"THE INTERNET

IS THE

INFORMATION AGE.

BUSINESS PEOPLE

KNOW THAT, EVEN IF

THEY DON'T HAVE

A CLEAR IDEA

OF WHAT THE

BUSINESS MODEL IS.

THE INTERNET IS

THE HOPE OF THE

FUTURE."

–BOB METCALFE

BOB METCALFE ON WHAT'S WRONG WITH THE INTERNET:

IT'S THE ECONOMY, STUPID

Bob Metcalfe, self-described technology pundit, eminently successful engineer-entrepreneur, and International Data Group Vice President and InfoWorld columnist is the subject of this month's Internet Computing interview. Metcalfe's invention of the Ethernet in the early 1970s grew out of work that had begun with his 1973 thesis at Harvard, Packet Communications (republished in 1996 by Peer-to-Peer Communications, San Jose, Calif.), and his study of the Alohanet, a radio packet communications network created by Norman Abramson and Franklin Kuo at the University of Hawaii. With David Boggs, Metcalfe developed the first Ethernet interfaces in 1973 that led to the landmark paper, "Ethernet: Distributed Packet Switching for Local Computer Networks," to a patent application in 1975, and ultimately to the formation of 3Com and the adoption of Ethernet as an IEEE 802 standard in 1982.

IEEE **INTERNET COMPUTING**

Facebook's Exhibit No. 1018

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After leaving 3Com in 1990, Metcalfe has continued to serve the field of networking through his role as a journalist. Clearly a believer in the watchdog role of the press, Metcalfe has been in the media spotlight for the past year because of his flamboyant predictions of Internet "collapse." In an interview with IC*'s EIC Charles Petrie and staff editor Meredith Wiggins, Metcalfe said that people would read his columns and say, "What is he doing?" We hope this interview will answer that question.*

We spoke with Metcalfe on February 10 in Indian Wells at the DEMO conference sponsored by IDG. In preparation for the interview we had sent him a copy of our interview with George Gilder, contributing editor to Forbes *and prominent author, which appeared in our first issue. Metcalfe began our interview by picking up* Internet Computing *and saying . . .*

Metcalfe: You know the more Gilder and I talk, the more I see we have so much in common. We're both very conservative. And then technologically speaking we agree on almost everything. He makes a big point of my saying that we lack bandwidth, whereas he believes bandwidth is in abundance. Well bandwidth *is* in abundance and can be in abundance and will be in abundance—in time. It's a question of time frame.

The biggest point of disagreement that I've noticed between us—and I hasten to reemphasize it's a very small disagreement—is on the issue of wireless technologies. He's very gung ho about wireless, and I'm very pessimistic.

IC: Why are you pessimistic? There is certainly a lot of investment going on.

Metcalfe: Because I've heard the story before. I mean, I've been to this ball game, and the main problem is we all desperately want everything to be wireless. We want it so bad that we're willing to believe anything anyone tells us about wireless.
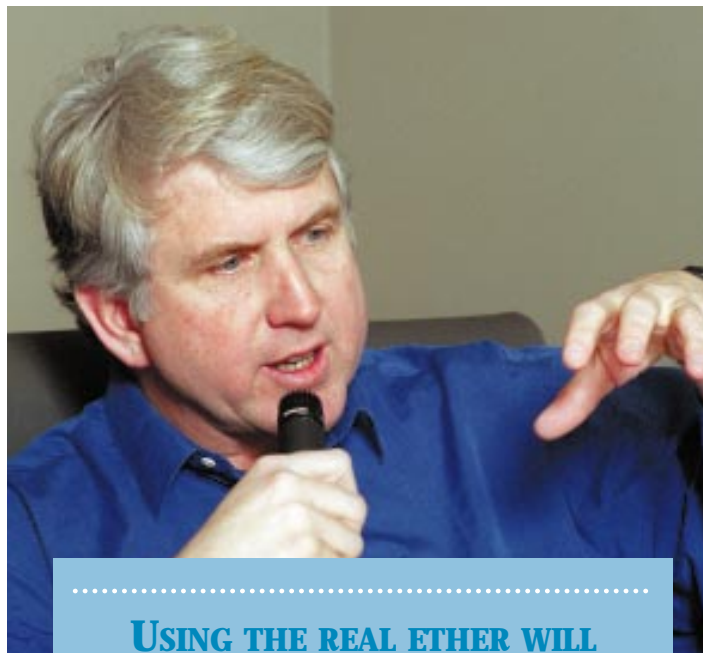
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Especially in product magazines like *InfoWorld*, look and you'll see that we're already in a wireless world. (*Points to an ad in InfoWorld*.) Oh! there's wireless. Even personal computer products in ads are wireless already. Advertisers have figured out that people want their equipment wireless so they take the wires out of the pictures. Show me the wire. Here's a picture of a PC for sale. There's no wires in it.

