Building a Nationwide Broadband Network:

Speeding Job Growth

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February 25, 2002

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Executive Summary

Many industry experts agree that broadband deployment is occurring much too slowly. However, public policy changes are being considered and advocated that will encourage widespread broadband deployment in the U.S. Once deployed, these investments would encourage the development of new and innovative applications, as well as bandwidth-consuming content. The resulting development of services, applications and content will create huge consumer benefits, spur economic growth and increase business productivity.

This study investigates the economic benefits of building a nationwide broadband network and quantifies the job gains that this investment will have on the U.S. economy. The major finding of this study is that building and using a robust, nationwide network will expand U.S. employment by an estimated 1.2 million new and permanent jobs, specifically:

- 166,000 jobs in the telecommunications sector;
- 71,700 manufacturing jobs generated by the direct purchase of network plant and equipment and customer premise equipment; and
- 974,000 indirect jobs created if a next generation network were built.

These well-paid, high-skill jobs would be a welcome boost to our economy. Additionally, although not explicitly measured in these figures are the direct benefits to consumers, improvements in network security, productivity increases for businesses, and the development of new products for overseas markets.

Policymakers need to create incentives for the huge investments necessary to create and maintain broadband networks. Needless regulations that make deployment of these advanced technologies too costly should also be eliminated.

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Introduction

Deployment of broadband services holds the promise of increasing consumer benefits and productivity, as well as developing bandwidth-intensive applications and content. Although broadband services are being deployed, many experts agree that these investments are not taking place as fast as they should be and that incentives are needed to spur that investment.[1]

Without widespread broadband availability, consumers are left with narrowband dial-up Internet access. Because Internet users visit fewer web sites that contain predominantly text and increasingly greater numbers of Web sites that contain bandwidth-rich content and applications (such as pictures, music, video, and software applications), dial-up Internet users face longer download times. These dial-up Internet users have experienced a 50% increase in download times over the last two years, leaving the promise of economic benefits well out of reach from most consumers.[2]

Regulatory and legislative policy changes are being considered that would create incentives for speeding broadband deployment.[3] If these policy changes encourage investment and lead to the full deployment of broadband services, how would such investment affect jobs?

This paper examines the important stimulative effects that IT investment has had on the economy, and highlights the need for IT investment as an economic stimulus for the future. More specifically, it examines the economic impact of building a robust nationwide broadband

[1] "Building the Networked World," the Computer Systems Policy Project, Washington, DC, 2002; and "A National Imperative: Universal Availability of Broadband by 2010," The TechNet CEO Broadband Task Force, January 15, 2002.

[2] Estimates for download time are available from the Keynote Consumer 40 Internet Performance Index, Keynote, San Matao, CA.

[3] For example, the FCC has five opened proceedings that deal with broadband, including the Triennial UNE Review Notice, Cable Modem NOI, the National Performance Measures NPRM, Broadband Notice, and the Incumbent LEC Broadband Notice. Congress is considering legislation, such as the Internet Freedom and Broadband Deployment Act (H.R. 1542).

network and estimates the number of new and permanent jobs that could result directly from that action, as well as the indirect job gains once that network is in use.[4]

A Robust Broadband Network

The replacement value of the current telecommunications network is quite substantial. Recent evidence suggests that the cost of building a nationwide next generation broadband network is not much more expensive than reproducing the current network.[5] This will result in a significant increase in bandwidth to consumers and businesses compared to traditional telephone technologies. One example of a robust broadband network is a passive optical network (PON), which brings fiber as close to customers as possible. This network is often described as fiber-to-the-curb, fiber-to-the-loop and fiber-to-the-home. It will support switched wavelength services with bandwidth to the customer at rates up to 622 Mbps (Megabits per second downstream) and from the customer (upstream) at rates up to 155 Mbps, about 100 times faster than most commercial DSL services. The wavelength services available on the PON will be faster and more economical than dedicated T-1 copper services, which transport data at only 1.5 megabits per second. Aside from speed, PONs offers improved security performance and transmission reliability, suitability for interactive and distributive services, reduced installation costs and repair costs, and true bandwidth-on-demand. This is in addition to the services, applications, software, and content that will follow. As fiber is pushed closer to customers, it reduces the length of copper in those loops, making existing copper more suitable for higher-speed services, such as DSL or successors with even higher speeds.

