Solid Earth Systems Scientific Challenges for Petascale

One Scenario: Build a global, near real-time, solid-earth dynamics model; however this includes a number of existing components.

EAR demonstrates complexity in a way that may be different from ATM/OCE. A suite of community models is needed, single one will not suffice. Biggest challenge involves the initial value problem(s).

Geodynamics -> Why do we have plate tectonics? -> Earthquakes; magmatic systems.

- Q4: What types of service and support will your discipline require and what are the types of applications that will need to be supported?
  - Envision: leverage existing, ongoing IT/Data efforts - SCEC, CIG, GEON, EarthScope
  - Research is organized around large problems, Plate tectonics, geo-dynamo, magma-dynamics, petroleum reservoirs, earthquakes, mineral physics - which and how are these related to global geo-systems?
  - E.g. end-to-end community models in SES: SCEC well organized - component suite from science, software, hazards applications, focused on a system-level problem, analogous to the climate problem.
  - The solid-earth science community is doing system-level science and is ready to expand to petascale - at this scale there is a shorter list.
  - Runs on large system versus middle tier developments, what is the pathway between middle and upper tier services - need support for development at all levels of the “pyramid”.
  - Mining the data from ‘big’ runs; broader communities and impacts, e.g. SCEC, SES is just starting to do this - need proportionate resources to facilitate this
  - Observational data is critical for assimilation and model constraints.

- Q1 structuring - BOTH capability and capacity
  - Some SES problems are adaptable to grid technology (aka capacity), others require capability (big everything)
  - SES needs a spectrum of small to large-scale facilities to handle the complexity and variety of computations; prefer to be scalable.
  - Anecdotal/educated guesses:
    - 25% of computational science of SES research is at Terascale; some poised to move to petascale
    - 50% of solid earth science at PC-cluster (capacity).

- Q2 effectiveness
  - Science/computer pathway supported at the discipline/domain science; support for application codes
  - Education, outreach to PIs, etc.
  - CI qualifications: what is it: hw, sw, people,science - balance 1:1:1:1 or CI:science is 1:1?
  - Model of ITR is effective - how to continue that in a model where domain scientists merely pay for programmers
  - To effectively manage this facility - achieve high uptime, minimize wait time, ensure the operational process is transparent and portable from node-to-node (provide service)

- Q3 Allocations
  - Allocation pathway is needed: to scale from development to large production in a computing environment that works effectively without having to do lots of manual effort (know who to ask, etc.)
  - Science review of resource request - science goal, method/algorithm, code/implementation, complemented with technical panel
  - Percentages within disciplines, across disciplines - how are they assigned?
  - Priority and scheduling are very key issues. Need to know expectations and have visibility in the process.

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