The Encryption Wars

An Interview With Jay Worthington

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WORTHINGTON: There's a tone of exhortation that seems to run through your writing on encryption- do you see a civic obligation to encrypt on the part of people making use of the internet, e-mail, digital communications generally?

MOGLEN: I guess. This was particularly true during the fall of 1998, when I gave a talk at NYU called "So Much For Savages." There was then a feeling that the United States government might actually continue export controls, and that it was in that sense people's civic responsibility to take advantage of the fact that the controls no longer rested on any technical basis at all and that the attempt of the American secret agencies and other secret police around the world to slow down the endtoend encryption of the net was no longer a process over which they had actual control. The hypothesis of "So Much For Savages" was essentially that the determination whether to make an endtoend encrypted internet now belonged to the members of the internet community. If they used the publicly available tools, like SSH, they would in effect up the total level of encrypted traffic in the net to the point at which by mere volume alone, without regard to the quality of the algorithms being used, a lot of the traditional listeners would have lost their ability to listen.

WORTHINGTON: What density of encrypted traffic is necessary before mail in an envelope doesn't stand out from the postcards? At what point does encrypted traffic stop standing out against the background noise?

MOGLEN: It depends whom you're thinking of counteracting. As the Europeans have been aware—which was what this year's Echelon controversy has been about—the U.S. has been essentially the empire in charge of who got what in the global telecommunications structure. There was the carefully farmed-out approach which Echelon represented for voice traffic, in which everybody had the right to declare some keywords but only the U.S. had control over the keyword dictionary and there were a lot of intelligence services around the world providing local collection for U.S. keywords that they couldn't actually see. That structure no longer seems likely to survive. The Americans will continue to try and take everything, but they will be on a more realistic basis with their foreign listener competitorcooperators. The Echelon mess will eventually develop into a European recognition that they're not going to give all the voice traffic on the continent away to the Americans. This in mind, if the net were 30% encrypted, that would be more than sufficient to overwhelm the collection and analysis capacities of everybody except the Americans.

WORTHINGTON: That's the sort of density where you would have to go fairly far down into the spectrum of casual users.

MOGLEN: Well, it depends. The people who are interested in transactional security now have SSL in the browsers of consumers, and they count upon it's being there. It's weak encryption, and they use it a lot less than they could, but just upping the total amount of encrypted data, all by itself, makes things more confusing. With respect to anything, you've got to decrypt to figure out what it is, and therefore this pure keyword approach to wading your way through the world's interactions becomes unusable. You've actually got to do traffic analysis in a way that allows you to decide what to decrypt, in order to find out if the keywords are there, instead of purely seining all the information flow in the world looking for words which is effectively how the system has operated up until now.

WORTHINGTON: It does seem the only way today that Louis Freeh could have plausibly suggested simultaneous monitoring one percent of all the telecommunications traffic in the United States.

MOGLEN: That's right. But it is absolutely true, as you suggested, that unless the dominant operating system used by almost everybody affords them real session security through an SSHlike client that simply routinely encrypts what comes in and what goes out as they are typing keys to remote computers, we're not going to have gotten where we need to go. "So Much For Savages," then, was an advertisement, a thought experiment, and a fundamental declaration about how things then stood, in the period after there was a defacto recognition that strong encryption was everywhere but while the United States government was still controlling, through export controls, the nominal extent of cryptography in this society.

WORTHINGTON: The export controls were lifted in the fall of '99?

MOGLEN: That's right.

WORTHINGTON: Do you think that's a battle the government has given up on?

MOGLEN: Well, I don't think their answer is "there's nothing we're going to be able to do about it." But the answer is "we are no longer attempting to delay the adoption of strong encryption technology by United States export controls." You'll notice that last night they took the error out of the Global Positioning System.

WORTHINGTON: So Iraq is now going to be able to target its cruise missiles precisely on top of the Washington Monument and not 50 meters away.

MOGLEN: Yes. The military says they will continue to provide wrong information in just those places that are absolutely important, but I don't think that means the White House or the Washington Monument. I think that means missile silos in Montana.

WORTHINGTON: Do you think, ten years from now, we'll see maps published showing the version of the United States that's being released now, with these abrupt transitions from crystal clarity to fog?

MOGLEN: Mapmaking is a very interesting subject in general, because when everybody in the country is carrying GPS equipment, one kind of mapmaking that will be absolutely possible consists of the whole structure of what we think of as free data. That is to say, people voluntarily walking around with GPS-equipped cell phones donating the stream of their information to a mapping database which will be a very accurate map of everywhere all the time. Every bridge, every road, every place in the country will be repeatedly measured by people moving around with GPS receivers.

WORTHINGTON: Have you heard of any project like this today?

MOGLEN: I'm not aware of any. But you can see that it will happen, because that data stream will exist, and there will be a kind of decentralized geographic information service structure, but I don't think anybody has yet thought about what will happen. You have lots of people thinking about it from a commercial point of view: Pizza Hut guys wondering how soon they'll be able to advertise to you on your cell phone where the closest Pizza Hut is.

WORTHINGTON: It sounds like you were going in more of an open-source direction, though.

MOGLEN: That's right, and indeed, lots of open data possibilities of all sorts exist out there that we will begin to see. But like a lot of free software activity, this will self-organize as people perceive the need or the possibility. It doesn't organize ahead of that perception. We get, in our movement, accustomed to the idea that what people think is neat, or needed, they'll do. As the net makes possible various kinds of collaborations that have never been possible before they'll do things, collaboratively, in new ways. Part of what I'm trying to do myself is to understand the political economy of a world full of that kind of content sharing; this is just one tiny example of such a process.

