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Regulating the Telecosm

by George Gilder

The general theme of my argument is, Don't solve problems. When you solve problems, you end up subsidizing your weaknesses, starving your strengths, and achieving expensive mediocrity, and in a competitive global economy expensive mediocrity goes out of business.

Washington has a compulsion to solve problems, and that is really the basic flaw of the Washington approach to problems—it tries to solve them. Washington's solutions have accumulated over the years and have formed a gigantic regulatory apparatus with all its associated beneficiaries, clients, constituents, and petitioners. Washington is full of people who pretty much understand how that works, but very few really comprehend the dimensions of the technological change that's under way today. So I want to discuss the technological revolution.

Carver Mead, one of the key founders of the digital revolution, is my leading guide in this field. His theme is, "Listen to the technology. Find out what it is telling you." Today technology is crying out in pain. The danger is that government will try to find a solution to that pain.

Every era is marked by a key scarcity and a key abundance. What is scarce in the information era? Is it energy? No, energy is more abundant than ever. Is it food? *Business Week* recently had a cover story on impending food shortages, which is an unfailing signal that food is more abundant than ever, as indeed it is. Per capita food production has gone up 40 percent over the past 30 years.

Is it spectrum? Bureaucrats in Washington think so. In Washington, electromagnetic spectrum is viewed as a scarce item that has to be husbanded and parceled out very carefully. And, of course, anything that the government regulates soon enough becomes rather scarce. But spectrum is essentially infinite and to make it scarce will take a lot of work, probably even more work than Stakhanovite bureaucrats could manage.

The real scarce item is time. Time, I think, has two key limits: the physical limit, the speed of light, and the biological limit, the span of life. First let's examine the speed of light. It takes light 30 milliseconds to cross the continent and a quarter of a second to reach a geosynchronous satellite. The speed of light defines the limits of electronic and communications technology. It is the key constraint on the evolution of all technologies.

We can conclude from this focus on the speed of light that the most common PCs of the next era will be digital cellular phones.

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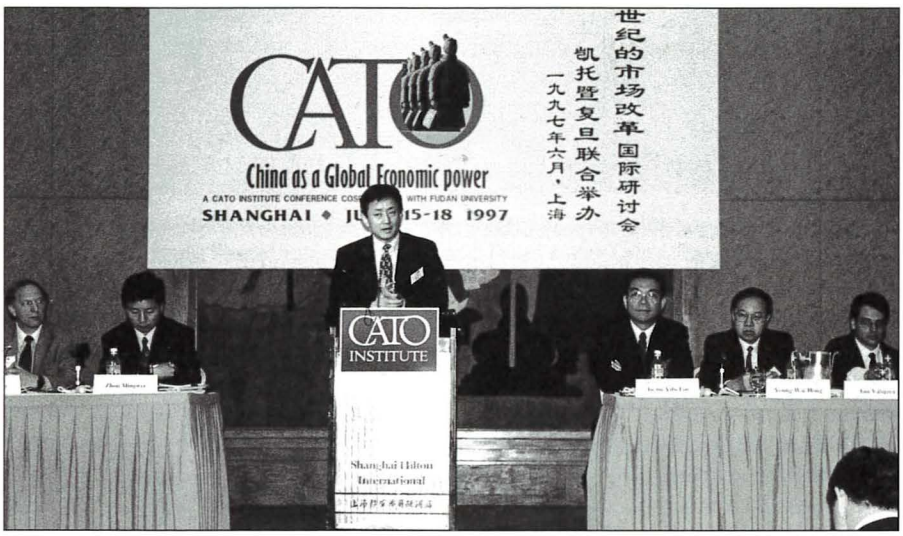

Fan Gang of the China Reform Foundation speaks at the Cato Institute's June conference in Shanghai. Conference organizer James A. Dorn, Cato's vice president for academic affairs, is at left. Other panelists are Chinese scholars Zhou Mingwei and Justin Yifu Lin, Hong Kong publisher Yeung Wai Hong, and Cato's Ian Vásquez.

