Technology Transfer in Computing Systems

D3.4: Individual TTP4 abstract

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TETRACOM D3.4: Acceleration of genomic analysis algorithms on FPGAs

Hardware acceleration of computationally intensive algorithms promises to provide improved performance beyond what a regular computer system can provide. One computationally challenging field that can benefit from such computational solutions is the genomics field. This project is meant to enable Bluebee to benefit from hardware components developed by the CE lab to integrate into their genomics solutions offering.

Bluebee has an ongoing collaboration with the US based company Convey Computer. This presented Bluebee with a concrete opportunity to sell a hardware-accelerated version of the BWA-mem genomic data assembly algorithm to one of the customers of Convey. In addition, Bluebee is discussing with IBM (who recently bought the third largest cloud provider in the world, Softlayer, to offer a cloud based BWA-mem service on the Power 8 machines with FPGA blades. So this initiative serves both a short and long term commercial strategic option of Bluebee.

The transfer of technology between Bluebee and the Computer Engineering Lab (CE lab) of the TUDelft involves existing components as well as components to be developed that, when put together, will implement the BWA-mem algorithm for genomic data assembly.

Hardware components transferred

Some of the components that need to be implemented in hardware have already been developed in by the CE lab and have been integrated, after some modifications, to implement the more recent BWA-mem algorithm. The following blocks have been reused after adaptation:

- bwt_sa: The algorithm implemented in this block has very similar functionality to a block present in the implementation of the BWA-aln algorithm that the CE lab has already implemented. The existing block has partly been adapted to extract the exact matching functionality and connected to other blocks in the BWA-mem algorithm.
- ksw_extend: The algorithm implemented in this block is based on the Smith-Waterman (SW) algorithm that the CE lab has already implemented. The block has been adapted to enable chain extension as required by BWA-mem.
- ksw_global: The algorithm is again based on the SW algorithm the CE lab already has. However, this algorithm is being modified to its global form and adapted to connect to other BWA-mem blocks.

Impact of hardware transferred

Three main realisations can be mentioned that are directly related to the Tetracom TTP:

- Bluebee has installed at the site of its first customer the accelerated version of BWA-mem and is currently doing an extensive user acceptance and on–site testing of the BWA-mem system.
- The customer will sign a contract to buy 2 more Convey systems and is currently negotiating with Bluebee a license contract for the use of BWA-mem on all Convey machines. This customer will therfore be the first paying customer of Bluebee.
- Bluebee has secured a first financial injection of €1.5 million thanks to the first two realisations.