

Software Design & Productivity



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Day 1



- **Presidential Information Technology Advisory Committee (PITAC) points to Software as central product and problem**
- **<http://www.itrd.gov>**
- **Major Recommendation: “Make fundamental software research an absolute priority”**
- **Four major research priorities:**
 - Software
 - Scalable Information Infrastructure
 - High-End Computing (including software R&D)
 - Socio-Economic & Workforce Impacts



PITAC

■ **Software Research: Findings**

- Software demand exceeds Nation's ability to produce
- Nation depends on fragile software
- Technologies to build reliable & secure software inadequate
- Nation under-investing in fundamental software research

■ **Software Research: Recommendations**

- Fund fundamental research in S.D. methods & component tech.
- Sponsor national library of sw. components in subject domains
- Make software research substantive component of every major IT research initiative
- Fund fundamental research in human-computer interfaces & interactions

What Next?

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- **What are the fundamental problems?**
 - NOT making Java secure or UML sound and consistent
 - **What are the real barriers and challenges?**
 - NOT attaining absolute security and assurance
 - **What are the most promising directions?**
 - NOT creating the ultimate formal specification notation
 - **What is the ideal outcome?**
 - NOT infinite productivity at zero quality
 - **How should software research be pursued?**
 - NOT as a theoretical *tour de force*; NOT as eternal slash & build

Barriers and Challenges

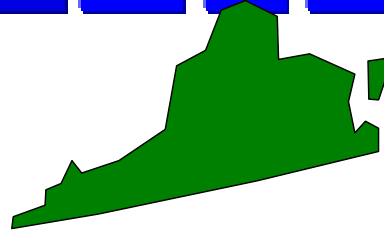


- Intellectual control over
unbounded complexity
- Systems are
distributed
heterogeneous
hybrid
untrusted

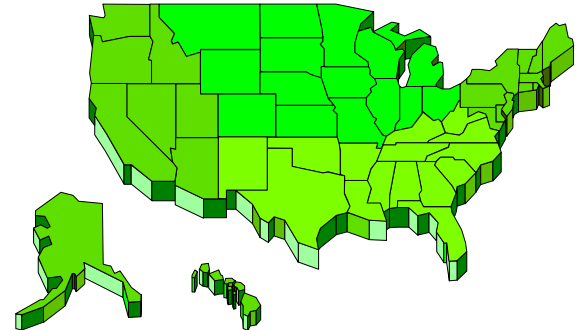
New Software for a New Millennium



■ Where have we been?



■ Where are we today?



■ How should we get to 2010?



Establishing an SDP Research Agenda



1. Attack the **major problems**
2. Environment of **technological advance**
3. Solve **tomorrow's problems**
4. Remember it's an **Engineering problem**

1. Attack the Major Problems



- **Productivity of workforce**
- **Fragility of existing software**
- **Building for Reliability and Security**

2. Technological Advance



- **Invention is the mother of necessity**
- **New technologies mimic the past:**
 - **Imitation is flattering, but faces backward**

3. Solve Tomorrow's Problems

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- IT is the *creator*
and the *victim*
of intensely rapid change
 - Convergence of technologies and
expansion of applications

NCO, NSF, and Today's Charge



- **NCO coordinates across a large constituency:**
 - NASA, NIST, DARPA, NSF, ARO, ONR, DOD, FAA, DOE, NOAA, NSA, NIH, ...
 - Each agency has different interests in IT research
- **If we want agencies to invest, we have to have an exciting agenda that connects to their concerns**
- **NSF/CISE has half a billion dollars to spend**
- **Like to see at least \$50M of this in SDP**
- **NSF interested in the most fundamental aspects of the research**



Day 2

Fundamental Research



- **What science underlies software process and software construction?**
- **What fundamental limitations exist on size, complexity, compositionality, testability,...?**
- **What research is needed to evaluated alternative strategies to increase productivity?**
 - Component technologies
 - High-level abstractions
 - Empowerment of end users
 - Open software approaches
 - Process automation
 - New approaches to development

Fundamental Research

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- **How can we build for change?**
 - **How do we exploit (rather than disparage) the sea of legacy code?**
 - **How do we do the “city planning” to architect a cyber world that is not the equivalent of a slum or an endless strip mall?**
 - **What new technologies pose the greatest challenges to our basic assumptions?**
 - **How do we validate/refute our basic assumptions?**
 - **What can we do to lower barriers to tech infusion?**

Deliverables



- **By noon today, each subgroup should produce**
 - Powerpoint slides + Notes
 - Additional statement of directions, challenges, concerns,...
- **Need specific ideas that can lead to research themes**
- **Federal research funding can support almost any kind of research, development, infrastructure, testbeds, human development, education, ...**
- **If you had \$5 billion to spend, what would you do?**