

Advanced Operating Systems: Lab 2 – IPC ACS/Part III Assignment

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Your lab report will explore the behaviour of UNIX pipe and shared memory IPC across a range of buffer sizes, as well as the potential probe effect of tools you use in analysing that behaviour.

Approach

The following questions are with respect to a fixed total IPC size of 16MiB (the default for the benchmark). Take measurements across a spectrum of powers-of-two buffer sizes between 128 bytes and 16MiB. Use `zproc` mode, and only the `-i pipe` and `-i shmem` IPC types in your experiments.

Submitting your completed assignment

Your submitted lab report will be a single PDF file using the the ACS/Part III lab-report LaTeX provided. All submissions are via the course's Moodle page.

Data collection

First, gather baseline data on the performance of pipe and shared memory IPC:

- Create a plot illustrating how pipe and shared memory IPC performance changes across a range of buffer sizes.

Create further plots to explore pipe performance using OS-based and performance-counter techniques to understand the performance curves, taking care not to combine different units on the same Y axes:

- Explore the architectural behaviour of both IPC types using the hardware performance counter set `arch`. How does the amount of work performed differ between the two types, measured as instructions retired, load instructions, store instructions, and function returns.
- Explore the microarchitectural behaviour of both IPC types using the hardware performance counter set `tlbmem`. How does the amount of work performed differ between the two types, measured as bus accesses?

Partition and analyse the IPC performance results. Use kernel statistics and DTrace profiling/tracing to explore and explain changing OS behaviors (e.g., number of system calls, context switching, and so on) across a range of buffer sizes, and between the two models.

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Conclude your data collection by gathering data on the probe effect associated with DTrace use itself:

- Explore the impact of the probe effect on your investigation, focusing on how DTrace may have changed the behavior of the benchmark and impacted the accuracy of your analysis.

While the corresponding Part II assignment differs from this lab assignment, you may find its advice on data collection and analysis useful.

Lab report

In your lab report, evaluate the lab hypotheses (see *Advanced Operating Systems: Lab 2 – IPC – General Information*) in light of this data and analysis, as well as using other data you may have collected.