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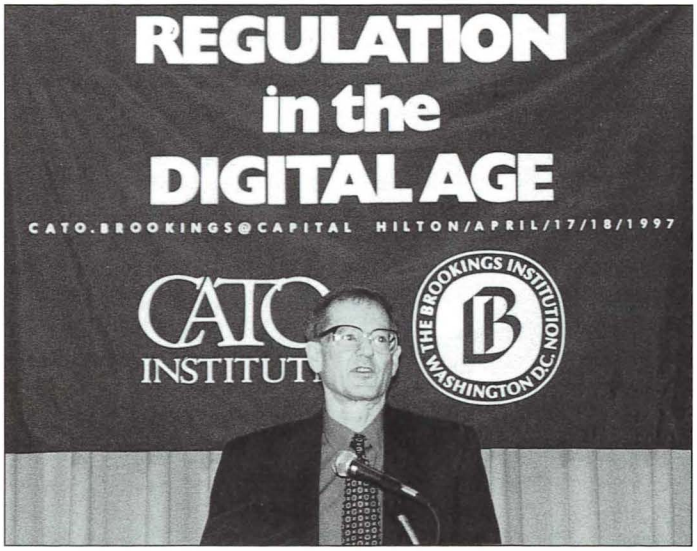
George Gilder is a senior fellow at the Discovery Institute, a contributing editor to Forbes ASAP, *and the author of* Microcosm. *This article is based on his remarks at the Cato–Brookings Institution conference "Regulation in the Digital Age," held in Washington on April 17–18, 1997.*

"Governments are always propping up the past in the name of progress."

TELECOSM *Continued from page 1*

They'll be as portable as your watch and as personal as your wallet. They'll recognize speech, navigate streets, plug into your car. They may not do windows, but they'll do doors—they'll open your garage door, your front door, your car door, the door to your safe. They'll collect your mail, and read it to you if you want. They'll connect to a variety of displays of all kinds with infrared connectors or possibly radio frequency connectors. They won't be limited to any particular form of display. They'll all have Internet addresses and they'll have Java runtime engines. And they will be low-power devices. They have to be low power because one of the scarcities of this era, surprisingly enough, will be power. Mobile technology faces real power constraints. Battery technology does not advance as fast as other technologies.

The model for the new uses of spectrum will be the cell phones and door openers that share a tiny span of frequencies today without significant conflict. So it's really a cellular network, and the speed of light is a constraint that dictates the dominance of cellular mesh networks. The speed of light will dictate the evolution of technology.



George Gilder

The Span of Life

The other key scarcity is the span of life, which I can sum up as the customer's time, the creator's time, the citizen's time, or the constituent's time. In an era of material scarcity, the customer's time was always an externality. By all means waste the customers' time! Line them up in a queue! Have them spend days and nights filling out forms! Keep them on a couch watching endless hours of television programs so that they can catch a few irrelevant advertisements! And by all means waste the creator's time! Make him come to Washington; make him line up outside lawyers', politicians', and regulators' offices; make him spend 16 years to get approval for cellular telephony; and then, in the end, approve the worst technologies. Government has a history of propping up the worst technology—windmills, catalytic converters, high-definition television—in the name of progress. To circumvent that problem—to effectively enhance the span of life by increasing technological efficiency—is the key role of business.

So time is what's scarce. What's abundant? What's the defining abundance of the era? The defining abundance of any industrial era is easy to recognize. It is marked by the plummeting price of a key factor of production. In the industrial era it was of course horsepower that plummeted in price. The price of physical force measured in kilowatt-hours ultimately dropped from thousands of dollars to seven cents. We've just gone through the microprocessor era, when the price of a transistor dropped from about seven dollars in the early 1960s to a few millionths of a cent today. Those were the key technologies of the previous eras. And they prospered to the degree that they were not heavily regulated. Activity and creativity almost always flow to the least regulated arena.

There's been a flaw in the technology of microprocessors, the technology of sand. To get an idea of its abundance, it's worth remembering that a silicon chip is made up of the three most common substances in the crust of the earth—silicon, oxygen, and aluminum. But there is a flaw and I like to sum it up by telling the story of the car in the jungle. If you encountered an automobile in the middle of the jungle, you might regard it as quite an impressive technology, particularly if you'd never seen an automobile before. It has heat, light, air conditioning, radio communications, a big back seat, and even a loud horn to frighten off fierce animals. You might never imagine in contemplating this car in the jungle, however, that the real magic of automobiles comes in conjunction with roads. For the last 30 years or so, we've mostly used our computers like cars in the jungle. We've been using desktop-oriented applications, without ever realizing that the real magic of computers comes in conjunction with networks. Of course, we've had local area networks—LANs—but at LAN's end is a communications cliff and a bandwidth scandal, and you're back to the heavily regulated 4-kilohertz jungle of the telephone wires. The 43 million tons of copper that the regional Bell operating companies command is, I believe, essentially a copper cage. It prevents us from effectively developing the new technologies that really will define the new cellular device—the CDMA spread-spectrum personal computer.

It is providential again that, like a giant river approaching a waterfall, a new key factor of production is nearing its historic cliff of cost. And that new factor of production is bandwidth, communications power. Its importance is really rising at a stunning pace, far beyond what most people comprehend. For example, we are developing technology that essentially allows you to send many separate bit streams down a single fiber thread as thin as a human hair. (There are some 25 million miles of fiber thread in the United States today, and it's being laid at a rate of about 4,000 miles a day.)

