Software Research

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Findings

- Demand for software exceeds production
- The Nation depends on fragile software
- Reliable and secure software inadequate
- Software diversity and sophistication growing
- More and more ordinary people use software
- Under-investment in fundamental software research

Finding: Demand for software far exceeds the Nation's ability to produce it

- Software gap:
  - Everyone & everything needs software, BUT
  - Software more complex, labor shortages, poor technology...
- Will inhibit progress!
- Need: Software Research
  - Software research >> software engineering
  - Includes: tools & systems for commerce, embedded devices, information management, interoperability, etc...

Finding: The Nation depends on fragile software

- Fragility:
  - Unreliability,
  - Lack of security,
  - Performance lapses,
  - Difficulty in upgrading, etc.
- Examples:
  - IRS,
  - Air traffic control,
  - Year 2000 bug, etc.
- Need: Technologies for building robust systems

Finding: Technologies to build reliable and secure software are inadequate

- Hardware ↑↑↑↑↑
- Software ➔
- Need:
  - Meaningful software specifications
  - Sound approaches for development and testing
  - Libraries of robust components

Finding: The diversity and sophistication of software systems are growing rapidly

- Need advances:
  - Real-time software
  - Interoperable software
  - Ubiquitous computing
  - Human-computer interaction
  - Scalability
  - And many more….

Finding: More and more common activities of ordinary people are based on software.

- Software critical in:
  - Banking,
  - Finance,
  - Entertainment,
  - Medicine, etc.
- Need:
  - Support for inexperienced users
  - Research in HCI and human-centered info management
  - System integration (middleware)

Finding: The Nation is under-investing in fundamental software research.

- Need ideas for commercial advances in 2015
- Systematic under-investment in software
  - Example: HPCC, focus on short-term problems, no general-purpose software technologies,...

Recommendations

- Fundamental research in:
  - Software development methods and component technologies
  - Human-computer interfaces and interaction
  - Information management
- Software research in every IT research initiative

Recommendation: Fund more fundamental research in software development methods and component technologies

- Component-based software
- Automated analysis, simulation, testing
- Library of verified components
- Predictable reliable and secure systems
- Interoperability of applications

Recommendation: Support fundamental research in human-computer interfaces and interaction

- Reduce errors and misinterpretations
- Enhance complex control settings
- Increase use of natural language
- Provide more assistance to user
- Access by people with handicaps

Recommendation: Fund more fundamental research in information management techniques to (1) capture, organize, process, analyze and explain information and (2) make information available for its myriad uses

- Tools for data mining, filtering, privacy, ...
- Multimedia information management
- Digital libraries
- Exploiting information semantics
- Visualizing and understanding information
- Tools for integrating heterogeneous information

Recommendation: Make software research a substantive component of every major IT research initiative

- Software research essential in all IT initiatives
- Reverse under-investment in software research

Budget

Table 1 Funding increases for Software Research ($ millions)

		FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Software Engineering and Component Technologies HCI and Information Management	Added	112	268	376	472	540
	Total with 1999 base	421	577	685	781	849

Major Recommendation

- Make fundamental software research an absolute priority