Results from CSTB studies apropos broadband benchmarks

Jon Eisenberg, Director, CSTB

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CSTB & the National Academies

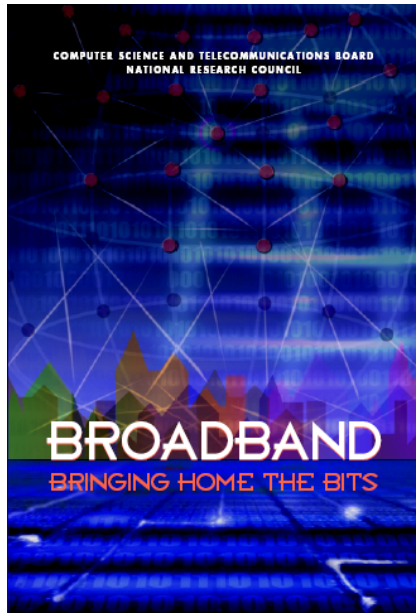
- **National Academy of Sciences** (Founded 1863)
- **National Academy of Engineering** (Founded 1964)
- **Institute of Medicine** (Founded 1970)

- **National Research Council** (Founded 1916)
  - Operating arm of NAS, NAE, and IOM
  - ~10,000 volunteers and over 1,000 professional staff
  - ~600 active study committees
  - ~200-250 reports study committee reports annually
    - Consensus advice and reports on convenings

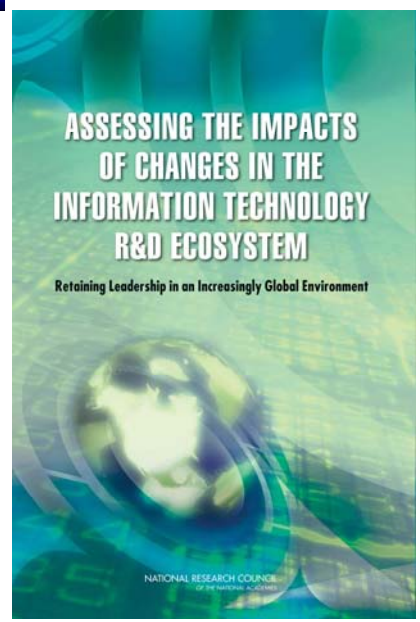
- **Computer Science and Telecommunications Board**
  - NRC unit for information technology and policy, including telecom

CSTB studies

***Broadband: Bringing Home the Bits* (2002)**

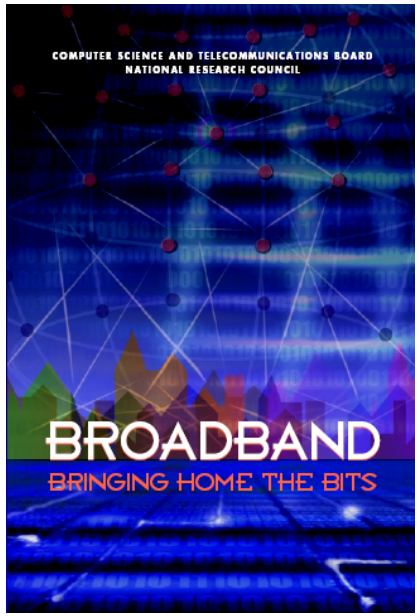


***Assessing the Impacts of Changes in the IT R&D Ecosystem: Retaining Leadership in an Increasingly Global Environment* (2009)**



Broadband: Bringing Home the Bits

(2002) examines the technical, economic, and policy challenges involved in expanding residential access to broadband



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contents

defining broadband

- A whole chapter in the report!
- Multiple dimensions
- Dynamic--definition will change over time (Broaderband)

not just speed

- Latency—how long it takes to deliver packets across the network
- Jitter—variation in the latency
- Symmetry between upstream and downstream capacity
- Always-on
- Connectivity sharing and home networks
  - Products for sharing widely available; not always used
- Addressability
  - Dynamic vs. static address; direct access vs. NAT
  - Clever work-arounds ameliorate—but require additional services
  - Functionality vs. security tradeoffs
- Controls on applications and content
- Internet or multi-service
  - What is (will be) delivered using plain IP vs. more specialized protocols and architectures?

Who benefits from workable definitions?