IC: There's not even a mouse wire. But evidence of wishful thinking still isn't proof that wireless won't work.

Metcalfe: No. It explains why the story is eternally with us that wireless is going to solve all our problems. Every time a random guy shows up and says, "I'm gonna make you wireless," we want it so desperately that we pump it up. And my conjecture is—and once again I'm talking

But seriously, what I'm saying is that in the future, computer networks (which is where I am expert, as opposed to cellular telephones where I'm a pitiful user) won't be wireless. In fact I've attracted the ire of the wireless community in saying that there will be wireless mobile computers, but they'll be just like pipeless mobile bathrooms. I'm trying to make an analogy between bathrooms and computers. There'll be as many mobile wireless computers as there are mobile, pipeless bathrooms. There are mobile pipeless bathrooms in airplanes, in ships, construction sites, sporting events. But in fact most of the networking in the world will be like bathrooms are. There'll be pipes.

IC: What's the basis of your prediction?

Metcalfe: Well, take satellite. I've recently been out to visit Hughes, who has DirecPC, which is wireless satellite distribution of data. It's a very exciting product; I'm rooting for it. And they have a new follow-on product which they call Spaceway✳ which I'm very enthusiastic about. But they need help in encouraging themselves to make the $3 billion investment to put up these eight satellites. And when it's all said and done, the amount of bandwidth that would be provided by such a system is a drop in the bucket. It's a few gigabits per second. One optical fiber strung from here to New York would provide much more bandwidth. To satisfy the Internet's needs for bandwidth you'd have to blacken the sky with satellites.

If you do the arithmetic, the satellites won't "win" against optical fibers, because the capacities are orders of magnitude out of whack. That doesn't mean they have to win. We're going to see satellites being very useful for broadcast applications, for highly mobile applications, and for highly remote applications. But you're not going to eliminate optical fibers with satellites.

IC: Will wireless then need a different pricing structure?

Metcalfe: Yes. The simple fact is that wireless uses one copy of the ether. There's only one copy of it, and they all have to use it, and eventually they'll run out. Whereas each optical fiber is its own copy of the ether; when you run another one, you have a whole new spectrum. You can duplicate the ether.

> ## USING THE REAL ETHER WILL ALWAYS BE MUCH MORE EXPENSIVE AND MUCH SLOWER.

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about a one percent disagreement—that George Gilder has been suckered because, like all of us, he *wants* it to be wireless. And while the people who are peddling wireless technology are sincere in their efforts, they're exaggerating its effectiveness. Oh, there will be wireless, there *is* wireless. Look what I have on my belt. I have this wonderful wireless device. (*Produces a cellular phone.*) I'm trying to make it a prosthetic, the way my glasses are, so that it's always with me.

See my glasses are always with me, and my pen, and I'm trying to be this wireless guy. But really, this StarTAC is gorgeous and wonderful. Of course, it doesn't work all the time. If you open it up, a large part of this device is dedicated to proving that it doesn't work. See these lights? These lights are important; they tell you if it's working now.

And then there's the battery. The battery doesn't really work. So there's an enormous number of lights dedicated to proving that the battery doesn't really work. It doesn't work so often that you have to be constantly aware that it's about to run out.

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Now wireless people by cellularizing are hoping to reuse the ether, and there's promise in this. And this is where George Gilder might turn out to be right, although I don't think so. If they cellularize down to cells that are really small, like this room here, then they get to reuse the ether; they're making copies of the ether in a geographical way. And now we're slipping into intuition: My intuition is that using the real ether as opposed to copies of the ether in coax and in copper and optical fibers will always be much more expensive and much slower.

