assignment 6	Due 2 April 2015

1. **I/O**

   (a) **General Questions**

      i. State three advantages and disadvantages of placing functionality in a device controller instead of in the kernel.

      ii. The Unix-like operating systems differentiate between block and character devices. What is the difference between them?

      iii. What is the purpose of an IOMMU?

   (b) **DMA**

      i. 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.

      ii. A DMA controller has 4 channels. The controller is capable of requesting a 32-bit word every 100 ns. A response takes equally long. How fast does the bus have to be to avoid being a bottleneck?

2. **Virtual Machines**

   (a) List all machine resources that must be virtualized and discuss why. List some uses of virtual machines.

   (b) What is the difference between native (type 1) and hosted (type 2) virtual machines? Which one is more suitable for a data center (cloud provider) and which one is more suitable for your laptop?

   (c) Discuss the differences between full virtualization and paravirtualization, i.e., state the benefits each one has over the other.

   (d) Discuss the functionality of ballooning. What problem is it trying to solve and how does it solve it?