International Exascale Software Program

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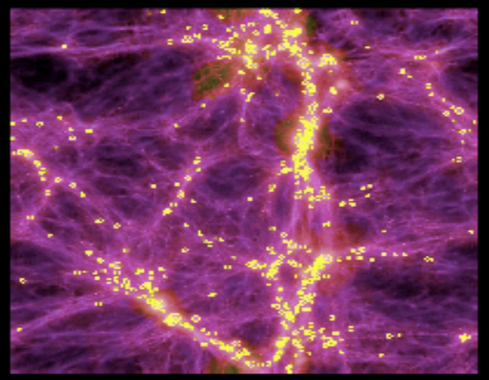
Drivers

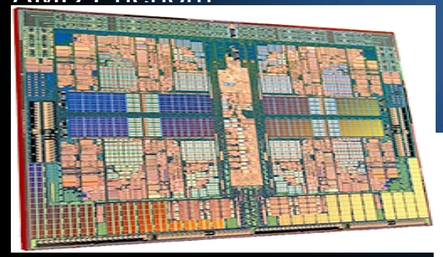
- Advances in most branches of science and engineering are critically dependent on increasingly complex multi-scale, multi-physics, data driven computations and analysis.
- Complexity of Systems
  - Moore's Law and Beyond -- Multicore, manycore, ...
  - Heterogeneous machines
  - Data Intensive Scalable Computing
  - Workflows, Grids, Clouds ...
- All this complexity dealt with by software and tools!
- Support for which is ad hoc, disjoint and spread across divisions, directorates and agencies!



First Cosmological simulations to include black hole physics by Di Matteo et. al. at Carnegie Mellon funded by OCI and MPS/AST.

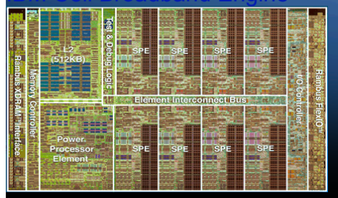
Optimal siting of oil exploration platform estimated by using simulation and optimization tools to maximize product

AMD Phenom

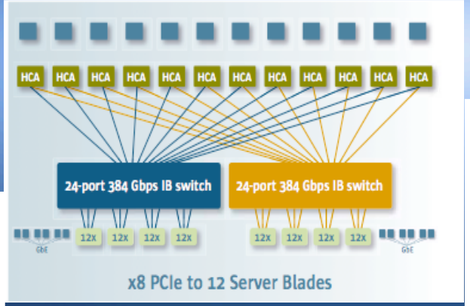


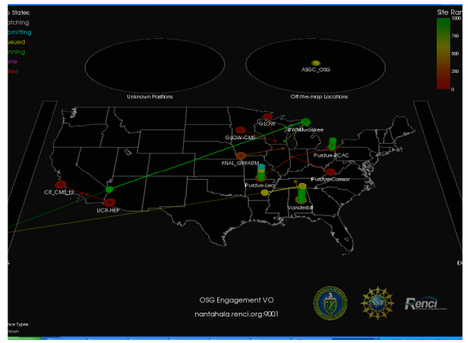
http://www.amd.com/us-en/assets/content_type/

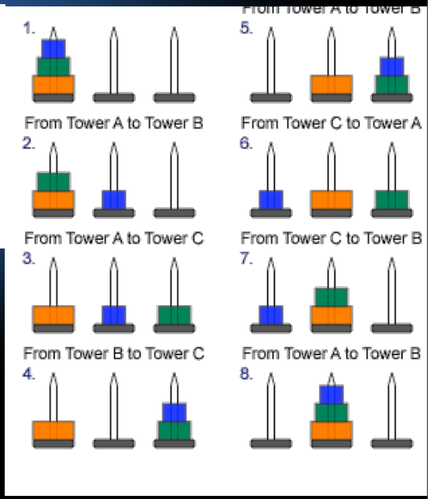
IBM Cell Broadband Engine



http://domino.research.ibm.com/comm/research.nsf/pages/r.arch.innovation.html?open







How?

- NSF/OCI engaged in actualizing “CI Vision...” -- Atkins et. al.
- Computational Science -- the unifying theme across many threads that lead to successful use of computational hardware in the discovery and innovation process -- support for which is ad hoc, disjoint and spread across divisions and directorates
- Advisory Committee on Cyberinfrastructure (ACCI) has formed sub-committees -- “Task Forces” to deal with multiple aspects -- HPC, Grand Challenges, Software, Campus Bridging, Data, LWD

“CI Task Force”

- “opportune time to carefully investigate alternate mechanisms and methodologies for ensuring that the research, development and sustenance of the nation’s software and tool infrastructure is well positioned to help our scientists with a competitive advantage and not a disadvantage.”
- The charge to the group comprises of the following:
  - Characterize and estimate the magnitude and scope of need
  - Develop initiatives and programs to promote future growth, development and sustainability of the software and tool infrastructure needed for transformative research and innovation leading to industrial competitiveness and knowledge leadership.
  - Analyze institutional and other barriers at NSF to promoting and supporting such an infrastructure.

Questions?

- What are the new applications that are emerging or likely to emerge in the coming decade?
- How can NSF best stimulate development of exascale software applications?
- How can useful software that has been developed as part of the exascale effort be sustained beyond the development period?
- What systems software will be required? Distributed systems support, programming environments, runtime support, data-management user tools?

Questions?

- What application support environments will be needed? Application packages, numeric and non-numeric library packages, problem-solving environments?
- How can NSF aid or catalyze developments that make it possible to use the same tools, including compilers, debuggers and performance tools, on system scales all the way down to the typical researcher's laptop or desktop?
- What education and training actions should be considered to prepare researchers, students and educators for future cyberinfrastructure?

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