Information Technology: Transforming Our Society

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Irving Wladawsky-Berger

- Importance of Information Technology to Society
- Need for Major Advances to Address Technical Challenges
- Need for Major Advances to Address Societal Challenges
- "Grand Challenge" Transformations

Transforming the Way We ...	Challenges	Benefits
Communicate	• Scale for growth & reliability of telephone system • Improve human interaction with computers • Address fragility • Global networking issues • Find best use of new communication possibilities: 1 on 1 & groups	• One billion users can access Internet simultaneously, regardless of language and physical limitations
Deal with Information	• Improved data access methods • Multimodal human-computer interaction technologies • Reliability / bandwidth: audio & video-streaming improvements • Scalable software support • High performance computing • Delivery & protection of critical information • Policy re: electronic preservation of information	• Access, query, & print any book, magazine, newspaper, video, data item, or reference document, regardless of language using mouse, touch screen, speech, or eye-link • Value added through refreshed and software enabled tools
Learn	• Scalability & reliability needed for information infrastructure • Improved software technologies for development of education materials & support their modification and maintenance • Determine best use of computing and communication technologies for effective teaching / learning • Learn which traditional teaching methods to leave alone • Learn how to teach children best use of these new technologies	• Regardless of location, age, handicaps, or schedule, anyone can participate in online education programs • Everyone can access educational materials to discover best learning style for them • Customized educational programs for everyone: no one is left behind
Conduct Commerce	• Privacy and security to ensure consumer confidence • Reliability of communication networks, computers, & business applications	• Customers can reach any company regardless of location • Immediate feedback facilitates fast adjustment of marketing strategies & inventories • Consumers shop at their convenience • Companies immediately access to funds from sales • Consumers have automated statements permitting improved financial management
Work	• Develop high-speed networking for all regardless of location or handicap • Develop software to allow effective collaboration • Ensure privacy & reliability of information infrastructure • Determine how employers, employees, & self-employed can respond to changes	• Workers have access to jobs regardless of proximity to population centers • Workers live where they want, not needing to be near jobs • Workplace can better accommodate individual needs
Practice Health Care	• Ensure privacy of knowledge repositories • Develop robotics & remote visualization methods to support applications such as telepresent surgery	• Doctors use teleconferencing & telecasting to interview & examine patients • Surgical procedures can be demonstrated with full-based video • High-end systems provide expert advice • Patients access biomedical information, gaining empowerment to make decisions
Design & Build Things	• High-end computing technologies needed for concept design, simulation, analysis with interactive control & computation steering, moving archived data, rendering of data • Need bi-directional engineering development processes linked with business processes	• Complex designs done via computer simulations • All parties, including end users, participate in process • Safer products, higher quality, lower costs
Conduct Research	• Research problems become more complex and interdisciplinary • Researchers need to find innovative ways to collaborate	• Research conducted in virtual laboratories, interacting, accessing instrumentation, sharing data and other resources, all regardless of physical location • All journals available on line
Deal with the Environment	• Accurate & robust climate modeling research to improve forecasting • Increase computing capability by orders of magnitude • Develop improved numerical methods & algorithms, base for data storage, management, analysis & visualization, software development & testing, and advanced networks for distributed computing	• Reliable climate models • Models accurately predict response of ecosystems to changes in conditions • Fully integrated models facilitate decision making by scientists and policy makers
Conduct Government	• Develop significant improvements in data access, high performance file systems & tools • Develop reliable, secure networks & software to deliver & protect critical data • Improve wireless, base network technologies & adaptive networks, improved computational environments, & collaborative environments	• Government services & information available to all regardless of location computer literacy etc • One-stop shopping for locating information • Automated business processes accelerate responses • Enhanced responses to natural disasters

- Government must take the Lead for Funding Long Term Information Technology Research, for a variety of reasons:

    - National Security
    - Education and Training
    - Science and Technology
    - Economic Benefits
    - Societal Implications

- Industry cannot take the leading role in funding long term information technology research
- Industry must focus on being successful in the marketplace by developing competitive products and services, at increasingly short development cycles
- While the IT industry invests significantly in R&D, the bulk of the investment is product development (90%), the bulk of the remaining is short term, applied research, with only a few larger companies doing any long term, basic research

- R&D has declined as percentage of revenues due to competitive pressures on prices and profit margins, putting further pressure on long term research
- The Federal Government has the major responsibility for long term, basic research, while industry has the major responsibility for bring products and services to the marketplace