Economic and management challenges and needs of computational resource providers and industry partners

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Background and Overview

- ## Experiences and challenges
  - Insights from vendor and center experience

- ## Technology implications
  - Evolution/revolution

- ## Industry-community coordination
  - Crosscutting and complementary efforts

- ## Collaboration scenarios
  - Precompetitive and competitive
  - Economic and political feasibility

Petascale Lessons for Exascale

- Programs
- Process
- Mechanisms
- Outcomes

- Good
- Bad
- Ugly

Would we do it the same way again?

# We Applied The Fundamental Axiom of Computing …

- … All problems can be solved via another level of indirection

- Which is to say, we discussed how to collaborate and how to create roadmaps

Preliminary Outbrief

- ## Discussion focus
  - Metrics define outcomes (choose wisely)
  - Collaboration models and horizons
    - $N \times X \mathrel{!=} X \times N$
  - Regional differences identified
    - U.S., Europe (e.g., PRACE), Japan
  - Strong interest in international collaboration

- ## High level issues
  - Pre-competitive partnerships desired
    - Horizon should be 5+ years if involving provider competitors
    - Procurement winner(s) known early
  - Co-development implications
    - Shared risk, funding and outcomes
  - Vendor types/sizes have different constraints
    - Risk, time horizon, funding fungibility
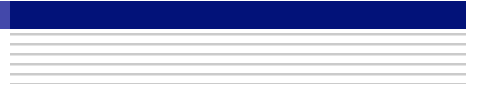
Background

Exemplar Technical Issues Affecting Software

- Parallelism scale
- Component heterogeneity
- Communication
  - bandwidth/latency
- Memory models
- Storage system structure
- Component reliability
- Energy management

- Design options
  - Evolutionary
  - Revolutionary

- Baseline identification
  - Strengths/weaknesses
  - Available resources

- DARPA architecture reference
  - Evolutionary strawmen
    - "Heavyweight" strawman"
      - Commodity-derived microprocessors
    - "Lightweight" strawman"
      - Custom microprocessors
  - Aggressive strawman
    - "Clean Sheet of Paper" silicon

Interaction Modalities and Motivations

- ## Commercial provider issues
    - Profit
    - Differentiation
    - Market share and sweet spots
    - Customer loyalty
    - Interoperability
    - Continuity/sustainability

- ## Type-specific issues
    - ISVs, software, hardware, integrators

- ## Commercial and open source software
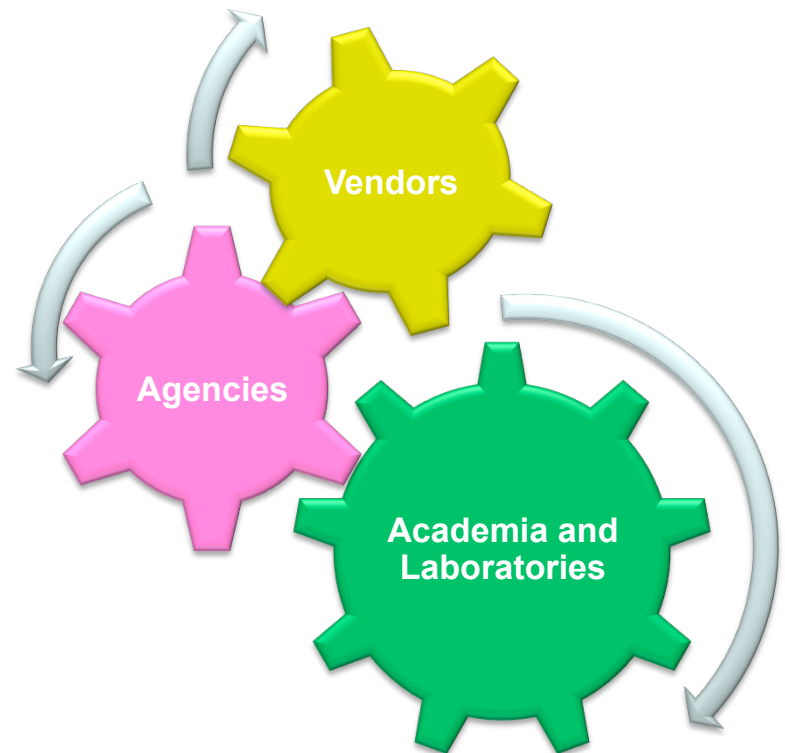
Hypothesis: Timelines and Processes Really Matter

- ## Procurement-driven research and development
  - Rewards incrementalism and product evolution
  - Punishes revolutionary innovation
  - But, it is our historical model

- ## Short timelines reduce collaboration
  - Create vendor competitive pressures
  - Lessen information sharing

- ## Competitive advantage and compatibility
  - Differentiation and interoperability

- ## Implications
  - Define strategic, not tactical roadmaps
  - Enable pre-competitive industry collaborations

Collaboration Scenarios

- ## Tightly coupled collaboration
    - International governance and funding structure
    - Multi-company development teams
- ## Collaboration with standardization
    - Definition of standards, test suites, and benchmarks
- ## Loosely coupled collaboration
    - Focused workshops on software activities
    - Comparison of technical milestones
- ## Little collaboration
    - Periodic workshops, status reports of regions
    - Voluntary and ad hoc usage of project products
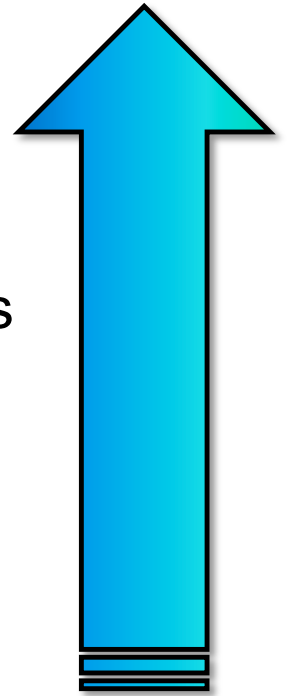
Vendor Exascale Software Roadmap

- The roadmap should
  - Specify ways to re-invigorate the international computational science software community
  - Include computational science software activities across industry, government & academia
  - Be created and maintained via an open process that involves broad input
  - Identify quantitative and measurable milestones and timelines
  - Be evaluated and revised as needed at prescribed intervals
  - Specify opportunities for cross-fertilization of activities, successes and challenges
- Agency strategies for computational science
  - Shaped in response to the roadmap
- Strategic plans
  - Recognize and address roadmap priorities and funding requirements.

Roadmap/Milestone

	2009	2010	2011	2012	2013	2014	2015	2016
Software/ Language Issues								
Sustainability								
Collaborative workshops								
Coordinated research								
Educational activities								
Standards activities								
Priorities								
Staffing								

- Coordination mechanisms
- Research and development topics