

CS-428: Embedded Systems Lab

Area: E4 - Computer Architecture and Computer Systems (ECTS: 6)

Semester: Spring 2025

Instructors: Angelos Bilas, Manolis Marazakis

Introduction to Virtualization Technologies: Assignment #2

Due: May 23, 2025

This assignment focuses on the configuration and use of I/O functionality with your QEMU-based RISC-V virtual machine from the prior assignment. The assignment consist of two parts:

1. [50%] VM I/O performance measurement: Build a statically-linked binary of the **iperf3** network bandwidth measurement tool [1] for RISC-V, and add it into the root file-system of your RISC-V VM from the prior assignment. Start your VM, and use iPerf3 to measure the network performance (specifically, bandwidth) for network traffic between the VM and the Host:
 - a. Two modes for the VM: iperf3 Server, iperf3 Client
 - b. Two protocols: UDP, TCP
 - c. 6 different message sizes: 8bytes, 64bytes, 1KB, 4KB, 64KB, 512KB.
 - d. Repeat these measurements with your Host in the role of 'iPerf3 server', and using another physical system in the role of 'iPerf3 client'. Compare with the measurements between the Host and your VM.
2. [50%] VIRTIO device setup: Study the code of the **virtio-serial-pci** device model of QEMU [2], and demonstrate its functionality using your RISC-V VM and the **minicom** utility [3].

After completing this assignment, you will need to submit a report (plain-text format) containing the output of shell commands (at both the Host and Guest sides) that you have used, the measurements from Part (a), and a description of the virtio-serial-pci device from Part (b). During the grading session, you will be asked to answer questions about the overall software architecture, and demonstrate your work and findings by running your VM.

References:

[1] iperf3 network bandwidth measurement tool : <https://iperf.fr/>

[2] virtio-serial-pci device model: <https://github.com/qemu/qemu>: hw/virtio/virtio-serial-pci.c

[3] minicom serial communication utility: <https://linux.die.net/man/1/minicom>