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The digital economy: Where do we stand?

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Abstract

The rapid transition towards a ''digital economy'' was enabled by a converging set of innovations. Computing saw the development of the semiconductor transistor, integrated circuit, personal computers (PCs), operating systems, and graphical interfaces. The physical layer of telecommunication was enabled via the emergence of optical fiber and new wireless communication technologies, while networking saw the development of the Internet (essentially packet switching) and the World Wide Web. These advances combined to realize a series of new applications of information and communications technologies (ICTs) such as business software, e-mail, and e-commerce. However, progress seriously stumbled with the collapse of the dot com bubble, which among other things revealed a huge amount of misdirected investment that could have been used more productively. The question of the day is thus how to realize new ''killer apps'' to stimulate a new round of growth. The use of cell phones for communicating text, pictures, and video is a rapidly expanding area, but it seems unlikely that these applications will have a macroeconomic impact. Entertainment is a key industry whose fortunes are entwined with ICTs. Indeed, the application of ICT to innovating entertainment products is an important driver for the continued growth of the industry. Distribution of music and video via the Web could significantly stimulate demand but also raises the thorny question of how to protect intellectual property rights (IPR) of content providers. Another possible killer apps are interactive video-on-demand and telecalls/teleconferencing. The latter would, among other things, stimulate adoption of telework. The current Internet is capable of handing neither one-way transmissions of high-quality video nor interactive video-on-demand. There are bottlenecks both for the ''last mile'' connection from Internet service provider (ISP) to the home but also the ''first miles'' from originating server to ISP. The effective first miles bandwidth has not increased along with

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improvements in equipment, essentially because demand increases with capacity and thus traffic jams on the net continue. Digital subscriber line (DSL) technologies over telephone wires, and possibly wireless networks, will play important roles in getting over the last mile hurdle. Upgrading the first miles will probably require new networking protocols beyond TCP/IP that support multimedia and also changes in the economic model of information transfer via the Net.

Keywords: Information technology; Computers; Internet; Broadband; Cellular phones; Economic growth; Innovation; Video-on-demand; Telecommuting

1. Introduction

Thirty years ago, electronic calculators were beginning to penetrate mass markets in rich countries. Today, around half a billion people are using machines that can store entire libraries of books, music, and video material, vastly extend their capacity to process information, and entertains with virtual realities of astonishing realism. Thirty years ago, long-distance communication was mainly via mail carrier and to a lesser extent the telephone. Today, much of the world is connected via sophisticated networks that allow volumes of text, images, sound, and video to be exchanged in an instant. The pace of innovation and adoption of information and communications technologies (ICTs) has been, to say the least, astounding. Innovation related to ICTs has continued on many levels: basic science, engineering, manufacturing, system integration, and new applications. Adoption has gone hand in hand with innovation, giving rise to a steady and growing flow of income to invest in further progress. The institutional and societal framework in many rich countries proved very able to support sustained innovation and adoption of ICTs. The important role that ICT-enabled products and services have come to play in modern economies gave birth to the idea of the "digital economy," suggesting a transition to a new set of rules for how to succeed.

Recently, something seems to have changed. While booms and busts have jiggled the industry since its inception, the dip in recent years is particularly severe. The potential of dot coms to succeed was vastly overestimated by investors leading to a collapse of ICT-related high-tech stocks. European telecoms are struggling with vast payments for cell phone technology licenses that may not realize profit for decades. The heady optimism of the late 1990s has turned into doubting voices questioning if the ICT revolution might be over.

Did something go wrong? Is the industry simply entering a new phase of slower technological progress and/or growth? Is this a natural stall due to overoptimism of investors and expansion will continue again as before? Should societies rethink how to facilitate innovation and adoption of ICTs? Given the extent that many societies have benefited economically and otherwise from ICTs, there is obvious interest in maintaining growth to the extent possible.

In this article, we attempt to shed some light on the above questions. In Section 2, we review the history of development and adoption of the different key components in