But let's return to encryption. Yes, it's correct, the United States government effectively resigned from certain kinds of control activities over the course of the past year. That represents the end of Phase I of the crypto wars as I knew them. Phase I of the crypto wars was a public law controversy about government control over cryptography. Phase II of the crypto wars begins now. To be precise, it began with the DVD case at the end of last December. This is a private law controversy over cryptanalysis, in which what people are attempting now to control is other people's ability to understand encrypted material, where previously, in round one, we fought over constitutional and other public law rights to encrypt things ourselves. So we have now moved quite sharply from one stage to another stage in the controversy about encryption in society. The leading forces against encryption and cryptography were policemen and spooks. Over the course of the past ten years, from the moment that PGP was distributed on the net until the government's change in regulations late last year, we were effectively in an environment in which the question was, were people going to be allowed to keep secrets or were cops and spooks going to be able to control the development of the technology?

That question has now been answered. If the NSA can develop quantum computers, if this, if that, if somebody figures out a way to factor very large numbers. something might destabilize this new environment in a deep way, but as things now stand, cryptography wins over cryptanalysis in civil society for one set of applications, which is the maintenance of privacy in personal communications. That will have a series of social consequences, some of them which we individually don't love, or do, but it will have a series of definite effects.

WORTHINGTON: What's your quick list of these consequences, good and bad? You seem to see a possible divide between the international and the domestic consequences of encryption.

MOGLEN: Well, at least I've wanted to point out to people that when you do this social accounting, you can't treat it as though all of us live in Lake Forest, Illinois. Some of us live in Baghdad, or Beijing, or various other places, and in those other places the balance of power between civil society and government is quite different from what it is in the United States and the social accounting is different. So, yes, the Iraqi gulag, or the Russian gulag, will be more difficult to erect in the 21^{st} century. You can still have an empire of fear, but you have to base that empire of fear more on networks of personal surveillance and informers than on the interception of communications.

WORTHINGTON: And domestically?

MOGLEN: Well, the right of anonymity, which people are beginning to see they might have some stake in, and what we now call privacy, by which this time we mean control over personal information, both depend upon encryption-based solutions. If we are going to have the ability to read what we want without being surveilled in reading it, that's because we are using agents to do our reading, which are unidentifiable and which restore content to us in an encrypted stream. That's how we get around people who establish surveillance blockages or interception points to find out what we're reading and whether we're paying for it, doing something seditious because of it, or just looking at naked people, or whatever. Our ability to behave anonymously on the net, and our ability to control the flow of information about ourselves both depend on our ability to encrypt what we do.

WORTHINGTON: At the same time, encryption is at the heart of the current mechanisms for extracting revenue from copyrighted streams of information on the net.

MOGLEN: That's precisely why we now find ourselves in disputes over whether cryptanalysis can be controlled by intellectual property law as cryptography was controlled by armsexport law. What we face in the DVD case and in lots of other conceptual or actual situations—CyberPatrol, for example—is a claim that interfering with the secrecy of other people's content, which in itself creates the possibility of copyright infringement, is somehow a sufficient basis on which to abate the cryptanalysis technology altogether. It is not proven in the DVD controversies—nor will it be proven, since it is not happening—that somebody is actually pirating movies off

DVDs using DeCSS. That's not what happens. Recovering 5.7 gigabytes of raw video and audio data on a hard drive is not a first step towards commercial piracy of DVDs. The way commercial piracy of DVDs goes is bitbybit copying in a mass pressing plant, without even trying to decrypt the content, just moving it from one place to another. That's why first-run movies on DVD are cheap in Thailand. It's got nothing to do with all this DeCSS stuff. DeCSS is intended as a part of a DVD player for personal computers using the Linux kernel. The goal is to make it possible for people who have validly bought DVDs to play those disks on computers they validly own, without having to buy monopoly software to do it with.

What we have is an environment in which rather than thinking about government control over whether we can encrypt, we are now thinking about private power control over whether we can decrypt without permission, and that's a different war, with a very different legal feeling to it. It also has a very different political tenor. The eight largest movie studios in the United States can, paradoxically, spend a whole lot more money litigating these questions than the United States government could ever spend litigating the export control regulations. It's a paradox of the way the U.S. government works that the secret agencies spent hundreds of billions of dollars building Echelon and all the rest of the interception gear, but when it came down to defending the export controls over encryption in the federal courts you had a couple of assistant U.S. attorneys. You had lots of FBI agents and lots of NSA guys hiding in the shadows, but no lawyers. They couldn't do scorched earth, bury the other guy, spend him into surrender litigation against Bernstein when he challenged the export controls, but when it comes to a Norwegian fifteen year old and the eight largest movie studios in the world, you can imagine that the shape of the legal confrontation is much more difficult.

WORTHINGTON: And do you think the lines here are as clearly drawn?

MOGLEN: No. What we have here are two different structures of the distribution of cultural product. You have a set of people whose fundamental belief is that cultural products are best distributed when they are owned, and they are attempting to construct a leak-proof pipe from production studio to eardrum or eyeball of the consumer. Their goal is to construct a piping system that allows them to distribute completely dephysicalized cultural entities which have zero marginal cost and which in a competitive economy would therefore be priced at zero, but they wish to distribute them at nonzero prices. In the ideal world, from their point of view, they would distribute costless copies at the same prices they get for physical objects which cost a lot of money to make, move and sell, and they would become ferociously profitable. They are prepared to give on price, but at every turn, as with the VCR at the beginning of the last epoch, their principle is that any ability of this content to escape their control will bring about the end of civilization.

This is an absurd claim. Nobody believes it but studio executives. My students are beginning to believe, to my shock, a communist thing—namely, "it's our music, and how dare they take it away from us?"—which is an enormously important and suggestive development. But, the theory of commercial distribution of proprietary culture is not a theory that one can say people have a duty to resist. I'm not at the Abby Hoffman "Steal this Book" level by any means.

