

02226: High-Performance Operating Systems

Exercise sheet 1

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This is a little exercise in system simulation for a system which is based on a PCI bus. The system contains a number of network cards, and is used to direct network traffic from one incoming link to one or more outgoing links. As in most modern computer systems, the CPU and memory communicate via a very fast system bus, whereas the network cards use DMA transfers over the PCI bus to place incoming data in buffers in the main memory or to transmit data from buffers in the the main memory. You may assume that the CPU time required to inspect the incoming data and direct it to the appropriate outgoing network link is negligible – in other words, that the time required is entirely dominated by the time needed to transfer data via the PCI bus.

Try to answer the following questions:

1. Assume that the network links operate at 100 Mbit/s, and all data is sent in units of 1500 bytes. Assume also that the PCI bus is a standard version operating at 33 MHz with 32-bit data. Is it possible to transfer data at the full network data rate if there is one incoming link and all the incoming data have to be transmitted via 2 outgoing links?
2. Under the same assumptions as above, how many outgoing links can be dealt with?
3. Now assume that the network links all operate at 1 Gbit/s. How many links can now be dealt with?
4. How many links can be dealt with if you are allowed to use a fast (66 MHz) and/or broad (64 bit) PCI bus?

1 The PCISIM Simulator

For this exercise, you may use the PCISIM simulator available via:

<http://www.imm.dtu.dk/~robin/RTMM/>

Read the manual first! The source code (in ANSI C) should be easy to compile on any Unix system. The instructions in the manual tell you how to do it in (Red Hat) Linux.

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