RADIOSS Porting on Xeon Phi
A Developer's Perspective

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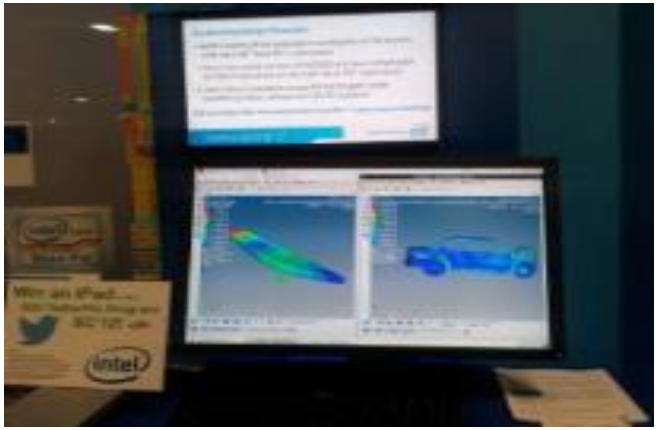
What's unique about my tuning work

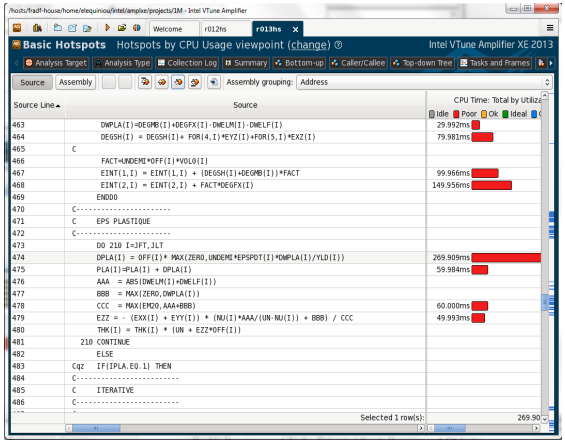
- **RADIOSS is the market-leading analysis solver for Crash & Safety simulations in Altair's Hyperworks CAE suite**
  - Finite Element Analysis solver for highly non-linear simulations
  - Known for its scalability, high quality and robustness
  - Highly parallel hybrid MPI/OpenMP code
- **Unique experience on Intel Xeon Phi with several execution modes**
  - First tests with Offload
  - Then Native porting
  - And generalization to symmetric MPI
- **Programming environment**
  - Fortran and C/C++ Intel compilers
  - Intel Vtune Amplifier for profiling
  - Intel Trace Analyzer and Collector (ITAC) for MPI communication



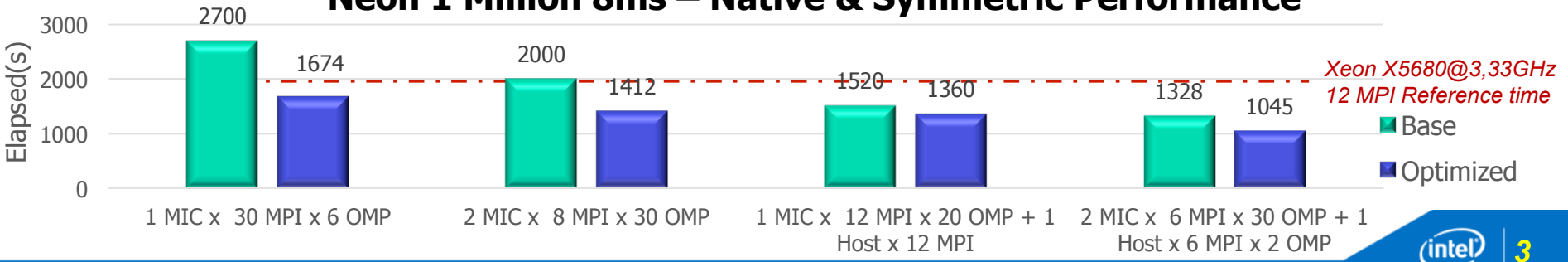
RADIOSS demo at Intel booth @ SC'12

Performance

- **Offload**
  - Performance ~2.5x faster compared to 2-socket Westmere w/o MIC
  - Suitable for Implicit but difficult to generalize to Explicit code…
- **Native**
  - Easy original porting `-mmic` compiler switch!
  - Require highly parallel code – good to have Hybrid MPI/OpenMP!
  - Important optimization work
    - Vtune + compiler (`-vec-report`) + ITAC (MPI)
    - Major vectorization improvement (loop, fast math, …)
- **Symmetric**
  - Easy to generalize
  - Communication cost between host and MIC
  - Problem of arithmetic difference (Parith/ON)

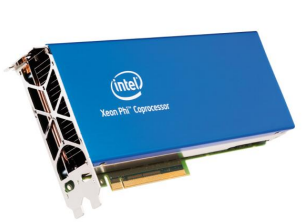


Neon 1 Million 8ms – Native & Symmetric Performance



Insights

- **Good experience**
  - Adequacy between many cores and Hybrid MPI/OpenMP programming model
  - Really helpful tools – vectorization & general speed improvement
  - Great benefit from Xeon Phi experience to improve code on Xeon!
    - Optimization work on vectorization also good for AVX
    - Huge benefit up to 15~20% on Xeon of some OpenMP improvement made for MIC
- **Xeon Phi is an innovative product**
  - A differentiator in term of ecosystem – a "supercomputer on your desk" with all your preferred tools!
  - More for early adopters?



- **Remaining challenges**
  - CPU Performance (intrinsic and hyper-threading)
  - Communication bottleneck (PCI Express)
  - User experience – KNC not as easy as Xeon despite the programming environment availability
- **When will I be able to test KNL? =)**

Questions?

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- **Visit us: Altair Booth 2231**

Thank you!