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## When Technology Drives Economics

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# When Technology Drives Economics

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## **Abstract**

Speech given at Session 2: World Communication: Where is Technology Leading Us? If technology is driving economics, in exactly what way is it driving it, and why is it driving it? Mr. Nagel gave an overview of exactly how fast technology is changing. He posits that it is changing so fast that instead of a quantitative change, it is appropriate to think of it as a qualitative change. More specifically, that change is leading to a fundamental transformation in the way that commerce itself is conducted.

# WHEN TECHNOLOGY DRIVES ECONOMICS

*David Nagel\**

As a technologist, it is always great to have a lead speaker be an economist who acknowledges that technology is driving economics. The technologists always get up in the morning thinking that, but it was very nice to hear someone else say that that is the case.<sup>1</sup>

This afternoon, I would like to talk about the question of, if technology is driving economics, in exactly what way is it driving it, and why is it driving it? I am going to give you a bit of an overview of exactly how fast technology is changing. It is changing so fast that instead of a quantitative change, I think it is appropriate to think of it as a qualitative change. That change, in particular, is leading to a fundamental transformation in the way that commerce itself is conducted.

I have been with AT&T about one year now. AT&T is an old company with a lot of history. It has something called an archive, in which it catalogs all the old lab books and a lot of the memorabilia about the early days of the company. In rooting through the files, I found a couple of old advertisements for our network and our services, at the end of the last century. As I looked at them, I realized that they really suggested how quickly technology was driving the ability to deliver, in this case, telephony services to our customers.

In 1891, one advertisement said: "Five hundred miles and return in ten minutes." It took six years for that to double to 1000 miles and return in ten minutes. That is not the way that we measure the performance of telephone systems any longer. At the end of the last century, the figure was really how quickly a call could be set up and completed because that was all done manually by a sequence of operators at stages along the path of the call.

Today, of course, we look at the ability of an information system, whether a telephony system or otherwise, to carry information — the capacity of the information. Call set-up times are,

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1. Detlef Eckert, *Perspectives of Global Communications*, 21 *FORDHAM INT'L. L.J.* 422 (1997).

from the point of view of most customers, virtually instantaneous. What really matters is both the speed and the cost at which information can be gotten from one point to another — what we now call “Wide Area Networking.” The performance of technology, the improvement of technology in the area of Wide Area Networking at the end of this century, is not doubling every six years, but rather, doubling every six months. In fact, if you look at the projections for the period from 1970 to the year 2000, you will see something like a 10 million or a 100 million-fold increase, a factor of  $10^7$  or  $10^8$  increase, in both the cost and the performance of these Wide Area information systems.

There seems to be a rule of technology that when you have these kinds of huge, quantitative changes in technology in time periods like decades, those changes inevitably lead to qualitative changes in the way the technologies are used and the impact that they have, in this case, on commerce. There is another kind of performance, another kind of change in technology, that is taking place that is not quite so dramatic. It is equally important, however, in explaining why computing networks and information communication networks are changing the way that they are. That change in technology is the ability to encode information, or even to discard information.

Today, in all contemporary telephone networks, speech is carried in digital form. It is generally transmitted at 64,000 bits per second, which is roughly at the basic rate that you get when you digitize speech with the bandwidths which we typically have, which are about 3,000 cycles per second, or 3,000 Hertz. If you compare the ability to carry speech in digital form in 1980 and 1990 to what we project to be the case in 1998, that is, the ability to carry speech at much lower rates than 64 kilobits per second, you can see the effect of carrying speech at much lower rates on the perceived quality of the encoded speech.

From 1990, until you get to something like eight kilobits per second, there is very little effect on the judged quality of the speech. The best you can do on this five-point scale, by the way, is about four points because you do not carry speech over telephone networks at the whole bandwidth. Speech has energy and frequencies up to about 10,000 cycles per second. We only carry it up to about 3,000 cycles per second, which is perfectly intelligible, but it is not perfect quality. In 1998, for the most part, speech will be of equally high quality at four kilobits per second

or sixty-four kilobits per second. In other words, the diminution in quality as you reduce the number of bits needed to carry speech is virtually nil.

There has been huge excitement generated consequently by what is now being called "electronic commerce." Why is the excitement so extreme? First of all, during the last decade or so, businesses have learned the importance of networking for the efficient conduct of business and commerce. The Internet allows businesses to bring that network directly to consumers, and it does so on a global basis. It simply removes many of the barriers that exist today in communicating from one business to another or from a business to a consumer.

The Internet, in particular, is especially important because it is an open standard-based framework, and so many of the bottlenecks and the costs associated with getting the disparate pieces of networking, the disparate software systems, and even things like disparate payment systems, to work together either have been removed or are rapidly being removed in the context of this Internet market. It does, I think, fundamentally change the business value chain in ways exactly envisioned by Porter and Millard.

We just completed a film a week or so ago that gives a vision of how at least one business might actually be transformed by the Internet, the Intranet, and Extranet. The film paints a bit fanciful picture of the way a business could be created by two young men who have a lot of ideas but not much capital, and, in fact, how the supply chain can be put together to create this virtual bicycle business, and even how people can buy bicycles off the Internet. It is not too fanciful a picture, however. In fact, the bicycle company that we used to do a lot of our filming got very intrigued by the capabilities, began to take it quite seriously, and talked about "gee, could we avail ourselves of some of these services?"

One of the points in the film that is important is that one of the things that the Internet has enabled is to eliminate the need in all cases to have this army of programmers, even this army of information system operators. Increasingly in the future you will be able to have someone completely create this network for you, manage it, and basically relieve the business owner from the complexities of the technologies themselves. This is what led

Del Gibbs, presumably, to begin talking about “frictionless commerce.” When I first heard him talk about that, I thought he was referring to the ease with which money was moving from my pocket into his. I think he has a very good point, however, that these kinds of information systems fundamentally are changing the way commerce can be conducted.

I am going to end on that note with one final caveat, which again is similar to what Dr. Eckert<sup>2</sup> said. We do need to improve the technology in significant ways. From the user’s experience, we need to work on the ease of use. It is still too hard, and we are working on making it easy. Most of the technologies involved in that video are still too difficult for people who are not today using computers.

There are other very significant problems which are part technical and part non-technical, and part regulatory. Privacy is a significant one. The industry has shown at least some attempt to self-regulate in this regard. I think there will be both technical and non-technical solutions. I do believe that, given that we all envision this to be a global electronic commerce market, it will become a global issue — not only technical, but regulatory and social as well. Thank you very much.

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2. *Id.*