But there is, of course, an alternative economy trying to grow up. With respect to software, it's happened already. There it's already been demonstrated that, in the real world in which we live, zeromarginal cost products that are collaboratively developed in the net and that have measurable functional characteristics—so that one can say, in an objective way, this is better or worse—are better produced anarchistically than they are in a proprietary mode. This is what the development of GNU, Linux, and all the rest are about. You can have more people doing more work, contributing more rapidly, fixing more bugs at the point of discovery, and you have Lamarckian evolution of software so that all favorable characteristics are inherited and therefore you get very rapid development. That's why the development curve on free software products has been so staggering to commercial producers who didn't know how these things could have roared up out of nowhere.

This is the hypothesis of "Anarchism Triumphant," and part of what I'm writing about in a book called "The Invisible Barbecue." We're going to have a competition in certain sectors of the economy between property and nonproperty production and nonproperty production is going to win. But the same can't be said when the goods are not functional and there is not an objective evaluation of betterness or worseness, and where the level of collaboration in production is less. We will see art forms in the next generation that are just as collaborative in production as software or free-data goods are, where thousands of people have collaborated on something, but many, almost all, of the traditional art forms are produced by a comparatively small number of people in direct contact with one another. In such a world, I maintain, there's no inherent reason why nonproperty production drives out proprietary production. In this world, however, nonproperty distribution drives out proprietary distribution, and the reason is simply that nonproperty distribution propagates at the speed of personal recommendation.

WORTHINGTON: Assuming decryption.

MOGLEN: Absolutely. Nonproperty distribution assumes music you can copy as many times as you please and give to whoever you want, changing it however you like.

WORTHINGTON: And how are producers compensated? Through the kinds of informal systems and prestige that commentators have observed in the free software movement?

MOGLEN: They may very well be, and we have to ask how the producer gets paid, but at the moment we can understand that the distributor who wants to do the same thing in a property way will fail. The market will saturate with nonproperty distribution. This is what the music industry is afraid of, with respect to Napster and Gnutella and so on.

WORTHINGTON: Unless people are willing to pay for certain proprietary content that can be defended.

MOGLEN: Absolutely. The point is only that the distribution structures have an advantage when it is free. But because the free production structure has no advantage, there's nothing to prevent Warner Brothers from making better music than a garage band that gives it away for free. Lots of people could prefer one, or lots of people could prefer the other. So, if there were no attempt to make what I would call monopolistic decisions, there's no end in sight to the coexistence of the free cultural entities market and the non-free, proprietary cultural entities market. They would exist independently of each other for the foreseeable future. What is happening now in the lawsuits against MP3.com and Napster is that the content industries are saying that you're not allowed to have a nonproperty distribution structure. The reason you're not allowed to do this, they're saying, is that even if you have nonproperty goods to distribute in it, the mere fact that you could also be distributing proprietary goods through such a structure means that the whole structure is contributory copyright infringement and should be suppressed.

WORTHINGTON: What do you think will be the longterm outcome of that particular struggle?

MOGLEN: You'd have to put every teenager in the world in jail, and you can't do it. I published an oped piece in the Harvard Crimson recently addressed to that audience, and I said "Isn't it interesting that here are these companies that do business all over the world selling to young people, and now they're suing, jailing and harassing them?" How can you keep on like this? You can't alienate your customers. What is the Mattel toy company going to do when children don't like it?

WORTHINGTON: Will customers actually make buying decisions with their social and political interests at heart?

MOGLEN: At the moment, all over university campuses, two things are going on: students are demanding that the sweatshirts sold in the bookstore not be made in sweatshops, and they're using Napster. I think the answer to your question is pretty clear: yes, they will put their behavior behind their attitudes. How far? We don't know. Could it really develop into a *kulturkampf* between Disney on the one hand and its consumers on the other? No, because Disney is not an idiot. It cannot actually forfeit the goodwill of its consumers.

WORTHINGTON: What if Disney targets, not its customers, but the programmers who make Napster possible?

MOGLEN: But, in the end, of course, that turns out to be the customers. The problem here is that the people who have made free distribution systems have not used free software to do it, and this is the difference between Napster and Gnutella. Once the free distribution structure is free throughout; the software is free; there is no centralized server anymore; there's no point of contact between Disney and the distribution system it is attempting to suppress, except the consumers who constitute the distribution system, so that after a while you'd have to attack the consumers, because the consumers are also the distributors. We've disintermediated the distributors out of the story. Now that happens with respect to zeromarginal cost goods throughout the economy. In the world where music has been subjected to a free distribution structure, there are only musicians, listeners, and people who try to get in between musicians and listeners who we used to refer to as facilitators, publishers.

WORTHINGTON: And people who write the free software that makes this distributed network of relationships possible.

MOGLEN: Absolutely. All of this depends upon that.

WORTHINGTON: Are there ways for the proprietary distribution camp to make that now formless element something tangible, something that they can approach or attack?

MOGLEN: What we are going to see is a strong effort on the part of the content industry to attack free software centrally. In the pipelines they're trying to build, the switch between their pipe and your eyes and ears, your computer is the weakest link in the chain. You control the operating system kernel of that computer, and if you control that operating system, then you can say: "Hey, on the way to the sound card, drop this where I want it put." You have decrypted the content. You're at the last stage before the noise emerges into air molecules.

WORTHINGTON: So the real civic obligation is to download Linux?

MOGLEN: The real civic obligation is to use free software. That's correct.

WORTHINGTON: How do you proselytize that?

MOGLEN: If you're a capitalist and you have the best goods and they're free, you don't have to proselytize, you just have to wait.

WORTHINGTON: How long would you say Linux has been the best good? Five years? It seems like there's a whole world of consumers out there who don't feel themselves capable of judging whether Linux is a better good at all.