- *Consumers*, who would like to be able to evaluate service offerings to see if the offerings are likely to meet their needs
- *Service providers*, who would like to develop, invest in, and deploy services that consumers will need and want
- *Application and content developers*, who would like to understand and track the connectivity performance options available to consumers
- *Policy makers or regulators*, who seek to monitor broadband service deployment and measure the impact of policy or regulatory decisions on deployment; define the characteristics of services eligible for grants, tax credits, or loans; or define the characteristics of services required in build-out commitments associated with regulatory relief
- *Public interest groups*, which seek to evaluate capabilities available to consumers and to understand the implications of alternative policy approaches that influence those capabilities

observations

- Defining “broadband” thus involves
  - identifying the kinds of applications that users are likely to find useful and desirable and
  - determining the benefits that different segments of the public anticipate from access to broadband services.
- Too limited a definition could result in a mismatch between expectations and capabilities while an unrealistic definition could prompt inappropriate or poorly aimed policy interventions.
- The absence of a consensus on definitions will confuse policy debate and require ongoing debates about what definitions to use.

two dynamic functional definitions of broadband

Definition 1. Local access link performance should not be the limiting factor on a user's experience in running today's applications.

- E.g., increasing performance significantly above the rate at which content is typically streamed won't improve the user's experience (though per Def 2 increased capabilities will spur high-quality streams)
- Increasing performance when bottlenecks exist elsewhere won't improve the user's experience
- Reflects engineering analysis of tradeoffs—e.g., one can compensate for limited bandwidth through compression or local caching.
- Presumption is that existing applications and capabilities of the rest of the network will be unleashed by improvements in the local access segment

Definition 2. Broadband access should have high enough performance—and wide enough penetration of that performance—to encourage the development of new applications.

- Capacity improvement and application innovation are tightly coupled in a "chicken-and-egg" fashion: an application will not be made available until a critical fraction of subscribers receives a high enough level of performance to support it, yet service providers will not deploy higher-performance broadband until there is sufficient demand for it.
- Presumption is that application innovation will materialize if performance constraints are eased

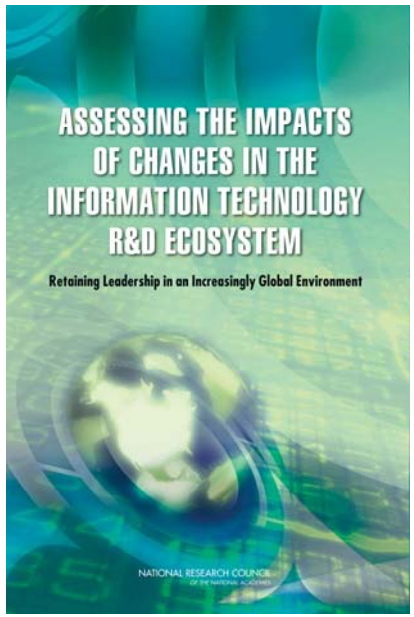
promise and reality of broadband apps

- Reality—today we run yesterday's apps (faster)
- Promise—with increased penetration of faster broadband, new applications will follow.
  - Now-commonplace broadband-enabled apps since 2002 report
    - Higher-quality video streaming
    - Mass sharing of user-originated video clips
    - Widespread VOIP
    - interactive Web-based apps
    - Cloud storage & computing, SAAS, …
    - …
  - What's next?

definitions suggest adoption of application performance indicators

- *For different applications, is the performance perceived by the consumer improving or deteriorating?* This is a measure of whether, by broadband definition 1, services available are actually broadband.
  - Sound metrics of performance and means of monitoring their trends would have to be developed and agreed to.
- *Are new applications that depend on high bandwidth emerging?* If they do not, it would be an indication that by broadband definition 2, the services being deployed are not broadband.

***Assessing the Impacts of Changes in the IT R&D Ecosystem: Retaining Leadership in an Increasingly Global Environment* (2009)** examines changes in the IT R&D ecosystem over the past decade and makes recommendations to strengthen the effectiveness and impact of federally funded information technology research; for the U.S. to remain the strongest generator of and magnet for technical talent; to reduce friction that harms the effectiveness of the U.S. IT R&D ecosystem; and to ensure that the U.S. has a communications, computing, and applications infrastructure which enables U.S. IT users and innovators to lead the world.



