Computing Research Association

Conference at Snowbird 2000

Slides from a plenary session

on the topic of

"What are the Important Research Areas for the New Millenium?"

presented by

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Monday July 10, 2000
8:40 am

http://www.cra.org/Activities/snowbird/00/plenary1.html

What Are the Important Research Issues for the New Millennium?

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Multiple Panel Roles

- PITAC member
- Software systems researcher
  - Language design and implementation
  - Software development
  - High-end computing

PITAC Research Priorities

- Software
  - The Nation needs software that is far more usable, reliable, and powerful than what is being produced today.
- Scalable Information Infrastructure
  - Learn how to build and use large, complex, highly-reliable, and secure systems
- High-End Computing
  - Drive research by trying to attain a sustained peta[fl]ops on real applications by 2010 through a balance of software and hardware strategies
- Socio-economic Impact
  - IT research on socio-economic & policy issues
  - Accelerate and expand education in IT at all levels

PITAC Vision: IT Transforming our Society

- Transforming the Way We Communicate
- Transforming the Way We Deal With Information
- Transforming the Way We Learn
- Transforming the Practice of Health Care
- Transforming the Nature of Commerce
- Transforming the Nature of Work
- Transforming How We Design and Build Things
- Transforming How We Conduct Research
- Transforming Our Understanding of the Environment
- Transforming Government

Why is Software Research Important?

- If we project the current labor shortage, every worker will be a programmer (a software producer)

- If we project the IT transformations, every person will be a computer user (a software consumer)

Software Research Challenges

- Enable fewer people to produce more
  - Greater abstraction
  - Deeper understanding of properties – reliability, security, QOS, correctness, efficiency, structuring and organization, application requirements, …
- Greatly improve ease-of-use for everyone
  - Not just user interfaces –
  - Appropriate services
  - Predictability
  - Adaptability
  - Tolerance for physical and cognitive limitations

What about High-End Computing?

- Platforms are becoming ever more complex
  - Performance issues; economic issues
  - Software to exploit the platforms is difficult
- Vast amounts of complex data are involved
- High-speed, long-distance communication is an essential component

Fundamental Research Agenda Remains

- Give people the ability to express their computations precisely at a high level and to reason about them
- Map those computations to computational platforms in a manner that achieves the desired behavior

What Keeps Changing

- Richness of Human/Machine Interface
- Size and Diversity of Computations to be Described
- Complexity and Diversity of Platforms

Ideas to Exploit for Software Development

- Persistence – more than just profile data and `make` systems and data caches
- Multimedia interfaces – more than just data visualization and algorithm animation
- Analysis and inference - affordable and powerful
- Broad notions of language

Concluding Observations

- We need to look further ahead
- We need to consider the world around us
- We must be willing to try things that fail
- We need to think “outside the box”