MOGLEN: There are two possible ways of thinking about this question. One is, how long does it take the current user base to get to free software, and the other is how long does it take the current user base to be replaced by another user base? It's a transitional issue. In 1979, when I was working at IBM, I wrote an internal memo lambasting the Apple Lisa, which was Apple's first attempt to adapt Xerox PARC technology, the graphical user interface, into a desktop PC. I was then working on the development of APL2, a nested array, algorithmic, symbolic language, and I was committed to the idea that what we were doing with computers was making languages that were better than natural languages for procedural thought. The idea was to do for whole ranges of human thinking what mathematics has been doing for thousands of years in the quantitative arrangement of knowledge, and to help people think in more precise and clear ways. What I saw in the Xerox PARC technology was the caveman interface: you point and you grunt. A massive winding down, regressing away from language, in order to address the technological nervousness of the user. Users wanted to be infantilized, to return to a prelinguistic condition in the using of computers, and the Xerox PARC technology's primary advantage was that it allowed users to address computers in a prelinguistic way. This was to my mind a terribly socially retrograde thing to do, and I have not changed my mind about that.

I lost that war in the early 1980s, went to law school, got a history PHD, did other things, because of the fundamental turn in the technology which we see now represented in its most technologically degenerate form, which is Windows, the really crippled version. I mean, I use Xwindows every day on my freesoftware PCs; I have nothing against a windowing environment, but it's a windowing environment which is network transparent and which is based around the fact that inside every window there's some dialogue to have with some linguistic entity.

WORTHINGTON: There's a command prompt in every window.

MOGLEN: Exactly. And, of course, network transparency, a central idea of how to organize computers in the world so that what's behind your window might be a process on another computer, which for the Windows user is largely gone. The whole thing represents a very downmarket view of the way people and machines ought to interact.

WORTHINGTON: Don't you think, in today's world, that it's increasingly difficult to resist Windows?

MOGLEN: Well, maybe. But think of the two and three year olds, who've grown up with computers since the day they were born, and for whom the limited semantics and even more limited syntax of mouseframe interaction are just second nature. My two and a half year old nephew, who has all of the difficulties of handeye coordination and language acquisition that any two and half year old has, he's absolutely comfortable moving a mouse around and looking at a pointer on the screen, and he can do 30 or 40 interactions on the screen per minute. All of that is natural to him, and he's two and a half. When he's fifteen, is he going to want to use an operating system he can't change? The idea that he can't get under the covers after a whole decade and half of life with computers, he's just got to accept that they're as formlessly, seamlessly, totally incorporated, with nothing for him to do, as his father's Oldsmobile? That's just not the way society is going to exist. The number of people who are going to demand to control their environment is going to be very large.

WORTHINGTON: You mean demanding to have access to their source code, tinker with it, and share it with others? Is that how you're defining controlling their environment?

MOGLEN: Absolutely. In the same way, kids, boy kids particularly of course, they wanted the engines of automobiles to be malleable.

WORTHINGTON: What fraction of Americans actually knew how to tinker with the insides of their cars?

MOGLEN: The answer would be an interesting one. I don't know, but it's an important question in the historical sociology of the American relationship to the automobile. At that moment after the Second World War, when a highschooltofactory attitude prevailed about where the good working class life was, what proportion of those kids—mainly boy kids—grew up messing with automobiles?

WORTHINGTON: That's the question you'd ask in a different form today.

MOGLEN: Yes, you would. And you would say, it's not going to quite as much a boy thing, but it's already too much of a boy thing, and the level of sexual dimorphism in this is interesting to observe and to think about and do something about. But, look at the life histories of a bunch of the people you come across when you occupy this beat: people like Richard Stallman and John Gilmore. Gilmore and I met when he was nineteen and I was sixteen and we sat at adjacent desks in Westchester county working for the same timesharing company, and with two other guys we were writing what I believe was the first networked email system in the world. What I see when I look at guys in our generation, we are now in our 40's, we were kids who grew up in an environment where we were programmers—not of video games, but of really heavy stuff—we were youngsters who were allowed to work in ways that youngsters are not now allowed to work because the whole industry is professionalized to the point where you can't get in without some of the same kinds of credentialing that you get into any other business with.

We grew up in a freesoftware world. We shared everything. We worked in an environment where the source code to our mainframe operating system was given away. It wasn't that IBM didn't claim to own it, but they shared it with their customers so that everybody could improve it together. The people who grew up in the culture of the programmers of the early 1970s, the late 1960s, you see them now at the edges, or even at the center, of the free software movement. You see them now trying to bring about some sense of what it is like to grow up knowing how to program and wanting to be able to make changes and do neat stuff. I think what we're doing is showing why people will give away what they do, why they will do what's neat, why they will engage in making stuff just because they know how to do something terrific. To respond to your question, I say that the generation of kids growing up now with computers as standard equipment in their world, they're not going to lose that feeling, they're going to have that feeling much more than we did. Now the question is, what are they going to be able to do with it?

WORTHINGTON: Will we have that world even if children are using Windows software from birth? I'm inclined to think that a three year old growing up with Linux, in your story, is much more likely to grow up into your idealized fifteen year old.

MOGLEN: Well, if you look at the computer science 101 syllabi of universities in India, Southeast Asia, Indonesia, if you go on the web and look at these, the CS 101 curriculum in these universities assumes that people are using a Linux based computer rather than a Windows based computer. After all, it's free. So, Singapore and Thailand and Malaysia are going to produce a lot of young adults who learned about computers using free software; the computers in their homes are going to be free software computers; their children are going to grow up with free software computers. Which bunch of people are going to be the talented, engaging, aggressive programmers, busy making changes?

WORTHINGTON: So, culturally, you see the collective decision to use Windows as one which forecloses the possibilities of generations down the road?

MOGLEN: Well, it's a decision to have fewer programmers. The whole point of free is freedom to change, not low cost, and the whole point of the world towards which we are moving is that the primary power distinction, the class line, is between those people who know how to change the behavior of computers and those people who don't. Because that kind of knowledge, in particular, the ability to interact with complex technological systems to alter their behavior, is power over ordinary daily life in a profound way.

WORTHINGTON: So what civic obligations does that leave us with today?

MOGLEN: Well, I don't want to be dogmatic about what other people's responsibilities are.

WORTHINGTON: Go ahead.

