

Semester Thesis:

## Ultrasound “To Go”

### Implement a multi-threaded version of an ultrasound device

Ultrasound imaging is one of the most important diagnostic procedures in modern medicine. Being non-invasive and not emitting any potentially harmful radiation (like X-Rays), it is relatively low-cost at the same time.

Yet, it could be used in many more contexts and situations still. This is however hampered by the size and the power-consumption of current devices, which are basically comparable to desktop PC systems. While there are also mobile ultrasound devices, their image quality is distinctively worse than that of state-of-the-art non-mobile devices.

The swiss-founded Nano-Tera “Ultrasound To Go” project now tries to develop portable high-quality and low-power ultrasound devices, which would allow for ultrasound diagnostics in a new field of situations, e.g. in emergency cases or in rural areas. Clearly, such a technology is far from trivial and necessitates the use of all possible methods of energy saving. One of those methods is the use of energy-efficient multi-processor chips, which, however, have to be programmed carefully such that they can be efficient.

**Task:** At our group, we developed the high-level multi-core parallel programming framework “DAL”. A DAL program consists of multiple processes written in pure C, with an XML description specifying the interconnection of these individual processes. The goal of this thesis is to use the DAL framework to implement a parallelised version of the ultrasound image reconstruction algorithm. This includes the following steps:

1. Understand the concepts of DAL and of ultrasound imaging.
2. Port an existing MATLAB code for ultrasound image reconstruction to DAL.
3. Test your implementation on the Intel Xeon Phi multi-core platform and try to optimise its performance.

**Requirements:** You should be familiar with C. Knowledge about process networks or ultrasound imaging would be an asset, but is not required.

**Interested?** Please have a look at <http://www.tec.ethz.ch/research.html> and contact us for more details!

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### Further Reading

- DAL: <http://www.tik.ee.ethz.ch/~euretile/dal.php>
- Nano-Tera Ultrasound To Go project: <http://www.nano-tera.ch/projects/359.php>
- Xeon Phi: <http://www.intel.com/content/www/us/en/processors/xeon/xeon-phi-detail.html>

