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Highlights of the
FY2001 IT R&D Budget Request
Dr. Ruzena Bajcsy
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Breakout of funding by PCA $ in Millions

<table>
<thead>
<tr>
<th>PCA</th>
<th>FY2000 Enacted</th>
<th>FY2001 Request</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCI &amp; IM</td>
<td>91.6</td>
<td>135.8</td>
</tr>
<tr>
<td>LSN</td>
<td>81.2</td>
<td>111.2</td>
</tr>
<tr>
<td>HECC R&amp;D</td>
<td>83.8</td>
<td>102.1</td>
</tr>
<tr>
<td>HECC Apps &amp; Infrastructure</td>
<td>206.0</td>
<td>285.2</td>
</tr>
<tr>
<td>SDP</td>
<td>15.8</td>
<td>39.5</td>
</tr>
<tr>
<td>HCSS</td>
<td>9.6</td>
<td>20.5</td>
</tr>
<tr>
<td>SEW &amp; Workforce Dev.</td>
<td>28.6</td>
<td>45.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>516.6</strong></td>
<td><strong>739.6</strong></td>
</tr>
</tbody>
</table>
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- 51% of proposed FY2001 increase will support longer-term IT research (3 years out or longer)
- 29% of proposed FY2001 increase will support applications development
- 20% of proposed FY2001 increase will be used to acquire infrastructure
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IT R&D supports NSF’s broad mission to initiate and support:

- Basic scientific and engineering research
- Programs to strengthen scientific/engineering research potential and education at all levels

Advances in IT research will enable all science and engineering communities and other sectors to be more productive and examine new, complex problems.

IT investments will deliver capabilities and tools to benefit people at every level of education.
Software Design and Productivity

- Application-focused software systems for end user programming.
- “No-surprise” performance-engineered software and infrastructure systems.
- Hardware/software co-design.
- Theoretical foundations of on-line decision making.
- Component-based software systems to address quality and productivity issues.
Human Computer Interface and Information Management

- Technologies for meeting, working, and collaborating online.
- Assistive technology to make computing accessible to more people.
- Ubiquitous content infrastructure.
  - Online scientific data.
  - Large-scale scientific data mining research.
  - Seamless retrieval of available information.
- Content-based information theory.
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- High Confidence Software and Systems
  - Technologies to build, design and analyze IT systems for security, availability, reliability and safety.
  - Verification of system designs.
  - Critical Infrastructure Protection: networking, high performance computing and software research that will enable computer and communications systems to be safer, more reliable, and free from intrusions.
Scalable Information Infrastructure (1)

- Middleware for applications development on high performance networks.
- Wireless network access with improved data rates and improved interoperability with fixed networks.
- Broadband Internet access for tetherless devices.
- Improved network architectures, protocols, monitoring, and management tools and techniques.
Scalable Information Infrastructure (2)

- Understanding, modeling, and predicting network behavior.
- Extending high performance network connectivity to additional members of the research and education community.
  - Access network technologies that extend reach of high performance network environments to more institutions, such as HBCU’s and colleges, and closer to users.
  - Very high performance broadband access networks including optical networks.
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- High End Computing R&D
  - Revolutionary Computing (e.g., Quantum, Neuro-Biological and DNA Information Processing).
  - Advanced Computational Research.
    - Three technical thrusts: visualization, data handling, and parallel numerical algorithms.
    - Large Scientific and Software Data Set Visualization program.
    - Center for Large Data Sets and Analysis.
High End Applications in Biology

- Computational algorithms and functional linkages among diverse databases for functional genomics and modeling.
- New approaches to visualization of biological data.
- Scaling algorithms essential for relating, for example, cellular functions to changes in ecosystems.
- Data models that accommodate high degrees of complexity and ambiguity in biological systems.
- IT for Biology Program.
  - Investment in areas of biological research poised to benefit from IT research advances, e.g., genomics, protein folding and molecular design.
High End Applications in Engineering

- Simulation of complex molecular phenomena and macroscale systems.
- Process modeling for the service sector: concurrent product, process and supply chain architectures and other structures; a semantic framework for managing information flow in an enterprise network.
- Tether-free communications for secure and seamless information transmission and reception, and conduct of work and personal tasks from any location.
High End Applications in the Geosciences