MOGLEN: If you want to gain knowledge, you need to know these things. If you want to convey knowledge, if you want to help other people learn, you have to help them to know these things. If you want to be living in contact with the real issues, you're going to have to know enough about the technology to see where the real issues are. If we wrote down on a list the eight or the ten most important political issues in this society at the moment, my guess is that three or four of them would be issues that you can't understand, let alone have a good opinion about, unless you know a good deal about technology. If we wrote down the issues that we feel most nervous about, of those ten we'd probably find that three or four are places where we think that people are getting rushed out of the question already, because the guys who know are racing to lock it up before everybody else figures out what's going on.

Now, in an environment where both of those things that I have just said are true, civic duty is to learn what you need to learn in order to make the decisions in a democratic society in a grownup way. That's the same civic duty that Thomas Jefferson or George Washington believed in. The people who think that we need to have a democratic society are always people who are worried about whether the voters who control the society know enough, and it's not a question of taking power away from them, it's a question of helping them to become knowledgeable and engaged. We've got a duty to try and explain this stuff clearly. We've got a duty to learn these technologies so that we can ourselves participate, and most importantly we have a duty to look at the educational system to find out whether it teaches people who grow up in the society what they need to know.

You look again and again at how we educate people about technology in this society and again and again you see people who've given money to have their technology taught and to have other's people technology not taught. Cisco Systems is a very interesting business, which is now regarded somehow as the antithesis of Microsoft. If Microsoft is bad and weak and vulnerable which it now suddenly is thought to be, Cisco somehow is unquestionable. Well, what do they make? They make "the infrastructure of the internet." What is that? We don't know, but we buy their stock. Cisco is in fact a most extraordinary example of the paper tiger, a hollow animal. The Cisco world consists of selling at exorbitantly high prices routers which use proprietary software. So, in order to know how to program a router you have to know Ciscotalk. They spend vast amounts of money in junior colleges on vocational educational systems to teach people Ciscotalk, and those kids graduate with Cisco certification, they go to work in the businesses that need network infrastructure, and they install Cisco hardware. There's a bilateral monopoly between technically, vocationally trained people, who have learned a proprietary way of doing things, and a manufacturer which sells goods at very high markups, because it has a proprietary, secret language.

Now, the router is in fact not a complicated entity. Many years ago we created, spontaneously, a thing called Linuxrouter.org, which is simply a way of providing a Linux kernel optimized for routing in a very flexible little package that fits on a 1.44 floppy disk, and the routers are in fact throwaway boxes: a strong simple router is a 100 megahertz 486.

WORTHINGTON: That was a throwaway box five years ago.

MOGLEN: Yes, but I use one as my server. All the web stuff of mine that you read, all my email, all my electronic courses, the one box that does all that work for me is a 100 Mhz box with 32 Meg of main memory in it, and I keep it that way deliberately, in order to make a point.

WORTHINGTON: I have a 133 Mhz motherboard sitting in a box under my bed.

MOGLEN: It would make a fine server. One of the fundamentally untold parts of this story is what the WinTel hard strategic alliance gave Andrew Grove, who has come out of this beautifully. Intel isn't being broken up by the United States Government. But what the WinTel box did was create a bad, slow, bloated software division for a hardware manufacturer that needed to keep the market from saturating.

WORTHINGTON: And the way to do that is to continually escalate the demands created by bad software.

MOGLEN: Absolutely.

WORTHINGTON: And yet in the long run you feel that Windows has already lost the war.

MOGLEN: There's no question. But the world economy would not necessarily be better off if nobody needed to buy any PCs any more. The fact that the hardware market actually saturated with all the computers we really needed years ago is not really an argument for why the society would be so much more prosperous if we stopped making them.

Rather, this is the digital divide problem in a serious way. I made a proposal to the Israeli government a year ago that went like this: Take every computer that you threw away in the state last year, just the ones you scrapped, and put free software on them. They are now the routers, bridges, switches and email servers for an entire free broadband network for all of Israel. The only thing you don't have is the cable. But you have required annual military reserve duty. Take one cycle and say everybody not performing militarily essential service is laying fiber, for one year. You are now finished. Free software, scrapped computers, one year of conscripted labor, plus the physical cost of the fiber and you're done. You have a broadband network in a little, demographically concentrated country with a highly educated population. And when I talk about building a network I mean on the West Bank and Gaza too, and then you say "This is a gift. We're leaving this here. This is a little bit of what we need to do: two states, one network." And you know what? Nobody will ever bomb that network, tear it up or throw it away, because that's how, if you're in Gaza or the West Bank, you get out to the world. That's how you free the people you have been chaining up all these years.

Now, after I finished making that pitch, I was leaving the room, and the chief of the computing center in one of the big universities turned to one of his opposite numbers and said to him in Hebrew, 'Oh, these Americans, they're so idealistic. It's impossible.' And I said to myself, you see, the Zionists are no longer the idealists. It's the Americans. Now, they'll get there eventually, but they're not ready yet. The belief that it could actually happen isn't there. They haven't taken a hard look. They don't realize it is in fact technically possible.

But the truth is, that what the digital divide means, what inequality of access means now, primarily, is a series of decisions about the allocation of hardware and software coming home to roost. We have all the computers we need. We have more computers than we need. Giving every kid in the country a computer? That's nothing. We're scrapping the stuff. And software? We can provide free software to everybody. That's no problem. Our movement is built for that.

