

Intel Compilers

The Intel compilers in multiple versions are available, via module intel. The compilers include the icc C and C++ compiler and the ifort fortran 77/90/95 compiler.

```
$ module load intel
$ icc -v
$ ifort -v
```

The intel compilers provide for vectorization of the code, via the AVX2 instructions and support threading parallelization via OpenMP

For maximum performance on the Salomon cluster compute nodes, compile your programs using the AVX2 instructions, with reporting where the vectorization was used. We recommend following compilation options for high performance

```
$ icc -ipo -O3 -xCORE-AVX2 -qopt-report1 -qopt-report-phase=vec myprog.c mysubroutines.c -o myprog
$ ifort -ipo -O3 -xCORE-AVX2 -qopt-report1 -qopt-report-phase=vec myprog.f mysubroutines.f -o myprog
```

In this example, we compile the program enabling interprocedural optimizations between source files (-ipo), aggressive loop optimizations (-O3) and vectorization (-xCORE-AVX2)

The compiler recognizes the omp, simd, vector and ivdep pragmas for OpenMP parallelization and AVX2 vectorization. Enable the OpenMP parallelization by the **-openmp** compiler switch.

```
$ icc -ipo -O3 -xCORE-AVX2 -qopt-report1 -qopt-report-phase=vec -openmp myprog.c mysubroutines.c -o myprog
$ ifort -ipo -O3 -xCORE-AVX2 -qopt-report1 -qopt-report-phase=vec -openmp myprog.f mysubroutines.f -o myprog
```

Read more at <https://software.intel.com/en-us/intel-cplusplus-compiler-16.0-user-and-reference-guide>

Sandy Bridge/Ivy Bridge/Haswell binary compatibility

Anselm nodes are currently equipped with Sandy Bridge CPUs, while Salomon compute nodes are equipped with Haswell based architecture. The UV1 SMP compute server has Ivy Bridge CPUs, which are equivalent to Sandy Bridge (only smaller manufacturing technology). >The new processors are backward compatible with the Sandy Bridge nodes, so all programs that ran on the Sandy Bridge processors, should also run on the new Haswell nodes. >To get optimal performance out of the Haswell processors a program should make use of the special >AVX2 instructions for this processor. One can do this by recompiling codes with the compiler flags >designated to invoke these instructions. For the Intel compiler suite, there are two ways of doing >this:

- Using compiler flag (both for Fortran and C): -xCORE-AVX2.
This will create a binary class="s1">with AVX2 instruc-

tions, specifically for the Haswell processors. Note that the executable >will not run on Sandy Bridge/Ivy Bridge nodes.

- Using compiler flags (both for Fortran and C): -xAVX -axCORE-AVX2. This will >generate multiple, feature specific auto-dispatch code paths for Intel® processors, if there is >a performance benefit. So this binary will run both on Sandy Bridge/Ivy Bridge and Haswell >processors. During runtime it will be decided which path to follow, dependent on which >processor you are running on. In general this will result in larger binaries.