- Enhanced computational models and capacity at the National Center for Atmospheric Research.
- Expanded capabilities of the Upper Atmospheric Research Collaboratory.
- Continued development of computational resources to enable analysis and synthesis of data from major global ocean field programs, and develop predictive global- and regional-scale coupled ocean-atmosphere models.
- Computationally challenging research topics in the Earth sciences including dynamic modeling of Earth system processes and management of very large data sets.
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- **High End Applications in Mathematics and the Physical Sciences**
  - Algorithm development, statistical analysis, optimization theory, network design, physics of information, understanding limits to computation, and fundamentals of quantum/optical computing.
  - Ultra-miniature chemical switches, gates, new realizations of electronics, nano-devices and revolutionary computing.
  - Advanced computational methods for chemistry, materials, etc..
  - Integration of computation and measurement for “smart” networked instruments.
High End Computing Acquisitions

- Second 5 teraflop computing system acquired in FY 2001.

Terascale Computing System FY 2000 Milestones

- 12/30/99  Solicitation released for FY 00
- 04/03/00  Proposals due
- 06/15/00  Site visits completed
- 07/15/00  Recommendations and NSB documents prepared
- 08/03/00  NSB action
- 09/15/00  First Terascale award in place
- 02/15/01  System in “user friendly” mode
- 04/01/01  Sustained demonstrated of an application

Terascale FY 2001 Competition

- 11/01/00  Solicitation released
- All other dates follow 2 MO earlier than FY 2000 milestones.
Social, Economic, and Workforce Implications of IT and Workforce Development (1)

- Demonstration tests of new Internet-based research techniques, e.g., online interviews and surveys.
- Research developing and employing digital libraries.
- Computational social science research to develop new techniques for collecting, archiving and analyzing social-science data.
- Enhanced support for IT in Advanced Technological Education program
- Expanded research on social, economic, legal and ethical implications of IT and the digital divide.
Social, Economic, and Workforce Implications of IT and Workforce Development (2)

- Research on reasons for lower participation in IT education and career paths by women and minorities.
- Research on IT use in educational settings.
- Research in Interactive Education program.
  - A research base for new means of delivering education to traditional and non-traditional students.
- College Connections program.
  - Network middleware and connectivity to facilitate access to high bandwidth networks for four-year colleges across the country.
Funding Mechanisms (1)

- Mechanisms used to Accomplish Proposed R&D
  - Managed by CISE Directorate and coordinated by cross-directorate ITR Coordinating Committee
  - Increased emphasis in all areas with a particular increase in scientific research applications of IT
  - One cross-directorate solicitation will be issue
  - Standard NSF merit review process will be employed
  - Review process will be modeled primarily on FY 2000 competition. New in FY 2001, each directorate will take leadership in review of relevant application-driven proposals, with participation from CISE
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- Funding Mechanisms (2)
  - Plans for Funding Types of Centers Recommended by the PITAC
    - NSF will initiate an additional 11 centers focused on major disciplinary science and engineering research challenges.
    - Some centers will develop testbeds and will have significant education, training and outreach components.
    - Some centers may be "virtual" centers that join geographically separate institutions via high performance network links; others may be at a single location.
  - An estimated 100% of funding will go to institutions of higher education.
Coordination and Collaboration in IT R&D

- NSF, a basic research agency, is especially a leader in:
  - Teleimmersion and human computer interaction; assistive technologies; ubiquitous network access; network middleware; interactive educational technologies; software languages and environments; and SEW aspects of IT.

- NSF’s efforts complement:
  - DoE activity in high performance computing (HPC), NASA activity in synthetic environments, DARPA activity in embedded systems, and NIH activity in digital atlases and HPC.

- NSF is coordinating efforts with DARPA on embedded systems and digital libraries and with NIH on HPC.

- NSF recently signed an MOU with NASA on a broad range of research topics, including information science.
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- **Expected Congressional Reaction to FY2001 Budget Request**
  - NSF expects strong bipartisan Congressional support.
  - PITAC can continue to express support for the IT R&D initiative and to make the case why the initiative is vital to the Nation’s continued leadership in IT and consequently it’s economic well being.