These guys brag that they're now running at 9.6 or 19.2 kilobits per second. In the LAN world, where I was raised, 10 megabits per second was hot stuff. Now 100 megabits per second is de rigueur, and gigabit Ethernet is coming. Those numbers are astronomically higher than 19.2 kilobits per second, which these guys think is the greatest thing that ever happened. I'm sorry, there will always be a huge disparity, which means that we should not plan on the world being entirely wireless. It will have a mix of wireless and wired, but the predominance of data transmission will be optical fibers.

IC: Do you agree with Gilder that transmission times through optical fiber are going to be radically improved using techniques like wavelength-division multiplexing? Is this another reason you don't think wireless will win?

Metcalfe: There's great progress in optical fibers. Just speeding everything up with digital is great progress, then you have multiplexing, you have solitons and doped fiber and it's gonna be great. Of course transmission is not the whole game. There's this other thing called switching. One of the funny phrases I laugh about is "dark fiber." Telephone companies talk about dark fiber and the Internet people talk about dark fiber. By that they mean this fiber is all over the world, it's everywhere. It's just not being used. It's excess capacity. And were it not for the fact that they haven't connected up the lasing diodes and the switching systems, all that bandwidth would be there.

This is a little bit like—now I'm going to make a joke—it's a little bit like talking about dark silicon. I mean there's silicon all over the place! Look at Saudi Arabia, look at the desert. It's dark silicon! It's right out there! So Pentium chips and Power PCs and optical fibers are made of silicon. And it's just all over the place! The trouble is, there's a long way from dark to useful. Now I admit, a dark fiber that's been installed is a long way from dark silicon, but it has that same sort of futile pregnancy about it. I know there's a lot of dark fiber, but look at how much work has to get done to convert it into real bandwidth. All the switching has to get

done, and the customer support, and all the telephone poles. So dark fiber is a joke.

So George is right, and I agree with him. As I agree with him on most other things. There will be abundant bandwidth, but it's all dark silicon. It's just so far from fruition.

What's going to take it to fruition? We need an economic model for that. And Gilder and I would agree again that the way to do it is through free market processes, investment capital, and the technological advance fed thereby.

Now I figured out recently that I agree with what Al Gore says about most things related to the Internet, which is a big surprise because he's a Democrat. But for a long time he's been saying words that I agree with: that the Internet is not going to be built by government. It's going to be built by private industry. Now we're finding out what he means: Government regulation is going to *force* private industry to build the Internet. He's recently come out in favor, and the FCC and Reed Hundt have recently come out in favor, of
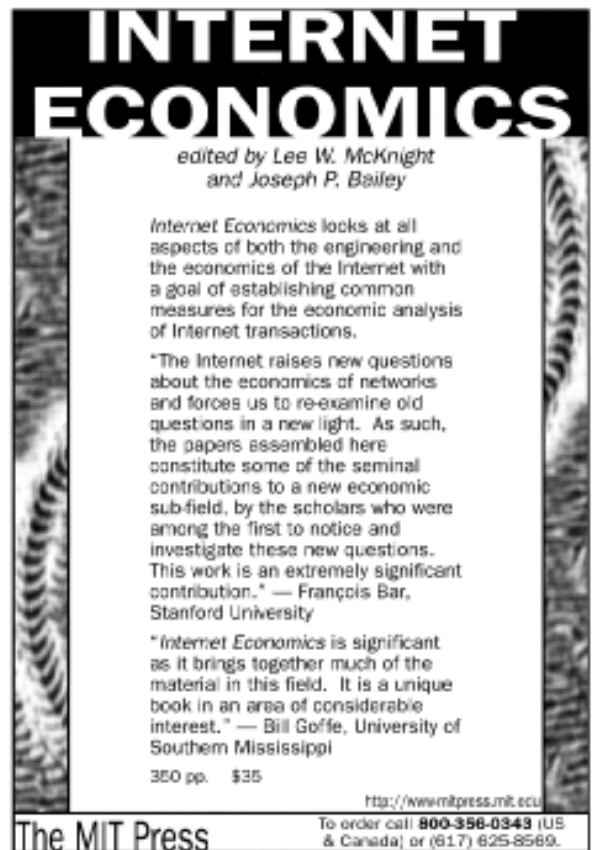
forcing Internet service providers to provide Internet access to schools and libraries. Forcing them to give discounts to schools and libraries. That's not free enterprise.

