Leibniz Supercomputing Centre
of the Bavarian Academy of Sciences and Humanities

KNL MCDRAM Usage Lab

In this lab you run simple programs and the stream benchmark to use MCDRAM and DDR on 2 KNLs with different memory/cluster mode configuration.

Appropriate Environment

Open 3 xterms. In 2 xterms first login to the Linux-Cluster (directly reachable from the course PCs, use only account a2c06aa!)

```
ssh lxlogin1.lrz.de -l a2c06aa
```

Then login in one xterm: **`ssh mcct03.cos.lrz.de`**
and in the other xterm: **`ssh mcct04.cos.lrz.de`**
Login to the SuperMIC login node in the third xterm.

Lab 1: First steps

- Figure out the number of physical cores, DDR and MCDRAM memory size on both KNLs. Compare with stampede2 shown on the slides.
- Which memory mode is used on mcct03 and mcct04?
- Which cluster modes could be configured?

Lab 2: Testing compatibility on KNL

- Compile `hello.c` using "`icc hello.c`" and run on the KNLs and the login node.
- Recompile `hello.c` using "`icc -xmic-avx512 hello.c`" and run on the KNLs and the login node.
- Compile using "`icc -xsse2 -axmic-avx512 hello.c`" and compare again on the KNLs and the SuperMIC login node.
- You can also test versions compiled with "-mmic" on KNLs and the above versions on the KNCs.

Lab 3: Measuring stream bandwidth on KNL

- Compile the stream benchmark using
  `icc -qopenmp -O2 -xMIC-AVX512 stream.c`
- Measure on both KNLs.
- Compare performance on both KNLs using `OMP_NUM_THREADS=1` and `OMP_NUM_THREADS=x`, where x is the number of physical cores
- Use
  `numactl –m 0 ./stream`
  and
  `numactl –m 1 ./stream`
  and compare the performance both with `OMP_NUM_THREADS=1` and `OMP_NUM_THREADS=x`
- Copy `stream.c` in `stream-hbw.c`. Change the code to dynamically allocate the arrays `a,b,c` using `hbw_malloc`.
- Run the code on the KNL with flat memory mode using both
  `numactl –m 0 ./stream-hbw`
  and
  `numactl –m 1 ./stream-hbw`
  and compare the performance both with `OMP_NUM_THREADS=1` and `OMP_NUM_THREADS=x`. Which memory is allocated in these cases, MCDRAM or DDR?