Building a high-speed network that connects people is the first step in exploiting the pent-up demand for advanced consumer equipment, and bandwidth-intensive applications, services, and content – all of which will benefit consumers. These innovative applications will enhance communications, entertainment, healthcare, games, computing, business productivity, security, education, job training and many other areas common to people's daily lives. Where these

[4] This paper assumes that it would take approximately eight years of construction to reach all markets. The direct jobs (telecommunications network construction and manufacturing of equipment) could be expected to begin quickly, as soon as construction projects begin. The indirect jobs would be subject to the rollout of services.

[5] Testimony by Timothy J. Regan, Senior Vice President of Corning, Before the House Committee on Energy and Commerce, April 25, 2001.

innovations occur, there will be additional ripple effects throughout the economy that will create permanent jobs, increase discretionary spending and improve quality of life.

The IT Sector is Inextricably Linked to the Economy

The information technology (IT) sector is enormously important to the overall health of the U.S. economy. From 1994 to 1998, IT jobs grew at 30%, adding 1.2 million new jobs.[6] Furthermore, the outlook for IT jobs appears promising. According to the latest *Occupational Outlook*, the Bureau of Labor Statistics projects the five fastest growing occupations to be in the IT sector. The report also states that these IT jobs pay on average 85% more than other private sector jobs.[7] Thus, IT has been an important variable to labor growth in the U.S. economy.

IT capital investment has been a key factor contributing to the health of the overall economy. According to a number of studies, IT investment has been shown to be a significant factor in explaining increases in national productivity.[8] For example, according to one study, IT accounted for at least one-half of the productivity gains experienced in the economy since 1995 and was responsible for a one-half percent decrease in inflation.[9] Another study estimated that capital investment contributed to 22% of Gross Domestic Product Growth.[10] Yet another study estimated that IT investment was responsible for two-fifths of the growth in total factor productivity and 68% of the accelerated growth in labor productivity.[11]

Because the IT sector is so important to business productivity, consumer prosperity, and economic growth, maintaining the growth of the IT sector is becoming the linchpin that sustains an increasingly service-oriented economy. Another study estimated that the Internet has led to improved efficiency and saved business and government operating expenses by $155 billion.[12]

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[6] *Digital Economy 2000*, Economics and Statistics Administration, U.S. Department of Commerce, June 2000.
[7] Ibid.
[8] Kevin J. Stiroh, "Investing in Information Technology: Productivity Payoffs for U.S. Industries," *Current Issues in Economics and Finance*, Federal Reserve Bank of New York, 7:6, June 2001.
[9] *Digital Economy2000*.
[10] Dale W. Jorgenson, "Information Technology and the U.S. Economy, *American Economic Review*, 91(1), March 2001, pp. 1-32.
[11] Stephen D. Oliner and Daniel E. Sichel, "The resurgence of Growth in the Late 1990s: Is Information Technology the Story?" *Journal of Economic Perspectives*, 14:4, Fall 2000, pp. 3-22.
[12] Based on a report issued by Momentum Research Group, the University of California at Berkeley and the Brookings Institution (see www.netimpactstudy.com).

Conversely, one could reasonably conclude that public policies that slow IT advances and deployment would have a negative impact on economic growth.

IT investment has proven to be an effective boost to the economy. Investment in next generation IT equipment is one important step industry can take to revitalize the health of our economy. Once these investments are in place, they provide a platform for creating bandwidth-consuming communications services, applications, software, entertainment, and content. The potential benefits to consumers are significant. By one estimate, the benefits to the economy would be $500 billion, if broadband services were universally available. The major benefits to consumers cited would come from broadband services and household equipment, as well as benefits derived from entertainment, telemedicine, shopping, commuting, and telecommunications services.[13] Another study by the Yankee group study predicted a $233 billion cost saving from high-speed services. Their estimate excludes inventory savings, which may be quite sizable and assumes ubiquitous deployment of broadband services, well out of reach given today's infrastructure.[14]

The deployment of broadband services holds great promise for consumers and would stimulate the economy. Public policies that create incentives for speeding broadband investment into next generation infrastructure will speed these benefits to consumers and stimulate economic growth.

