Role and Participation of national and international funding agencies

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Background and Overview

- *Existing Funding US*

  DOE ($250M/year in s/w and algorithms for HPC)--

  – OASCR $50M/year (SCIDAC fraction) computer science and applied mathematics both independently and in applications

  – $60M in base programs

  – NNSA ~$100M

  – (30% Univ, 70% Lab)

  – Retargetable $50M??

  NSF $50M (diffuse across many programs),

  OCI, CISE coordinate-- HECURA, PetaApps, CDI, SDCI, STCI, CISE/CCF)

  Retargetable $10M (guesstimate)

  DARPA (*homework*!)

Background …

- *Existing Funding Europe*

  ANR (National Agency for Research) Euro 25M -- in a mix of application and systems software

  GENCI -- substantial investment in PRACE

  Euro 25M national… detailed agreements being worked out

  BMBF Euro 20M for HPC s/w

  Finland Euro 5M

  UK/Italy/Spain/NL/Others …(homework!)

Background …

EC (DEISA, PRACE investments, …)
~E40+M/yr

- DEISA/PRACE etc. E20M/yr
- Computing Systems E12.5M/yr
- Tera-device Computing E7.5M/yr

Background

Japan ???

Other Asian???

Background

- *International Partnership Mechanisms*
  - EC programs open to others -- developed countries pay their way;
    - ANR -- joint program possible but each country funds its own personnel; ANR target 7-8% international
  - Partnership is common but challenging-- time synchronization, …
  - Flexibility in NSF funding scenario using supplements
  - NSF has Office of International Science and Engineering -- area specific expertise both at NSF and locally available

Motivation

- Science & Engineering & Medicine & … needs exascale (see before)! Challenges are increasingly GLOBAL (climate, energy …)
  - Extreme computing now drives all science not just a few classified needs (e.g. ASCI)
- Exascale will be different!
  - Existing stack not adequate/extensible
  - Need *ab initio* effort
  - Exascale effort needs to start ALONGSIDE but SEPARATELY from current tera/petascale efforts IMMEDIATELY
  - Need Roadmap for planning actions and prioritizing investment areas
- Risk Mitigation -- Collaborative efforts spread risk and cost
- Failure to coordinate can delay societal use of exascale
- But Challenges With Petascale will Persist
  - Need continuity of effort Peta --> exa
  - Exascale communities will arise from existing petascale groups

Education & Training

- Joint Education Training
  - Training needs to focus on exascale challenges of concurrency …
  - O(100) students and junior fellowships loosely affiliated to research at large scale computing in both US and EU;
  - Computational Science Graduate Fellowship at DOE more focused but ONLY 10!!
  - Extensive mobility among EU partners
  - Need scaling up in numbers and partners, structured exchanges? Community formation?

Education and Training …

- *Joint Education and Training*
  - New programs in Germany and France HPC Masters -- 50 students/year in each, Teratec, Juelich …
  - HPC related PhD positions in France
  - …

Environment to develop Exascale

- *Weaknesses*
  - Design of research program for the “uncharted territory” of the High Risk-High Return research needed now
  - Industry does not perceive significant immediate ROI compared to other users of HPC; applications that are not at the table
  - HPC needs careful quantification -- e.g. DOE workshop series for some areas of Science
  - Application software vendors need to be involved… ongoing efforts
  - Funding for “new technology adoption” is not flexible enough for quick response needed
  - Availability of critical mass of technical personnel and resources

Environment to develop Exascale

- *Strengths*
  - Science case for benefits from extreme scale computing in the grand challenges of society -- energy, life sciences etc. is clear
  - HPC ROI over the last decades is significant -- recent National Academy study -- Reduction in product development cycle
  - Availability of critical mass of technical personnel and resources at US national laboratories

Collaboration Scenarios

1. Almost no collaboration --Joint workshops only
   - *Not adequate*
2. Loosely Coupled Collaboration -- Benchmarks defined
   - May be beneficial but inadequate in many cases
3. Collaboration with standardization
   - *Can be very beneficial in most areas*
4. Tightly Coupled Collaboration
   - *Beneficial in some cases*

Collaborations

- Collaboration Elements
  - Joint roadmaps, periodic workshops
  - Coordinated Investment
  - Expertise driven joint projects
  - Structured Framework
    - International Clearing house of what is funded
  - Open Source Model
    - *Need policies that promote effective reuse*
    - *Weakness in long term support and maintenance that needs to addressed in funding mechanisms*

Actions

- Respond to “Roadmap” needs defined by the IESP/ DARPA (and other) groups
- Need “new program”?
- New components in existing programs?
- Need stable and longer term framework for collaborations
  - Existing Collaborations Bilateral and driven by individual initiative
  - Need agreements at different levels -- laboratories, agencies, political?
  - Need mechanisms for involving new stakeholders

Action

- Clear definition of “responsibilities” for different groups? Top/down, … Physics community model?
  - Need more multilateral structured mechanisms?
- Funding agencies’ need identified and tangible targets
  - Programming models, compilers, frameworks
  - Support for application drivers -- multiscale, multiphysics, uncertainty quantification …

Timeline for Funding Agency Coordination

- Meet in September to evaluate interim IESP plans --
- IESP workshop in Tsukuba in Oct 18-20
- Draft plans by April 2010