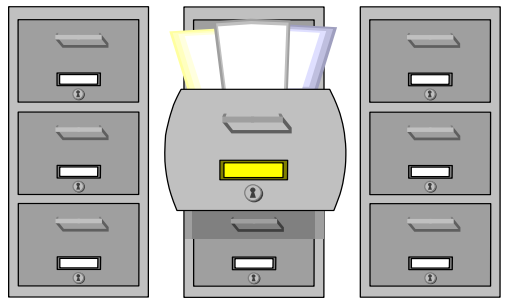
Software Design & Productivity



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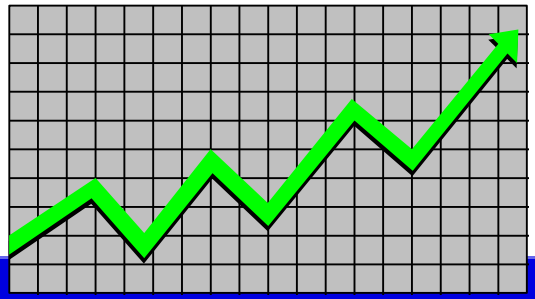
Day 1

PITAC

- 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



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

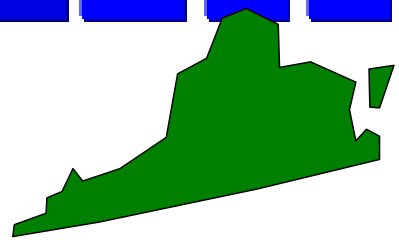
What Next?

- 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

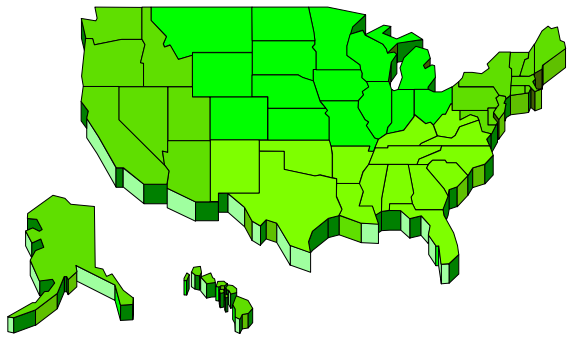
Barriers and Challenges

- **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

- **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

- 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?