High-End Computing University Research Activity

(HEC URA)

The 100,000 foot view brought down to earth …

Need for <u>Basic Research in HEC</u> Identified in Previous Studies and Reports

President's Information Technology Advisory Committee, Report to the President, "Information Technology Research: Investing in Our Future," February 24, 1999.

- Innovations are required in high-end systems and application-development software, algorithms, programming methods, component technologies, and computer architecture. … Current Federal programs that address innovative high-end architectures and technologies are too small, having shrunk dramatically in the last decade.

Report of the Defense Science Board, "Task Force on DoD Supercomputing Needs," Office of the Under Secretary of Defense for Acquisition, Technology and Logistics, October 11, 2000.

- "The third recommendation of the Task Force is for the DoD to invest in long-term research … essential to refilling the Research and Development (R&D) pipeline with new technologies that will enable tomorrow's supercomputers … best carried out by universities and research laboratories where scientists can focus on long-term research without the pressing need to support short-term development.

"Report on High Performance Computing for the National Security Community," Department of Defense, submitted to Congress April 2003.

- "… in short, the research pipeline has been drained and needs refilling."

HECRTF RD&E Strategy

Activity	Purpose	Performers
Basic and Applied Research	*Refill the academic pipeline with new ideas and people*	*Academia and government labs*
Advanced Development	*Develop component and subsystem technologies*	*Mostly industry led, partnering with academia and government labs*
Engineering and Prototype Development	*Integration at system level and development of Serial No. 1*	*Industry*
Test and Evaluation	*Reduce risk for development, engineering, and government procurement*	*Government labs and HEC centers*

High-End Computing
University Research Activity

- **Begin implementation of basic and applied research under the High-End Computing Revitalization Task Force Plan**

- **Address critical need to re-establish research & researchers pipeline in HEC**

- **Multi-Agency participation in topic selection, proposal review, and project execution**

Strategy

- **Desired Results**
  - Building critical mass in research teams
  - Advance the field towards goals of HECRTF 2010/2015 software
  - Avoid duplication and share lessons learned
  - Develop links between basic research and advanced development and engineering

- **Planning**
  - Proposal submissions process with coordinated look-and-feel
  - Single portal at NCO pointing to NSF and DOE/SC solicitations
    - http://www.itrd.gov/hecrtf-outreach/hec-ura/index.html
  - Develop teaming mechanisms across HEC agencies
  - Start in FY2004

HECRTF RD&E - Key Technology Areas

Hardware

⇨ Microarchitecture
⇨ Memory
⇨ Interconnect
⇨ Power, cooling, and packaging
⇨ I/O and storage

Initial Focus

Software

⇨ Operating systems
⇨ Languages, compilers, and libraries
⇨ Software tools and development environments
⇨ Algorithms

Systems

⇨ System architecture
⇨ Reliability, availability, and serviceability (RAS)
⇨ System modeling and performance analysis
⇨ Programming models
⇨ System modeling and performance analysis

Topic areas in FY04

- **DOE/Science solicitation focus is**
    - **Operating Systems**

- **NSF solicitation focus is**
    - **Languages, compilers and libraries**
    - **Software tools and development environments**

- **Expect to expand beyond these areas in FY05**

DOE/Science and NSF

- **DOE/SC FY2004, $4.5M, including $1M DARPA contribution**

- **FY2004 research announcement:** *Operating/Runtime Systems for Extreme Scale Scientific Computation*

- **24 proposals, ~$75M in proposed research**

- **6 awards totaling $14M over 3 years in lab, university, and industry research partnerships**

- **$6M in academic funding**

- **$7M/year for each of 3 years planned**

- **FY 2004 NSF/DARPA activity focused on research in languages, compilers and libraries**

- **100 proposals submitted in July 2005**
  - **82 projects submitted by 57 US academic institutions and non-profit organizations**
    - **Includes no-cost national lab and industrial lab collaborators**

DOE/Science and NSF

- **Reviewed in June; DOD, NSF participants in panel review process**

- **Six awards in these areas:**
  - **Reliable, scalable, adaptive Linux**
  - **Dynamic OS/Application optimization**
  - **MicroKernels**
  - **Plan 9**
  - **Framework for OS/Runtime adaptability**

- **NSF peer reviewed took place 5-6 August**

- **Nine projects were awarded in these areas**
  - **Tools and libraries for high-end computing**
  - **Resource management**
  - **Reliability of high-end systems**

Funding and Project Starts

Proposed	FY04	FY05	FY06	FY07	FY08
Funding	$10M	$10M	$10M	$10M	$10M
New-starts	14	7	6	6	1

Current Plan	FY04	FY05	FY06	FY07	FY08
Funding	$11.5M	$13.5M	Tbd	Tbd	Tbd
New-starts	15	Tbd	Tbd	Tbd	Tbd

Further details

- **BOF, Wed. 5:30, Room 325**
  - **FAST-OS: Scalability in Runtime and Operating Systems**

HEC URA Planning Group

- **Candy Culhane (NSA) – Chair**

- **Kamal Abdali, Jose Munoz (NSF)**

- **Robert Graybill (DARPA)**

- **John Grosh (DOD)**

- **Fred Johnson (DOE/SC)**