METROPOLIA
Information Technology

Lab. exercise 11
TI00AA55 Real-Time Programming

Page 1

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In this exercise we familiarize ourselves to real-time signals and timers.

Exercise 11 (Measuring the real-time signal delivery delay, 1p)

Write a program which measures the real-time signal delivery delay from one process to an another. This information is useful when you are designing real-time systems using signals for event handling.

First your program should display what is the resolution of the timers, so that you what is the measurement resolution. Then you need to create a new process (e.g. child process) who waits (using `sigsuspend`) for the signals to come with a signal handler. When the child process receives a signal, a signal handler must acquire the current timer value (using `clock_gettime`). Then you read from the pipe the signal sending time.[1] Therefore, after the signal, children read the sending time from the pipe and calculated the delivery delay time. This time is shown on the screen in μs.

Parent process take the current time value (`clock_gettime`), and generates the signal (using `sigqueue`). Note that you need to use special real-time signal, e.g. SIGRTMAX. After sending the signal, parent process sends the signal sending time to the children using a pipe.

Note: when you are using real-time signals, you need to use the -lrt option when compiling with the gcc.

Exercise 11 (Extra, Statistical analysis of the real-time signal delivery delay, 0.25p)

Modify your program in such a way that you generate multiple signals (e.g. 10000 signals[2]) in random intervals (delay between signals is n·1ms, where n=1,…,32) and then analyse from that set the mean, standard deviation, minimum and maximum delay values.

You should get output like this:
```
Real time clock resolution is: 0 s 1 ns
10000 signals received
Mean 13.9us, standard deviation 40.9us, min 5us, max 3064us
```

Note: In order to calculate the square root (`sqrt()` function, defined in <math.h>) you need to use the switch -lm when compling with the gcc.

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[1] Parent process must tell the signal creation time (in order children to calculate the delivery delay). Because parent and children memory spaces are separate, you need a pipe to transmit the sending time to the children.

[2] Test initially with the smaller value, but run the final test run with 10000 signals in order to improve the statistical reliability.