Effects on Jobs

The job growth resulting from the deployment of a broadband network will occur from three sources:

1. Direct labor associated with deploying and maintaining broadband investment;
2. Direct labor associated with manufacturing the infrastructure components and customer premise equipment; and
3. Indirect labor associated with creating services and applications, including supporting industries that would result once the network is deployed.

[13] Robert W. Crandall and Charles L. Jackson, "The $500 Billion Opportunity: The Potential Economic Benefit of Widespread Diffusion of Broadband Internet Access," Criterion Economics, L.L.C., July 2001.

[14] "The Collaborative Commerce Value Statement: A $223 Billion Cost Savings Opportunity Over Six Years, *Module B-to-B Commerce & Applications*, Vol. 6:6, Yankee Group June 14, 2001.

While this paper makes reasonable estimates of these benefits, the actual costs of building a robust broadband network will vary over time, depending on topology, inflation, interest rates, demand, resource availability, taxes, and regulatory factors.

To estimate the increase in jobs that could result from building and deploying a nationwide broadband network, a reasonable estimate of the cost of investment is required. In 1995, a State University of New York (SUNY) study estimated the cost of investment to be $416 billion for providing nationwide broadband services.[15] A second and more recent study estimates the cost at $300 billion.[16] Another estimate by Fat Pipe estimates the cost to be $270 billion or, by their estimate, $1,500 per line.[17] Since such estimates appear to have decreased in recent years, this study will use the most conservative estimate by Fat Pipe.

Assuming that various investments will have an average life varying from 3 years for customer premise equipment to 15 years for cabling, the weighted average life of the plant is estimated to last about 7.7 years.[18] This estimate gauges the number of years required to build the network. An annual investment of $35.2 billion is estimated to build a robust nationwide broadband network.

The annual employment requirements necessary to build and maintain a nationwide broadband network consist of three parts – direct labor requirements, direct material requirements, and indirect employment (multiplier effects). These three components make up the total economic benefit resulting from the construction and use of the investment.

The direct labor requirement measures the workforce necessary to build and maintain a nationwide broadband network. Given that estimated annual investment would be $35.2 billion per year and that telephone plant requirements consist of 28% capitalized labor,

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[15] SUNY, *New Technology Deployment Model: Broadband with Associated Depreciation and Overheads*, see www.tele.sunyit.edu/omad.htm, 1995.
[16] T. Randolph Beard, George S. Ford and Lawrence J. Spiwak, "Why ADCo? Why Now?" Phoenix Center, November 2001, p. 11.
[17] Gary Kim, "No Demise for DSL," *Fat Pipe*, Aug. 2001, www.dagdamor.com.
[18] Later in this paper, a sensitivity test will examine the effect of increasing the average life to 15 years.

$9.7 billion in additional labor resources would be needed to build a broadband network.[19] Based upon the Bureau of Labor Statistics estimate of average weekly wages for production workers in the telephone industry (excluding wireless services), grossed up for wage supplements, benefits, social security and supervisory overhead, the base case estimates the average loaded wage of a worker to be nearly $60,000. If the annual labor requirements were $9.7 billion, as calculated above, then 166,000 employees would be needed to put the broadband network into working condition each year.

Annual investment of $35.2 billion per year includes $9.7 billion in direct labor, the remaining $25.5 billion of investment is for material costs for plant and equipment. Using a ratio of value of shipments to employees for the computer and communications equipment manufacturing industries, the value of material investment can be converted into employees. Based on this approach, the manufacturing labor required to produce the plant and equipment necessary for the annual deployment of the broadband network would be about 71,700 permanent jobs. These new jobs will be in addition to the 166,000 employees required to build and maintain a robust broadband network. The total direct effect will equal 237,700 new and permanent jobs.

