Commercializing the Internet

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The "commercialization of the Internet" is shorthand for three nearly simultaneous events. They are the removal of restrictions by the National Science Foundation over the use of the Internet for commercial purposes, the founding of Netscape, and the rapid entry of tens of thousands—perhaps hundreds of thousands—of firms into commercial ventures using technologies that employ the suite of TCP/IP standards. These events have now turned every PC into a potential client for Internet applications.

The explosion of activity in 1994-95 caught many mainstream and potential market participants by surprise. Until then, the Internet simply failed to make the radar screens of many legal and commercial futurists in the computing and telecommunications industry. For example, as has been widely noted (in the context of antitrust scrutiny), TCP/IP received almost no attention in Bill Gate's 1995 book, *The Road Ahead,* which ostensibly provided a detailed look at Microsoft's vision of the future.

As another example, the US 1996 Telecommunications Act, the first major overhaul of federal regulation for the communications industry in 60 years, mentions the Internet only once. This occurred even though this piece of legislation is over 1,000 pages long and was the subject of several years' worth of lobbying from all the major incumbent telecommunications firms.

What happened and why? Enough time has passed for us to look at these events from a distance. Several coincident events led to this unexpected explosion. Understanding this past also helps us understand why the future may be very different.

TCP/IP origins

By the time of commercialization, many of the technologies associated with the Internet were already 20 years old. As is well known, TCP/IP technology dates back to DARPA (the US Defense Advanced Research Projects Agency) experiments aimed at developing communications capabilities using packet-switching technology. For all intents and purposes, DARPA issued the first contracts for Arpanet in 1969, which involved a few dozen nodes by the time of the first e-mail message in 1972.

After a decade of use among a small group of researchers in the 1970s, DARPA and its working oversight group established the protocols that would become TCP/IP, orienting them toward moving text between hosts.

By 1984, DARPA had established the domain name system, the DoD (the US Department of Defense) sponsored the TCP/IP standard, and we used the term Internet to describe the system. In the early 1980s, the DoD began to require the use of TCP/IP in all Unix-based systems, which were in widespread use among academic research centers. These policies encouraged extensive use of the Internet among virtually all research universities in the United States by the mid-1980s, which, in turn encouraged the further adoption of complementary applications such as FTP, Telnet, and so on.

In 1986, oversight for the backbone moved to the National Science Foundation, leading to a dismantling of Arpanet and the establishment of a series of regional networks. The NSF pursued policies that encouraged use in a broad research and academic community, subsidizing access to the Internet at research centers outside of universities and at nonresearch universities. The NSF also subsidized deployment of Internet nodes to many institutions. This had the intended effect of training a wide set of network administrators, students, and users in the basics of TCP/IP technology. In conjunction with this spread, the NSF sponsored development of changes to TCP/IP that let it be applied to more varied uses. By 1989, the Internet connected more than a 100,000 hosts worldwide (most were in the US). This is a slightly deceptive number since almost any computer with an IP address can act as a host.

In the late 1980s, the NSF began working with a wide variety of private companies, including IBM and MCI in prominent roles. The goal was to develop practical standards for network backbone communication that could be deployed on a large scale (routing protocols and addressing systems). At the same time, the NSF retained policies restricting use of the Internet backbone to research purposes. No advertising for commercial

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products was permitted nor was widespread use of the technology for the sales and distribution of products. As insiders knew, this restriction was widely disobeyed by many students who operated bulletin boards on campuses. However, this activity was small and decentralized.

Commercialization of the Internet

By the early 1990s, the Internet was confined to the scientific, academic, and military communities. The text-based activities in use provided only an inkling of TCP/IP's commercial potential. There was no consensus among insiders or futurists over where commercialization would lead.

Commercial interest in the Internet began prior to the invention of Web technology, and by itself, would have motivated commercialization of the Internet in some form. By the late 1980s, the suite of TCP/IPs offered an alternative technological approach to existing online services, which had demonstrated the efficacy and desirability of online activity. For example, bulletin boards already numbered in the thousands in the US. TCP/IP technologies also offered an alternative to services such as Prodigy, CompuServe, and America Online, which had several million home customers across the country by the early 1990s.

There was also a less concrete interest in developing any technology that might fuel further developments in electronic commerce, especially in business-to-business transactions. However, EDI (electronic data interchange) had not widely caught on by the early 1990s, so the fuel for electronic commerce was weak. Perhaps most importantly, the client-server revolution was beginning to take hold and gain momentum with business users around the early 1990s. TCP/IP offered an alternative or possibly complementary technology for achieving further connectivity in a networking environment.

The demand for commercial applications based on TCP/IP technology took a leap in a new direction with the unanticipated invention of the browser standard. As is now widely recognized, using the Internet for visual-based applications opened up a whole set of commercial possibilities.

This capability was first invented in 1989 for the purpose of sending scientific pictures between physicists. That was followed by a set of experiments with browsers at the University of Illinois, leading to the basis for Mosaic, a browser using Web technology. This browser was widely circulated as shareware in 1993-94, exposing virtually the entire academic community to the joy of sharing pictures.

The Mosaic experiments served as the inspiration for Marc Andreeson, who was part of the team at the University of Illinois laboratory that wrote Mosaic. Andreeson later went on to become chief technology officer at Netscape. This browser experiment also served as the technical basis for licenses from Spyglass, Inc. to Microsoft. Microsoft put TCP/IP technology into Windows 95 and sold a browser soon thereafter. (Microsoft, in the heat of antitrust scrutiny, claims it would have adopted a browser even if it had not licensed the technology from Spyglass.)

Plans for commercializing the Internet were put in place in the early 1990s. Commercialization principally involved lifting the NSF's restrictions on commercial activity, which could only come about when the NSF passed governance over the backbone to private hands. These plans were made prior to the invention of Web technology and were implemented at about the same time as the diffusion of the browser. Thus, when Netscape commercialized its first browser in 1995, it diffused to a receptive set of users, making a spectacular impression on most computing and communications industry participants. At the same time, most of the planners for commercialization had not seen it coming.

Why commercialization was so explosive

TCP/IP technology was developed in a research community that focused narrowly on a set of uses and users with needs were quite different from the average commercial user today. When the technology became commercialized in 1994, many new uses and users outside of the research community became potential users of a new set of applications, thus creating a mismatch between the frontier and potential users. In addition, the unexpected invention of Web technology, which occurred just prior to commercialization of the Internet, further exacerbated the gap between potential uses and the technical frontier.

In the environment of 1995, we saw the primary open issues as commercial, not technical. What business model would most profitably provide Internet access, content, and other services to users outside the academic environment? No consensus had yet emerged, so firms experimented with different business models for mediating between the frontier and the user. The frontier had developed without much use outside of the research environment and there were questions about its application in other settings. What would users be willing to pay for and what could developers provide?

The commercial opportunities in 1995 called for what looked like a one-time expenditure to set up connections and access for commercial and home users. This involved (and still involves) setting up a network in many different locations for many different applications, and customizing it to existing information networks.

Seen in this light, the value of being in the Internet business is fleeting in one sense and possibly enduring in another. It is fleeting because some of it depends on a one-time business opportunity, translating Internet access into a reliable and dependable standard service for nonacademic users. This opportunity is an artifact of the development of the technical capability in an environment that expressively forbids its use for commercial purposes.

The value of long-run business models is still uncertain because TCP/IP technology touches on many business processes, generating experiments in the use and delivery of Internet access. These experiments should spur other complementary developments whose economic value will remain unknown for some time. If any of them succeeds, future generations will remember this era as the explosion that preceded enduring and general advance.