What we don't have is a telecommunications infrastructure that is free. What we don't have is the time, the online hours. This is why we need to use the spectrum to create a free net. An uncharged, birthrightbandwidth system. A chapter of my book which proposes just that is not yet on the web but it'll get there one of these months. My proposal is for a simple, birthrightbandwidth structure, using just the current analog television frequencies that under the '96 Telecommunications Act the broadcasters have already promised to give up. It's good spectrum. It goes through walls very nicely. It does all the things we need. It needs to be used as though by cell phones, with little boxes that arbitrate frequency usage directly and intelligently, on a cellular broadcasting sort of model. We could give everybody who is here 400 megabits of bidirectional bandwidth, I'm sure. Maybe we could go to 600. You're not a television broadcaster, but you're a radio station, and if you and your friends get together, two or three of you, you can be a television station. My proposal is that bandwidth is personal to you. It's in a box like your cell phone. You take it to work in the morning, and you contribute that bandwidth to your employer. You take it to church, to your clubs, your bowling league, wherever you go. The idea is that civil society is constituted around the notion of an equality of access to communications. Everything else falls out. Old hardware, free software, wireless infrastructure that belongs to the nation as a whole, which is already required to come back to us.

WORTHINGTON: Would this bandwidth be inalienable? Would people be able to buy and sell the bandwidth they're born with?

MOGLEN: Well, my own judgment is that the proposition ought to be that it's not tradable, any more than you can sell your right to drive on I80. There's no market in buying from you your right to drive on the public highways, and there's no buying from you your right to drink the municipal water supply. But obviously, you can understand why people might think in those other terms. Now Nick Negroponte recommended years ago what has come to be called the Negroponte switch, which is to put all the commercial uses for all communications down on the cable lines and to recover the wireless domain for the personal communications uses which we now heavily use the cable lines for. I was listening to a rather right wing securities analyst—as though there were any other kind—talking about the telecom business six months ago, and he was talking about the long distance companies. And somebody said to him, "well now they're getting down to a nickel a minute any time, is there any more air in that? How could that price go any lower?" And he said, "you must be kidding: there's three and a half cents extra in that five cents," and he said, "you know, at nights and on weekends, the price ought to be zero." And I thought, "man, if the rightwing securities analysts are beginning to talk about free long distance calls, what's left?" We should be living in an environment in which the recognition is that the building of the public infrastructure allows us to render connection as completely and obviously a personal right as driving on the street or walking in the park or drinking the water or breathing the air.

WORTHINGTON: What do you see as the immediate cultural and political roadblocks in the way of that kind of a birthright reconception of bandwidth?

MOGLEN: The answer is "the invisible barbecue," the way our politics is owned. That's the problem. That's why I am writing about a threecornered entity: technology, law, and politics in this age of corruption. That's what we have. We're making land rushes. We're trying to turn everything into property. That's the conceptualization. The relevance of encryption is that encryption is a device for turning bitstreams into property, by creating the power to exclude. When I teach property law, what is it that I am teaching people about what property is? The Supreme Court, in an image that it likes, refers to a stick in a bundle. Now that bundle of sticks is the Roman thing called *fasces*, this word out of which we get fascism, it's just a funny little thing that has happened to us, the sticks in the bundle, like the rods and the axes that meant power in the Roman symbology of politics. One of those sticks in the bundle is the right to exclude, and often it is that right to exclude which in capitalist society is seen as the center of property. I have a right to exclude, and therefore I can create a market, and out of the market can come all these other great things. In order to have the right to exclude from bitstreams you need encryption.

But the whole political structure that we have at the moment: the ease of getting patents, the giving away of spectrum in the '96 Act to people who already had spectrum, in order to build an HDTV system that we notice they're not building, the Federal Communications Commission's fundamental strategy of permitting duopolies in whole areas of their traditional regulated fields, so long as those duopolies then go out and compete in other fields against other duopolies—all these structures bear a similar sign, which is that everything is for sale because our politics is for sale, and that the law's power to create property is now in use in a very heavy way.

Allan Greenspan gives a speech and he says, "We should beware of economic regulation and government interference in the market. Government should limit itself to creating and protecting property real and intellectual." As though that weren't regulation and intervention in the market. What we have is massive market intervention by legislators who have the power to create property rights through law and who are selling that power for bribes we call campaign contributions. We can't create a free anything, because it is ideologically deprecated for things to be free, and most importantly, because it is politically ineffective for things to be free, because making things free doesn't bring in "campaign contributions."

WORTHINGTON: And yet you seem to feel that at a certain point, the functions of these technologies are going to make irrelevant this legal apparatus trying to enforce this particular conception of property, because free software and free intellectual property will simply happen as a result of the increasing ease of communication and of creating cooperative, information sharing communities.

MOGLEN: Well, what I say at the end of "Anarchism Triumphant" is that this is the big political issue of the time, and aristocracy looks set to win. I mean, they're in control. They have all the money; they have the politics; they have the shape of things to come in their own view. The force is with them. When I say that there are these reasons why things ought to be different, I'm talking in the same way that people were talking in

European rathskellers in 1848: "there ought to be democracy; there ought to be liberalism; there ought to be freedom; aristocracy ought to go; the ancien regime ought to disappear." Well, yes and no. Hence, I end with Chou EnLai talking to Oriana Fallaci: "What's the meaning of the French Revolution?"she says; "Too soon to tell," he says. This is a long term question. Are Rupert Murdoch and Michael Eisner going to prevail in the short term? Yes. Are they going to prevail fifty years from now? I don't know.

In the long run, what's going to happen? In the long run, I do not think that the path is in the direction where they will own more and more and we will become their helots. I don't think that's what happens. Martin Luther King Jr. said, "The moral arc of the universe is long, but it bends towards justice." Now in that same broad sense, the moral arc of the universe still tends towards democracy, still tends towards freedom, still tends towards the growth of societies which enable people to be not under the control of others, either the rich or the powerful. In that broad sense, yes, I think certain things can be said to have the weight of history behind them.

