REPORT IN BRIEF

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Renewing U.S. Telecommunications Research

COMPUTER SCIENCE AND TELECOMMUNICATIONS BOARD

Background

The modern telecommunications infrastructure—made possible by research performed over the last several decades—is an essential element of the U.S. economy. The U.S. position as a leader in telecommunications technology, however, is at risk because of the recent decline in domestic support of long-term, fundamental telecommunications research. To help understand this challenge, the National Science Foundation asked the NRC to assess the state of telecommunications research in the United States and recommend ways to halt the research decline. This report provides an examination of telecommunications research support levels, focus, and time horizon in industry, an assessment of university telecommunications research, and the implications of these findings on the health of the sector. Finally, it presents recommendations for enhancing U.S. telecommunications' research efforts.

Findings

Telecommunications has expanded greatly over the past few decades from primarily land-line telephone service to the use of fiber optic, cable, and wireless connections offering a wide range of voice, image, video, and data services. Yet it is not a mature industry, and major innovation and change—driven by research—can be expected for many years to come.

Currently, the United States is the global leader in telecommunications technology. Without making an expanded investment in research, however, the nation risks losing that leadership position. Strong competition is emerging from Asian and European countries that are making substantial investments in telecommunications R&D.

For many telecommunications products and services that are now commodities, the United States is at a competitive disadvantage to low cost countries. Continued U.S. strength in telecommunications, therefore, will require a focus on high-value innovation

generated by greater emphasis on research. Expansion of telecommunications research is also necessary to attract, train, and retain research talent.

Telecommunications research has yielded major benefits such as the internet, radio frequency communications, optical networks, and voice over IP. Promising opportunities for future research include enhanced internet architectures, more trustworthy networks, and adaptive and cognitive wireless networks.

Nevertheless, research funding levels have fallen in recent years. Prior to restructuring of the telecommunications industry in1984, the Bell system's research labs played the dominant role in long-term, fundamental telecommunications research for the United States. Post-restructuring, support for such research has declined and become less stable. A diverse array of telecommunications firms—cable, internet, wireless—emerged leaving most research to equipment vendors, which became increasingly short-term. In addition, the diversity of players in today's telecommunications industry makes it difficult to achieve major, end-to-end innovations.

Federal funding of long-term research, which had been small prior to restructuring, has not increased to cover the decline in industry support. No systematic efforts, such as took place for the semiconductor industry with SEMATECH, have emerged. Because the benefits of much telecommunications research cannot be appropriated by individual firms, therefore, public funding of such research appears necessary.

NSF and DARPA have been the two primary sources of federal telecommunications R&D support. NSF is increasing its emphasis on telecommunications R&D spanning a wide range of topics. DARPA, which funded a number of important telecommunications advances in the past, is shifting its emphasis toward more immediate military needs. A consequence of this shift is a loss of support for long-term telecommunications research.

Recommendations

A strong, effective telecommunications R&D program for the United States will require a greater role for government sponsored and university research, and more funding of long-term research by industry. The key element of an enhanced research effort should be the establishment of the Advanced Telecommunications Research Activity (ATRA) to stimulate and coordinate research across industry, academia, and government. Industry should provide a significant fraction of total R&D funding for ATRA which would include researchers from academia and industry. ATRA's mission would be to (1) identify, coordinate, and fund U.S. telecommunications R&D, (2) foster major architectural advances, and (3) strengthen U.S. telecommunications research capability.

Key steps for implementing ATRA are (1) establishment of mechanisms for carrying out project-based research; (2) establishment of advisory committees with high-level industry participation; (3) exploration of the need for R&D centers; and (4) establishment of a forum for key parties to discuss critical technology development issues.

Even with ATRA, NSF and DARPA will remain important contributors to U.S. telecommunications research efforts. Both should establish criteria, based on their existing programs, for determining the appropriate level of funding. NSF should continue to strengthen its support for telecommunications research and should consider programs for attracting and developing young research talent. DARPA should continue support of telecommunications research for military applications, even if there is the chance of commercial development of those technologies. In designing its research programs, DARPA should also consider the telecommunications capabilities of potential adversaries and the risk of dependence on foreign suppliers for key technologies.

Effective expansion of federal support of telecommunications research through ATRA will require participation from both service providers and equipment vendors to help identify the most critical research needs. The industry—particularly the service providers—should make complementary investments in research. This may require mechanisms to enable the service providers to pool research support. ATRA can play an important role in facilitating such mechanisms.

For additional information:

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