Towards Exascale Computing in CSCAPES and EASI

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CSCAPES

- SciDAC applied math institute (2006-11)
  - Combinatorial Scientific Computing for Petascale Simulations
  - Participants: Purdue, SNL, ANL, Ohio State

- Sandia research focus:
  - Partitioning and load balancing
  - Sparse matrix ordering
  - Graph coloring
  - Software: Zoltan and Isorropia
EASI

• Joint Math/CS institute (2010-)
  – Extreme-Scale Algorithms and Software Institute

• Research focus:
  – Architecture Aware Algorithms
  – Multi-precision algorithms
  – Resilient algorithms
  – Libraries for the algorithms.
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- Scaling the graph partitioner
  - Partitioning for nodes/cores?
  - Hierarchical partitioning
  - Partitioner that uses a hybrid programming model

- Partition for millions of processing elements
  - Hierarchical partitioning?
  - How to represent the architecture itself
    - Another graph?
    - Who is responsible to provide it?
  - Dynamic repartition
    - How often will the dynamic repartition be called?
  - Dynamic task scheduling on the nodes – Who will do this?
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- Right programming model for future machines
  - MPI + Open MP, MPI + Threads, MPI + Collection of Thread teams + Thread Teams?
- Optimize for better communication, NUMA access, and memory access.
- How to write libraries that survive these changes
- How to keep the applications code “serial”
- How to support applications moving from 32-bit to new libraries? Templates?
Thank You