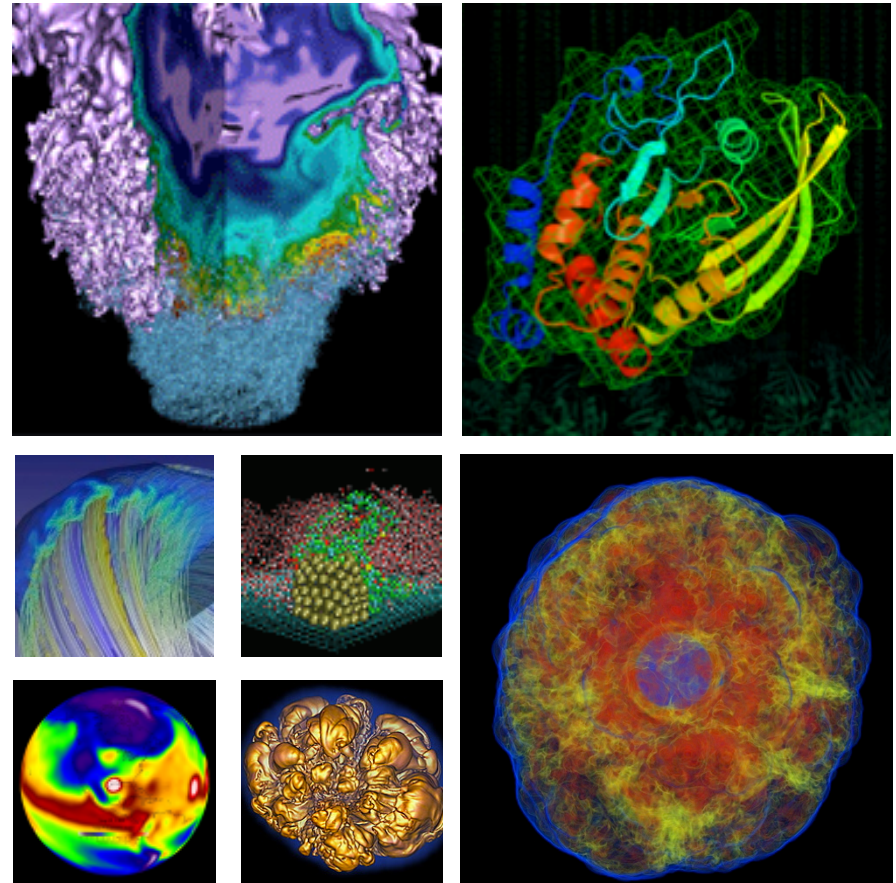


# Intel Tools for optimizations



**NERSC** **40** YEARS  
at the  
FOREFRONT  
1974-2014

**Zhengji Zhao**  
**NERSC User Services**  
**Cray QBR, Apr 8, 2015**



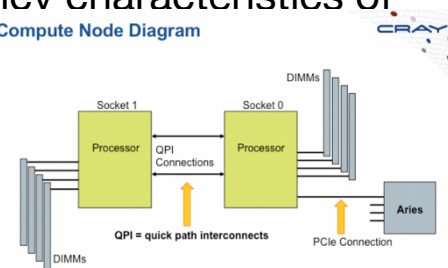
# HBM tools are available on Edison



- The memkind library is a user extensible heap manager. It can be used to test/simulate the benefit of high hand width memory (HBM or HBW) on the dual socket Edison compute nodes today.

- Use the QPI bus to simulate slow memory
- This is not an accurate model of the bandwidth and latency characteristics of the KNL on package memory, but is a reasonable way to structures rely critically on bandwidth.
- Code change is required with the compiler directive  
`!DIR$ ATTRIBUTE FASTMEM`

Compute Node Diagram



- To get started on Edison, see

- <https://www.nersc.gov/users/computational-systems/cori/preparing-for-cori/using-high-performance-libraries-and-tools/#toc-anchor-1>

- Reference

- <http://memkind.github.io/memkind>
- [http://memkind.github.io/memkind/memkind\\_arch\\_20150318.pdf](http://memkind.github.io/memkind/memkind_arch_20150318.pdf)

# More HBM tools will be available soon

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- **New features available in VTUNE – identify candidate arrays for HBM**
  - Will be available in May, 2015
  - This can be used with the memkind library
- **Auto HBMT – automatically move the arrays of certain size to the HBM at run time**
  - No code change is required

# Intel Software Development Emulator (SDE)



- **Intel Software Development Emulator (SDE)**
  - Supports the extended instruction sets for KNL (AVX512)
  - Allows developers to use currently available compilers and assemblers on the currently available processors (Edison) to gain insights about if applications are ready to take advantage of the opportunities created by the new instructions available on the future architecture (KNL)
- **To get started on Edison, see**
  - <https://www.nersc.gov/users/computational-systems/cori/preparing-for-cori/using-high-performance-libraries-and-tools/#toc-anchor-2>
- **Reference:**
  - <https://software.intel.com/en-us/articles/intel-software-development-emulator>
- **A method to evaluate the flops of your application codes:**
  - <https://software.intel.com/en-us/articles/calculating-flop-using-intel-software-development-emulator-intel-sde>

- **VTUNE is a performance analysis tool which can provide a rich set of performance insight into hotspots, threading, locks & waits, bandwidth and more. Use powerful analysis to sort, filter and visualize results on the timeline and on your source.**
  - For serial and parallel codes – single node performance
  - There are both GUI and command line interfaces.
- **Easy to use, detailed explanations, tuning suggestions, etc**
  - Very helpful to understand the code behavior so to further optimize the code
  - Compute or memory bandwidth bound at each loop level.
- **A guide to optimize codes for Ivy Bridge processors (Edison)**
  - [https://software.intel.com/sites/default/files/Using\\_Intel\\_VTune\\_Amplifier\\_XE\\_on\\_Xeon\\_E5v2\\_or\\_E7v2\\_Family\\_1.0.pdf](https://software.intel.com/sites/default/files/Using_Intel_VTune_Amplifier_XE_on_Xeon_E5v2_or_E7v2_Family_1.0.pdf)

# Experience with VTUNE on Cray XC30



- **Issues with static binaries - dynamically linked binaries are preferred.**
- **Issues with DVS projected file systems – use Lustre file systems.**
- **Running one analysis at a time in a single job script.**
- **Running MPI+OpenMP across multiple nodes**
  - 1 PMU per socket, 1 MPI task per socket for bandwidth and general exploration experiments
  - Attach to a process id
- **Profiling a specific code region**
- **Edison VTUNE website, <https://www.nersc.gov/users/software/debugging-and-profiling/vtune/#toc-anchor-4>**

# VTUNE is installed on Edison under CCM

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- **It was a long standing issue in QBR**
  - It was difficult to install and make it work on Crays.
- **Those kernel modules that are needed for the hardware sampling event based experiments are installed dynamically at job startup time on to the nodes allocated, and then removed at job exit time.**
  - Works nicely
  - Contact: Kris Howard at NERSC site, [khoward@cray.com](mailto:khoward@cray.com)



**Thank you.**