When the broadband network is built, its direct economic impact will spill over into other sectors of the economy, which would create many new (indirect) jobs. This phenomenon is referred to as an *employment multiplier effect*. The employment multiplier measures the number of indirect jobs created for every direct job used to build the broadband network. For example, broadband investment will encourage the development of innovative bandwidth-consuming services, applications and content, such as new interactive media, games and entertainment, multi-videoconferencing and switched digital video broadcasting. Many of the new jobs that will be created will be for IT-skilled workers are outside of the traditional IT sector, such as in the healthcare, education, and government sectors. As people are hired, a whole host of other services unrelated to the IT sector are needed, including transportation, real estate, insurance and legal services. Employment gains from IT investments cascade throughout much of the economy, creating a sizable stimulus to economic growth.

[19] This figure is based on the author's calculations of the relative weights used in industry telephone plant index calculations.

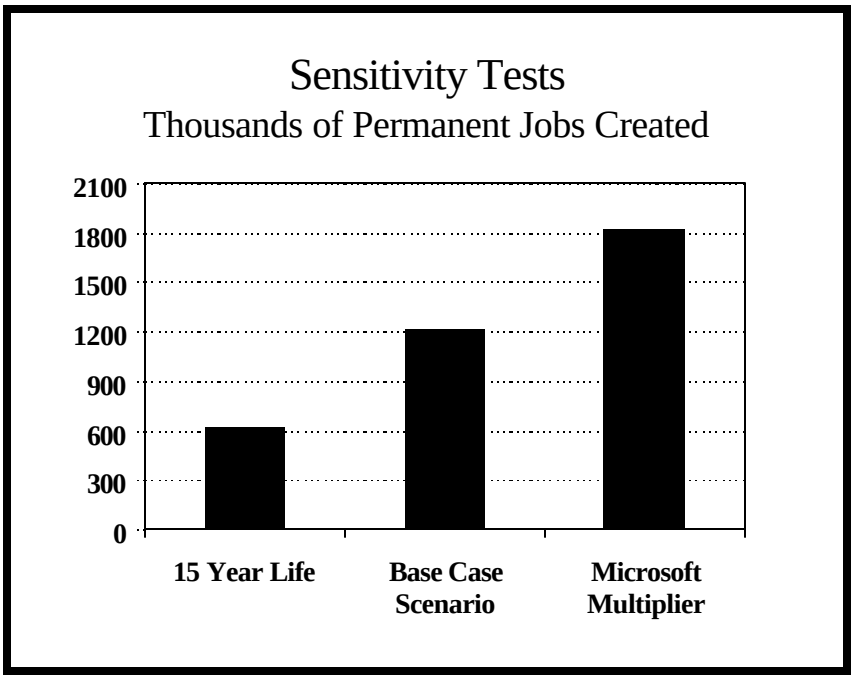
While the multiplier effects from deploying a next-generation broadband network should exceed those found in the general economy (estimated to be around 1.5 to 2.0[20]), it is likely to be less than the multiplier effects attributed to Microsoft (estimated to be 6.7[21]). Using these two estimates to establish a reasonable lower and upper bounds, this study assumes that 4.1 indirect jobs would be created for every direct job created from broadband investment – approximately 237,700 direct jobs and 974,000 indirect jobs. The total labor effect of building and using a broadband network would total over 1.2 million new and permanent jobs. This would be an enormous boost to the current economy. The economic stimulus from this deployment does not include the large consumer benefits predicted in other studies.[22] This study does not attempt to gauge the value of new products and services that have yet to be created.

The chart "Permanent Jobs Resulting from Broadband Investment" summarizes the estimated number of jobs that could result from the build-out of a robust nationwide broadband network.

Permanent Jobs Resulting from Broadband Investment

Direct Telecommunications Jobs	166,000
Direct Manufacturing Jobs	71,700
Indirect Jobs	974,000
Total Economic Effect	1,211,700

[20] For a comparison of an IT multiplier to the general economy see "The New Economy," in The Keystone Spirit: Putting Technology to Work at sites.state.pa.us/PA_Exec/DCED/tech21/b-neweconomy.htm.
[21] Michael J. Mandel, "The New Business Cycle," *BusinessWeek*, March 31, 1997.
[22] For examples, see footnotes 12-14.