IC: And the telcos are encouraging this because it protects their monopoly.

Metcalfe: You're right, the telcos love this idea because it drags the Internet under this regulatory umbrella that they know how to manipulate. It's a terrible idea. Now the ISPs will begin to be reimbursed out of the Universal Service Fund, that artifact of the outmoded and discredited regulatory regime that the telcos flourish under. It's like a bear hug for the Internet under the guise of schools and libraries, and gee, it's so hard to say I don't want schools and libraries connected to the Internet.

IC: There's a lot of controversy about universal service right now.

Metcalfe: That's right. The term universal service***** got invented decades ago to describe the deal that we make through the federal government with the regulated monopolies. That is, in return for universal service we give them a monopoly, and then out of the monopoly profits that they're able to make, we insist that they cross-subsidize. Urban subsidizes rural, rich subsidizes poor, business subsidizes residential. It's a deal, and it's a deal that basically has not worked, as the Internet has revealed. Here we are now with computers millions of times faster than they were recently, but the bandwidth isn't there. The digital services aren't there. ISDN is barely there, and it's too expensive. And what I love to do is talk about this in terms of Moore's law and Grove's law. What
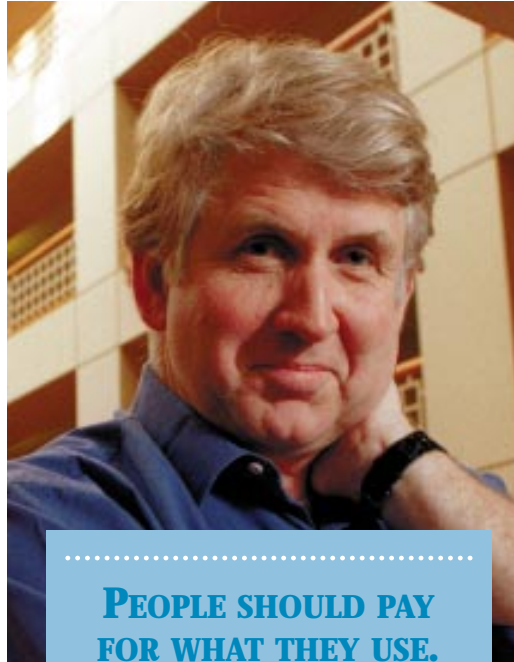
PEOPLE SHOULD PAY FOR WHAT THEY USE. IT'S A BASIC PRINCIPLE OF MARKET ECONOMICS.

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Moore's law says in essence is that microcomputers get twice as good every 18 months. Grove's law (*Intel's CEO Andy Grove*) on the other hand, says that bandwidth doubles every 100 years. And the reason it doubles every 100 years is because we have this malfunctioning, underperforming regulatory regime, that most people agree now is malfunctioning and that's why we have the Telecommunication Act of 1996.

IC: Which contradicts Gilder's prediction that bandwidth actually increases faster than computer speed.

Metcalfe: But we're confusing what we're talking about here. Gilder, when he says that, is talking about technological advance. When Grove and I talk about it, we're talking about what's available, what's deployed, what you can buy. And so there is in the lab all this technological advance, but you can't buy it. It's not for sale because this regulatory environment refuses to invest in deploying it. So we didn't get ISDN during the 1980s. We barely have it now, and it's expensive, and all that's being done under government supervision.

IC: ISDN did get deployed in Europe, where there's even more regulation of the telecommunications industry.

Metcalfe: And would you like to compare telephone rates in Europe with telephone rates here?

IC: Well, that's a good point. . . .

IC: Most people at home use their modems over voice lines to connect to the Internet. We hear it said that the local telcos are very slow in responding to the new usage patterns this is creating as local connections are left open for extended periods.

Metcalfe: Well first of all, Internet connection should not be going through the dial-up network. That's a basic problem, and it needs to be fixed. The reason it's

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