In this work we evaluate the performance of Devito, a domain specific language (DSL) for finite differences, on Arm ThunderX2 processors. Experiments with two common seismic computational kernels demonstrate that Arm processors can achieve competitive performance compared to Intel Xeon processors.

HPC-Optimised ARM Processors

HPC-Optimised Arm processors are emerging: Huawei (Kunpeng 920), Ampere (eMAG), Fujitsu (A64FX), and Marvell (ThunderX2). In recent studies, Arm based supercomputers have demonstrated capable of providing levels of performance competitive with state-of-the-art HPC-optimised processors (e.g. Intel Skylake and Broadwell) for a wide range of applications with very attractive performance per Dollar ratio.

The Isambard* system - the largest Arm based HPC production system in Europe:
- Cray XC50 (Scout) with Aries interconnect
- Each node has 2 Arm based processors - 32-core Marvell ThunderX2 CPUs, 256 GB of DDR4 DRAM
- 42 blades with 4 nodes
- The whole system: 10,752 Armv8 cores

Devito is a finite difference DSL for creating highly optimised finite-difference operators from concise symbolic expressions built upon SymPy. Creating operators symbolically allows application developers to:
- Build complex solvers from a few lines of code
- Utilise automated (symbolic, and loop) performance optimisation
- Adjust numerical discretization at run time
- To develop and integrate other mathematical operators that fall outside the stencil programming model
- Develop high-performance solvers in hours, not months

Currently, parallelism is supported by OpenMP and MPI which are integrated to the Devito compiler stack. Code generation for GPUs is under development.

Main Findings

- With Devito, Arm based processors are capable of delivering performance similar to state-of-the-art Intel Xeon processors for the execution of seismic inverse problems
- Devito is shown to be capable of generating efficient high performance code for Arm processor
- All models compiled and ran successfully, and no architecture specific code tuning was necessary to obtain high performance other than specifying the compiler and its options

![Image](https://bitbucket.org/ws-5-stmi/performance-of-devito-on-arm)