The chart "Sensitivity Tests" shows the degree to which the results could vary depending upon changes to the assumptions. It also indicates that, compared to the base case scenario described in this study, increasing the average life of the plant to 15 years would reduce the estimated number of new jobs. Increasing the multiplier effect to the one cited in *BusinessWeek* would increase the estimated number of new jobs. The estimated job gains predicted in this report's base case scenario fall midway between two alternative scenarios.

Policy implications

Broadband investment is clearly good for American workers, the U.S. economy and consumers. However, broadband networks are not being built at the pace one would expect. A major reason for this slow pace of investment and implementation is that regulators have interpreted the provisions of the Telecommunications Act of 1996 in a way that would apply traditional telephone regulations to advanced broadband networks and services.

Incumbent telephone companies that seek to build next-generation, high bandwidth networks face the prospect of having to lease these facilities to their competitors at prices that reflect incremental costs – and sometimes prices far below actual costs. Meanwhile, those same regulations give competitors little incentive to invest in and build their own networks, which

would lead to greater consumer choice and more jobs. This regulatory quagmire increases risk for investors and reduces ownership of innovation and property rights.[23] In the end, this regulatory framework discourages broadband investment, slows deployment, and keeps everyone – service providers and consumers – from winning.

Conclusions

There appear to be significant benefits to building a next-generation broadband network. This paper has focused on estimating the direct and indirect permanent jobs that would be created as a result of this IT investment.

Policymakers need to create incentives for telephone companies to invest in next generation networks. This study has shown that IT investment in next generation broadband networks will spur job growth and bring considerable benefits to workers, consumers and businesses. This investigation of the relationship between broadband expansion and jobs highlights the benefits that investment in this sector would have to the current economy.

[23] For three citations linking telephone regulation to the lack of broadband deployment, see Lawrence Gasman, "Why Fair Competition Fails in the Telephone Industry: The case of Wavelength Services," Cato Institute, Issue #27, November 26, 2001; Mark Lutkowitz, Sam Greenholtz and David Gross, "BellSouth and Qwest: Distinctive Metro Business Models Face Similar Regulatory Hurdles in Providing Wholesale DWDM Services, Communications Industry Researchers; and Testimony by Timothy J. Regan, Senior Vice President of Corning, Before the House Committee on Energy and Commerce, April 25, 2001.

About the Author[24]

For over twenty years, Mr. Pociask has worked in and consulted for telecommunications and high-tech industries. As President of TeleNomic Research, a consulting firm specializing in public policy analysis for information technology industries, he is responsible for a wide variety of applied economic studies. A number of his studies are filed at both federal and state regulatory commissions, and recently have included topics such as rate reform, deregulation and productivity incentive plans. Mr. Pociask has appeared before the FCC in its open forums and at its staff meetings. He has spoken to numerous state and local legislators on broadband issues, and testified before the Congressional Subcommittee for Telecommunications, Trade and Consumer Protection on Internet and broadband legislation. He has written about deregulation, long-distance industry cost structure, local exchange competition, the economics of multimedia data networking and cable competition. His study, "MCI WorldCom's Sprint Toward Monopoly: An Analysis of the Proposed Telecommunications Merger," co-authored with Dr. Jack Rutner and sponsored by the Economic Policy Institute, accurately predicted the Department of Justice's decision to block the merger. He has appeared numerous times in the media, including Bloomberg News, CNBC, Telecommunications Reports, Telephony, Congressional Quarterly, America's Network, NetworkMagazine and CNET Radio.

Mr. Pociask previously served as Chief Economist and Executive Vice President for Joel Popkin and Co., an economic consulting firm in Washington, DC. Before this assignment, he was Chief Economist for a major telecommunications provider. He has completed his Ph.D. coursework in economics and has an M.A. in economics from George Mason University.

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[24] This study is a result of work developed in response to proposals for research received by TeleNomic Research over the past four months concerning the potential impact of increased broadband deployment on job creation. Initial work was done at the request of equipment manufacturers and their associations. Further interest in the issue was peaked by the recent releases of studies by TechNet and other high-tech organizations on the need for increased broadband deployment. Financial support for the publication of this final report has been provided by Verizon. The New Millennium Research Council provided in-kind support.