Recently, it's become possible to escape the necessity for opto-electronic repeaters. That means that we are now able to send messages from origin to destination entirely on wings of light. And over the last two years laboratories from NTC Yokosuka Labs to Lucent Bell Labs to NEC have all demonstrated terabit per second transmissions down

"The myth that spectrum is a natural resource has to be overcome to prevent government from reducing it to a truly scarce resource."

a single thread. To understand what a terabit per second is, it's worth knowing that in 1994 the worldwide telephone system—all over the entire world—transmitted about a terabit per second. It's now possible to put a terabit per second down a single fiber thread. Actually, NEC just announced that it has developed three terabit per second technology. This is a contentious issue because a lot of people don't think the technology is coming, but I guarantee you that it is.

A few weeks ago, by the way, I predicted that the initial public offering of an obscure company called Ciena Corporation would be bigger than Netscape's IPO. Everybody thought that was ridiculous. But Ciena went public and it was bigger than Netscape. It was valued at $3.4 billion. It commands the wavelength division multiplexing technology of many bitstreams down a single fiber thread, and it has allowed Sprint to deploy a 40 gigabit per second backbone for its long-distance capacity. MCI also has developed such a backbone. What that has produced is an explosion of Internet traffic.

In April 1996 I had lunch with Bob Metcalfe, founder of 3Com Corporation. At that time, he was predicting a crash of the Internet, because he believed it simply couldn't handle much more traffic. So I started following Internet traffic figures very closely. It turns out that Internet traffic in the United States has risen 10-fold in the year since I talked to Bob. And since the effective privatization of the Internet in April 1994, traffic has risen from 15 terabytes a month to about 2.1 petabytes a month—a petabyte is 10 to the 15th power—in the United States. That figure doesn't really include global Internet traffic. Despite the rapid growth of Internet traffic—the 140-fold increase since April 1994—there still is pain. For example, Andy Grove, the head of Intel, declares that bandwidth increases 100 times more slowly than our ability to use it.

Morons' Law

What's the problem here? We have an explosive tide of new bandwidth, yet we somehow still have Andy Grove struggling to use mips and bits to compensate for the inadequate bandwidth of the regulated jungle. The essential conflict is between the inescapable laws that govern technology and government regulation, what could be called Morons' law. Morons' law is inexorably hostile to the flood of creativity we have witnessed. I like to sum up the conflict with a story of the inventor of chess and the emperor of China. Some of you may know this story, but it's still a joy to tell it.

The emperor of China was so excited about the invention of chess that he offered the inventor anything he wanted in the kingdom. The inventor thought for a moment and said, "One grain of rice, Your Majesty." "One grain of rice?" the puzzled emperor asked. "Yes, one grain of rice on the first square, two grains of rice on the second square, four grains of rice on the third square, and so on through the 64 squares on the chessboard." The emperor readily granted that seemingly modest request. Of course, there are two possible outcomes to this story. One is that the emperor goes bankrupt because 2 to the 64th power grains of rice equals 18 million trillion grains of rice, which

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Cato Calendar

Ayn Rand's *Atlas Shrugged:* 40th Anniversary Celebration
Cosponsored with the Institute for Objectivist Studies
Washington • Renaissance Hotel
October 4, 1997
Speakers include Nathaniel Branden, Barbara Branden, David Kelley, John Stossel, Ed Snider, John Aglialaro, and Robert Poole.

Money and Capital Flows in a Global Economy: 15th Annual Monetary Conference
Washington • Cato Institute
October 14, 1997
Speakers include Alan Greenspan, Walter Wriston, Jerry L. Jordan, Lawrence Kudlow, Michael Prowse, Roberto Salinas-León, and Judy Shelton.

Toward an American Renaissance
Minneapolis • Minneapolis Hilton & Towers
October 16, 1997
Speakers include Edward H. Crane, Tim Penny, and Stanley Hubbard.

Toward an American Renaissance
Chicago • Four Seasons Hotel
October 28, 1997
Speakers include Ward Connerly and Edward H. Crane.

Toward an American Renaissance
Los Angeles • Inter-Continental Hotel
November 12, 1997
Speakers include Ward Connerly.

Fifth Annual Bionomics Conference
Cosponsored with the Bionomics Institute
San Francisco • Mark Hopkins Hotel
November 13-15, 1997
Speakers include Michael Rothschild, Virginia Postrel, Gregory Benford, Peter Huber, and George Dyson.

Solving the Global Pension Crises
Cosponsored with The Economist
London • Queen Elizabeth II Conference Center
December 8-9, 1997
Speakers include José Piñera, Gary Becker, Antonio Martino, Frank Field, Naoki Tanaka, Peter Lilley, Jianyong Sun, and Leszek Balcerowicz.

