Role and Participation of national and international funding agencies

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Background and Overview

- **Existing Funding**
  - DOE ($250M/year in s/w and algorithms for HPC)
  - OASCR $50M/year (SCIDAC fraction) computer science and applied mathematics both independently and embedded in application teams
  - $60M in base programs
  - NNSA ~$100M
  - (30% Univ, 70% Lab)
  - NSF $50M (diffuse across many programs), OCI, CISE coordinate-- HECURA, PetaApps, CDI, SDCI, STCI, CISE/CCF)
  - DARPA ???
• **Existing Funding**
  - $25M ANR (National Agency for Research) -- in a mix of application and
  - GENCI -- substantial investment in PRACE ... detailed agreements being worked out
  - EC (DEISA, PRACE investments, ...) ~ $45+M/yr
    - DEISA/PRACE $15M
    - Embedded Systems $15M
    - Terascale Computing $15M
Background …

- Challenges With Petascale

- Existing Collaboration
Background …

• **Joint Education and Training**
  – Extensive mobility among EU partners
  – Programs open to others -- developed countries pay their way
  – Partnership is common but problematic -- 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
  – O(100) students and junior fellowships; CSGF
Background ...

- **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,
  - ANR -- joint program possible but each country funds its own personnel; ANR target 7-8% international
Environment to develop Exascale xxx

- **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
  - Decay of some past efforts
  - HPC needs need 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 -- power, life sciences 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
Environment to develop Exascale xxx

• Evolutionary Strawmen
  – Heavyweight with commodity -- embedded systems; Cell phones etc; …
  – Lightweight with custom

• Aggressive Strawman
  – “Clean Sheet”
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

1. Open Source Model
   - *Orthogonal -- mechanism rather than style*
   - *Weakness in long term support and maintenance*
   - NITRD Model?
   - International Clearing house of what is funded?
   - High Risk can be ameliorated by spreading it out -- Lloyds model?