

# The Role of High Performance Computing in a Cyberinfrastructure Framework

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Peter A. Freeman

Assistant Director, National Science Foundation

Computer and Information Science and Engineering (CISE)

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“[Science is] a series of peaceful interludes punctuated by intellectually violent revolutions . . . [in which] . . . one conceptual world view is replaced by another.”

--Thomas Kuhn

From *The Structure of Scientific Revolutions*

Advancing technology and  
innovative computational  
techniques are  
*revolutionizing*  
science and engineering.

## NSF's Role

- *A special responsibility to serve all of S&E*
- *Have enabled much of the revolution now taking place, both in technology push and application pull*
- *Long history of leadership in providing computing resources to serve research and education*
- *Committed to continuing this leadership legacy*

# Cyberinfrastructure: the future consists of ...

- Computational engines (supercomputers, clusters, workstations – capability and capacity)
- Mass storage (disk drives, tapes, ...) and persistence
- Networking (including wireless, distributed, ubiquitous)
- Digital libraries/data bases
- Sensors/actuators
- Software (operating systems, middleware, domain specific tools/platforms for building applications)
- Services (education, training, consulting, user assistance)

*All working together in an integrated fashion.*

# The Role of High-End Computing

- Supercomputers
  - high end computing, “capability” computing
- A vital component of CI - always has been, always will be.
- BUT, an always changing set of users
- The strategy: capability coupled with a balanced approach.

# Guiding Principles

- *Serve all of science & engineering*
- *Firm and continuing commitment to providing the most advanced cyberinfrastructure (CI), including supercomputers (HEC).*
- *Encourage emerging CI while maintaining and transitioning extant CI*
- *Provide balance in CI equipment*
- *Lead the fundamental research necessary to create future generations of CI*

## NSF HEC INVESTMENTS

- *TCS (LeMieux at PSC) in FY00: \$36,000,000*
- *Terascale (DTF, ETF, TEP): \$89,728,041*
- *PACI Equipment (FY 98-04): \$169,087,852*

# HEC-URA: New Initiative

- High-End Computing University Research Activity
  - Outgrowth of HECRTF 2003
  - NSF, DOE, DARPA, NSA
- Fund universities to conduct research in software specifically for high-end computing
- DOE/DARPA effort: Operating/Runtime Systems for Extreme-Scale Scientific Computations
- The NSF/DARPA: Software and Tools for High-End Computing
  - \$7M planned for FY04 (CCF, CNS, SCI)
    1. Efficient interactions between applications and systems
    2. Exploiting the deep memory hierarchy
    3. System scalability and reliability

# Closing Remarks

- NSF will continue to lead the way in providing capability and capacity computing to the open scientific community.
- Despite budget challenges, at the end of the day our actions will match the words of our commitments.
- HEC must be a central element of CI.
- At the same time, the optimal and right strategy is a balanced and broad CI to serve all of science and engineering.

# Contact Information

Dr. Peter A. Freeman

NSF Assistant Director for CISE

*Phone: 703-292-8900*

*Email: [pfreeman@nsf.gov](mailto:pfreeman@nsf.gov)*

Visit the NSF Web site at:

*[www.nsf.gov](http://www.nsf.gov)*