Tenth Annual Benefactor Summit
Grand Cayman Island • Hyatt Regency
February 11-15, 1998
Speakers include P. J. O'Rourke.

"Don't solve problems. When you solve problems, you end up subsidizing your weaknesses."

TELECOSM *Continued from page 11*

would cover the entire surface of the earth with rice fields two times over. So the emperor has a problem. But emperors don't like having problems and so the inventor loses his head. The emperor decapitates the technology. There's one obvious rule that the story conveys and that is, Always keep an eye on the emperor!

It's worth noticing that for the first 32 squares of the chessboard, the emperor could easily produce the 4 billion grains of rice required. Things really didn't start happening until the second half of the chessboard was reached. By 1994 there had been exactly 32 doublings in computer power since the invention of the NEAC digital electronic computer after World War II. So there have now been two years on the second half of the chessboard and things are really popping. A 140-fold rise in Internet traffic for example is the kind of awesome development that has occurred.

The other thing that's happened is that e-mail has overwhelmed postal mail in the delivery of messages in America. All those changes produce a process often called "disintermediation," which originated in the banking industry. Disintermediation is a big and confusing word, so I prefer the simpler and commoner phrase, "dis." And what the explosion in e-mail use has done is "dis" the Postal Service.

Another amazing thing that happened recently was that for the first time data bits outnumbered voice bits in the telephone networks. In addition, in 1996 more personal computers were sold than televisions. Because of those trends, I believe that TV and telephony are dying—but the television and telephone industries are not going to let them die without a struggle. They will come to Washington and ask regulators to save them from competition. So, the real issue will be whether they will be able to get Washington to decapitate the inventors of the new technology. If they are successful, other places all around the world will, of course, be happy to carry the ball.

Propping Up the Past

As I said before, governments are always propping up the past in the name of the progress, and you will see a frenzy of effort to prop up the broadcasters. Washington will work to keep that totally obsolete, useless source of industrial pollution—whenever you see a broadcast tower, just think of a smokestack with no filters—on its feet. In return, what the broadcasters will promise is to apply filters. They will offer children's programming, news programming, free political ads, anything Washington wants. Eventually television will be nationalized by default. But because activity flows to the least regulated arena, I think the computer networking business can prevail.

That brings me to what I think should be the two key regulatory principles. First, you can never have a level playing field. When someone talks about a level playing field, laugh him out of the room. You can't have a level playing field with capitalism. Only with socialism can you have a level playing field—a playing field where everybody is equally poor and a few bureaucrats are in charge. Competition means somebody wins, and somebody makes money. What competition means in Washington, of course, is essentially the allocation of markets by regulators. Whenever a politician says he's promoting competition, that's what he's doing—he's giving more power to regulators to allocate markets. He is attempting to deny the fact that you can never have a level playing field.

Second, spectrum is not beachfront property. It is not precious real estate; it has nothing to do with nature. Instead it is created through scientific dynamism. The myth that spectrum is a natural resource has to be overcome in order to prevent government from treating it like, and reducing it to, a truly scarce resource. That would be a crippling limitation on the evolution of powerful and important technology—and a classic example of government's clumsy problem solving. ■

CHINA *Continued from page 3*

did in the previous four decades."

Michael Tanner, director of health and welfare studies at the Cato Institute, urged China to adopt a privately run defined-contribution retirement system similar to the one in Chile. The man who developed that system, José Piñera, co-chairman of the Cato Project on Social Security Privatization, told the crowd that since Chile privatized its pension system in the early 1980s, it has experienced an average annual growth rate of 7 percent. After the conference, Piñera met with the official in charge of developing China's pension system, who expressed great interest in Chile's successful move toward privatization, and gave six reasons why a private system for China would be preferable to a pay-as-you-go state-run system.

Jerry Taylor, director of natural resource studies at the Cato Institute, advised China to abandon its obsession with the fashionable Western notion of sustainable development. In the long run, "economic growth, not sustainable development, is the only policy that can produce a clean and healthy environment for China."

Closing the conference was Liu Ji, vice president of the Chinese Academy of Social Sciences. He discussed "Prospects of Reform in China's Economic System." Although he is not a believer in laissez-faire capitalism, he maintained that the only people in China who still cling to the idea of central planning are "fossilized, dogmatic Marxists."

In addition to the formal presentations, Fudan University hosted an Open Forum for students and conference participants. David Boaz of the Cato Institute, Roberto Salinas-León of the Center for Free Enterprise Research in Mexico City, Richard Y. C. Wong of the Hong Kong Centre for Economic Research, Zhang Shuguang of the Unirule Institute of Economics in China, and José Piñera of the International Center for Pension Reform discussed the roles their organizations play and entertained questions from the crowd. More than 150 students from Fudan University attended the event.

The papers presented at the conference will be published as a book early next year. ■