But what kills ancien regimes is not that they are reactionary. What makes the ancien regime fall is that it is modernizing. This was the problem of the French in the 1780s; this is the problem of the Iranians in the 1970s; this will be the problem of the Chinese in the next decade. When you modernize, when you begin the process of change and to enable new forms of human growth and expression, there is a difficulty with keeping those processes under control. The processes now being lit as humanity comes into a new relationship, where everybody is connected to everybody else without intermediaries, that social structure, that condition of massive interconnection that we call the internet, that changes everything in profound ways. They are modernizing this regime. They think they are going to control it, that property relations, legal relations, technology, Lawrence Lessig's "code doing the work of law" kind of idea, that all of this is going to make them stable. But it is not going to do that, in my opinion. It is going to produce the hunger for the various kinds of freedom and the various kinds of liberation that the net makes possible, and if they stand between the people and that freedom, they are going to be pushed aside. Now, they have money; they have power; they have thought; they have influence. It does not have to happen to them.

WORTHINGTON: What if it turns out that people are content with the level of freedom that Windows 2010 provides them? What if some minimal level of the kind of freedom you're talking about is enough to create satisfaction?

MOGLEN: Of course, in the meantime, in that world of 2010, we've moved towards being a payperuse society for culture. Because in the meantime, the book publishing industry hasn't stood still. It's selling ebooks per read, and the music industry hasn't stood still; it's trying to sell you songs per listen. What you have in mind is a bargain in which we sort of stay the same as we migrate technologically. When we look at how it really functions, technologically, politically, economically, we find ourselves moving in a world in which we can have many different things, but staying the same is really hard. From the point of view of the copyright industries, the culture manufacturers, the limited term of copyright is unacceptable. What Disney went through to keep the mouse from expiring is just the beginning of that issue. Limited term is not acceptable. The first sale doctrine is not acceptable. Fair use rights are not acceptable. In the world of the electronic, absolutely free, frictionless copy, they need to move more and more towards a controlled environment. The traditional balance that lies underneath, that we no longer think about, where you just hand the newspaper to the guy sitting next to you when you leave the railroad train—that's not what they're thinking of, and the logic of the situation compels them not to think of it. The logic of the situation compels them to all or nothing solutions, and I think they're going to get nothing instead of all.

But they are groping. You can see the deal trying to get made, even now: How do we work this out so we can sell this music for something, without wiping out our high moral ground position that you should pay full price and never be allowed to give it to anybody? How do we facilitate sharing, which people want to do, without giving away the store? I think that there will be intelligence directed at that. I don't think all of this is going to be done in a hamfisted and thoughtless way. Jack Valenti has to die. You can't go into the twentyfirst century with Jack Valenti as the only face you have, because nineteen year olds are not going to accept that. There's going to have to be a different way to do it. They need somebody as good as Chuck D, and they don't have that yet. But there will be an attempt, there will be lots of attempts to find a way.

WORTHINGTON: Won't some kinds of cultural production simply fall by the wayside in a world of free distribution?

MOGLEN: Of course, but look, the same is true with respect to pyramids. Without hydraulic despotism and the divine right kingship of the pharaoh, we will underproduce pyramids. Now, we've been underproducing pyramids for three thousand years, and pyramids are beautiful but it isn't hurting us that we don't make them anymore. Without the Renaissance style of provisional citystate leadership in Italy that Burckhardt referred to as "the state as a work of art," you don't get all kinds of villas and palaces. There's nothing for Michelangelo to sculpt. You get a little bit of stuff for postmodern architects to build, but only if you're building a Guggenheim museum. Sure, the structure of art and expression is related to the material understructure of society, you don't have to be a Marxist to think that.

In a world of really free stuff, I think there would be a lot fewer Arnold Schwarzenegger movies. I think $100 million movies don't represent a particularly good form of free stuff.

WORTHINGTON: Any sort of high initial capital cost cultural production seems hard to justify. Blade Runner probably doesn't get made either.

MOGLEN: Absolutely. On the other hand we're going to have a golden age of poetry such as the world has not seen in a thousand years. Even traditional art forms may do very well. The literature for two pianos is due for an enormous revival. I say, fifteen years from now the dominant form of two pianos literature is going to consist of one live and one dead pianist. The whole ability for people to engage in jamming with Sidney Bechet has only begun to be discussed. What Bill Evans did in "Conversations With Myself" is going to become conversations with everybody. The only problem is that if I want to jam with Sidney Bechet I can't, because somebody owns Sidney Bechet's music on record and I've got to deal with them in court. There are ranges of collaboration; there are new forms of art; there are new ways of making and delivering everything, including dramatic video, that will come up, and there are art forms whose names we don't know yet that are going to happen. All of that is sure. But you meet people who say, "But if there weren't property then nobody would make the Flintstones." And you have to say, "well, what do we get on the other side? What's the name of all those art forms that we can't have now and that we will have then?"

The social accounting is done in a funny way. You could, for sure, say that the piano was going to kill off a whole bunch of literature for the clavichord. Until Keith Jarrett recorded an album of clavichord improvisations in the mid 80s, I don't think anybody had played a clavichord on record in decades, and the idea of clavichord improvisations was deader than Mozart. Of course technological change changes the forms of art. There's no question about this. And the social environment too. Americans listen to music; they don't make music. That's a whole profound change in one generation, really, in the history of music in the world. Music was a thing people made; now it's a thing we hear. I am a nonmaker, just a listener to music. I have an enormous privilege, as I see it, to live at the beginning of the digital era, when music from all over the world is available, before it has all been homogenized and paved over. I am deeply grateful for living at the time that I live, but I am product of a world in which, unlike Mendelssohn making his music at home in the evenings with his family and his friends, I am a consumer of music. I listen to other people's music. There's no question, all of the arts are going to be altered by this. Sure. We're not scared of that.

WORTHINGTON: Necessarily homogenized?

MOGLEN: There a zillion different things that could happen. The next great Oud virtuoso may be a fifteen year old Vietnamese girl who has never seen an Oud and who has never been in the middle east but who is listening to one of the great, or seven of the great, Oud virtuosi from the Sudan and from Iraq, and is deciding to play that thing herself. Who knows in which directions all of this goes? I can listen now to a choral musician from Senegal playing with a Norwegian vocalist and a mouth harp player. There's Kirsten BratenBerg's album, called 'From Senegal to Setesdal', here we have musicians from all over the world collaborating in ways that were never really thought about before.

