

Algorithm Engineering Lab Assignment 1

Brian Zahoransky (brian.zahoransky@uni-jena.de)

January 15, 2021

1. Describe how parallelism differs from concurrency.

Since in both cases progress is achieved on multiple tasks, the term of parallelism is more concrete. Concurrency allows also multiple tasks proceeded alternately by one processing unit. On the other hand parallelism means that this tasks are actual proceeded in the same time. For example, this can be enabled through multiple cores in a processor.

2. What is fork-join parallelism?

In short, it starts with one main thread which gets forked and joined (eventually multiple times) until the work is done. Fork-join parallelism also allows side threads to proceed fork-join parallelism. However, before the program determines, all threads are joined to the main thread.

3. About which „new“ (2005) CPU technologies does Sutter report?

Hyper-threading: A hyper-threading-processor contains commonly two program counters and register files. This enables the processor to switch immediately between two tasks, whereas a normal processor needs thousands of circles. **Multi-core:** A Processor with multiple independent cores. **Caches:** The register files of a processor are fast and due to physical conditions relatively small. Whereas the main memory provides much more capacity but data needs much more time to get to the processing unit. Therefore, caches were invented. They are not as fast as registers but still faster than the main memory. Further, they do not provide as much space as the main memory but still more than register files.

4. What do you think, can we have a free lunch again if we exploit them in our applications?

It seems to be a challenging task to predict the future, especially for a long period. Considering the next five to ten years, the free lunch may continue. One supporting point are the growing caches at the moment. According to the text the end of increasing clock speed was somehow surprising for the processor producer. It seems possible that comparable issues appear in cache development. For example could physical space become an issue. Even if this happens, a rising number of processors is almost certain. Having supercomputers with millions of nodes containing hundreds of cores each, shows up the opportunities. Thus, writing well scaling code also means a free lunch.

5. Discuss one thing you find particularly interesting in Chapter 1 from Computer Systems: A Programmer's Perspective.

In the following is discussed how a letter appears at the screen after hitting a key using the terms introduced in chapter 1.7. Consider, the command shell is open and letter 'z' is pressed at the keyboard. Now a electric signal is sent to the keyboard's microprocessor. There, the signal gets translated into a binary file and is sent to a process inside the computer. This process is called driver. Reaching the virtual memory of the driver, the file becomes translated into a new file which now can be understood by the operating system. The created file continues its way to the shell process. After reaching the virtual memory of the shell and being processed, a further file is sent to the driver of the monitor. Having passed the driver, a file which can be understood by the monitor is sent to its processor. However the file is exactly handled there, the screen will be updated and the character 'z' is shown.