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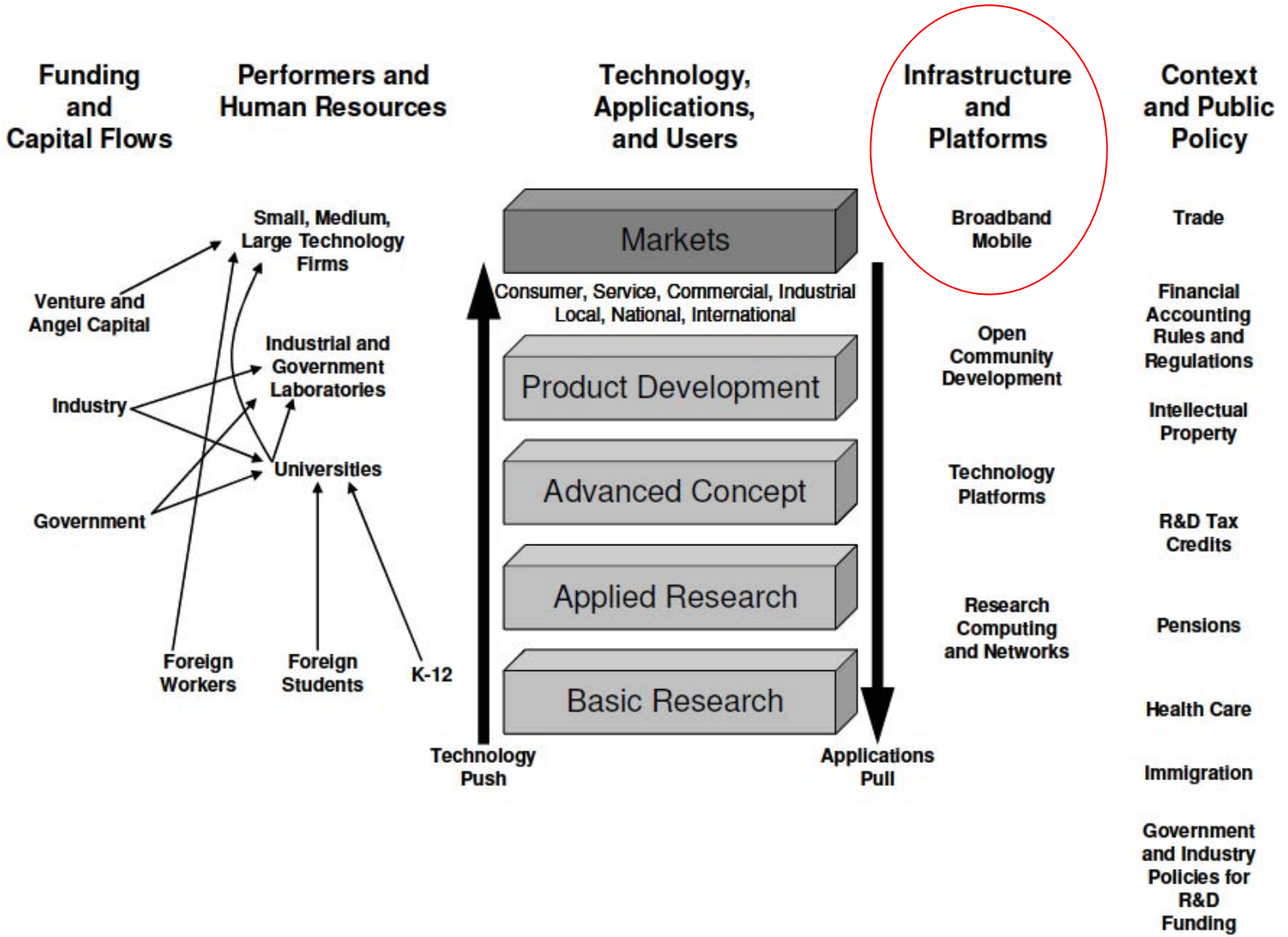
contents and scope

1. defining the IT R&D ecosystem
2. IT: the essential enabler for the information society
3. the changing landscape of the ecosystem, 1995-2007
4. a globalized, dynamic IT R&D ecosystem

findings and recommendations

- strengthen the effectiveness and impact of federally funded it research
- remain the strongest generator of and magnet for technical talent
- reduce friction that harms the effectiveness of the U.S. IT R&D ecosystem
- ensure that the united states has the infrastructure that enables U.S. IT users and innovators to lead the world

key elements and relationships in the IT R&D ecosystem



multifaceted innovation

- IT innovation not confined to university or corporate labs
- Market-facing, customer-involved aspects of IT are growing fast
- Customer-created value is increasingly prominent
  - Customers innovate by combining hardware and software into novel solutions

-> demand leadership by U.S. consumers increasingly important to U.S. global competitiveness

objective: ensure that the united states has the infrastructure that enables U.S. IT users and innovators to lead the world

Finding 4.1. The most dynamic IT sector is likely to be in the countries with the most demanding IT customers and consumers

- U.S. has enjoyed position of being largest market for IT, but this will not persist
- Innovation will go where there are technologically sophisticated users…and leading-edge product requirements

Finding 4.2. In terms of nationwide availability, use, and speed of broadband, the United States—the inventor of broadband technology—has been losing ground compared with other nations.

Recommendation 4.1. The United States should establish an ambitious target for regaining and holding a decisive lead in the broad deployment of affordable, gigabit broadband services. Federal and state regulators should explore models and approaches that reduce regulatory and jurisdictional bottlenecks and should increase incentives for investment in these services.

suggests another dynamic definition: “world-class”

- Setting—and reaching—an ambitious target would enable the U.S. to leap well ahead of other countries and to hold that lead
  - E.g., 1000 Mb/s available to 100 million homes and small businesses by 2020

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