It isn't necessarily homogenizing, but of course there are forces for homogeneity doing very well at the moment, and it is their activity in the net that we are primarily talking about. They are the people who want to encrypt. They are the people who want to own. The musicians all over the world looking for an audience, they don't show as their primary concern that they want to encrypt their music and keep it away from people. Ownership and homogenization have a relationship to one another. They're not just casually, contextually found in the same places. They exist where they exist for reasons. The goal of reaching the mass audience and getting paid for each and every eardrum is also the goal of homogenizing, to have broad appeal.

WORTHINGTON: It's cheaper if you first standardize the eardrums.

MOGLEN: It's not just cheaper, it's not much of a marketing opportunity if you don't standardize. That's what the beauty of being separated from production is. Nike doesn't care how an actual shoe is made anymore, because they don't make any shoes. They make image, they make icon. The icon is valuable precisely because everybody knows it.

WORTHINGTON: What kind of penetration does free software, GNU, Linux, whatever, need to have before these processes start to organize themselves?

MOGLEN: It has it now. Whatever the relevant level of penetration is, it's here. We're now living in a very odd world with respect to free software. Under the skin of the beast, free software is everywhere. The penetration in the server market is nothing to worry about. So what we really mean is, what's the difference between the technologically cluedin and the technologically checkedout? And the answer is, what they use. How big does the technologically cluedin population have to be before new ways of thinking about politics and economics and society take hold? Quite large. But we're going there. It's like asking, "What would the opposition to gas taxes in the United States be like in 1910?" "Not enough drivers."

We are going to a society which is not this one. We are always aiming at a moving target. The problem with analysis based on where we are now is that we are standing in the middle of tidal wave and trying to figure out how wet we are around the ankles. It just doesn't matter very much. One of the many lessons I've learned from Richard Stallman over my years of working with him is that I have strategic views and I would say, "Richard, we need to have this. We need to have that. We need to do this or this or this to meet the current situation," and Richard would say, "What needs doing will get done. What people need, what people want, they'll make."

WORTHINGTON: That seems to be GNU's organizing principle.

MOGLEN: That's right, and that's an important lesson. We will get where we are going when the people who need to be there are around. I don't know how long that takes. I don't know exactly what the numbers are. I don't worry that they won't show up, and maybe questions in the form "how many" are really questions in the form, "How do you know they're all going to show up sooner or later?"

WORTHINGTON: Or the question might be, how do you know there's not going simply to be a permanent 10%, or whatever percentage, of the deeply technologically literate, and everybody else? Two years ago, I corresponded with three people who used PGP - eight years ago I didn't know anybody using it - and today I still know three people who regularly use PGP. It does seem, and this might just be a generational question, that in today's world there's a certain group of people who are comfortable with these technologies and a larger group who aren't.

MOGLEN: I think you are right there, but PGP may not be the good test, after all. The questions now that you want to ask have a pretty fine granularity. They have to do with which kinds of technology will get widely adopted and which kinds won't. Nontransparent encryption of email is a specialist thing. If we sewed it into Eudora and distributed it to everybody they'd all use it, but they wouldn't know. They use the secure socket layer in their browser but they don't really know it's there because they don't see the little lock at the bottom of the page. This bites them sometimes. People you know are using encryption, they just don't know that they're encrypting. I do not think that encryption in itself will become something that everyone will know a lot about and care a lot about in the future.

WORTHINGTON: How about opensource operating systems?

MOGLEN: Now there, of course, eight years ago you didn't know anybody, and five years ago you knew four, and this year how many? Hundreds?

WORTHINGTON: Actually, no. Probably just several.

MOGLEN: That surprises me. If you go across the street and ask the undergraduates, it's cool, and to be a CS guy and not to have a Linux box, that's a weird thing. But we don't want the computer to be too fetishized as the most important thing in everybody's life. These are tools, and we do expect most people to have a pretty toollike approach to them. What people are going to use these switches for, and how much they are going to care about who controls them, that remains to be seen. My sense is a little different from yours, because I believe that kids growing up with computers are going to want to know how to change them.

WORTHINGTON: I hope that's true.

MOGLEN: And you've expressed some doubt about that and that's the experiment we are conducting. We will find out which of us is right about that in another ten or fifteen years, and a lot rides on that.

WORTHINGTON: The hopeful part of your story seems to lie in kids growing up on free software in Southeast Asia, kids who aren't being educated on Windows at all.

MOGLEN: Well, some of them will use Windows. Of course, the problem is money. The problem is the very thing which in the end turns out to be really important in the contemporary, local environment. Microsoft makes $400 billion a year selling stuff, than which there is better available for nothing. In the pure microeconomics of this you would expect it to go away. Now, there are a whole lot of things that can be done to stave off the law of supply and demand: you can advertise heavily; you can give people fear, uncertainty and doubt; you can do all sorts of things—but at the end of the day there are billions of people all over the world who need computers and software and some way to connect. This is a major issue of economic resources. How can the free software not win? Where's the money going to come from to buy all those Windows licenses? We are, after all, engaged in a capitalist enterprise on a bad business model. If they want everybody to use it, at a minimum the price has to be zero. At a minimum.

WORTHINGTON: Couldn't you have asked yourself the same question, and answered it with the same note of scorn in your voice six years ago?

MOGLEN: Yes, you could. I don't know whether it takes fifteen or twenty years to do Microsoft in: what difference does it make? They're going down. You can't make less good stuff and sell it at high prices indefinitely when the good stuff is free. For different users there are different answers to these questions, but in a place where an awful lot of people all over the world need software and are not going to pay $90 for an operating system (which doesn't work, but which is compatible with all the other nonworking operating systems all over the planet) they'll produce something else, and the something else will be free. And then they'll have an investment in free. Are the French actually going to require opensource software for government use? No, I don't think so, but it would be interesting to see what happens. Sooner or later, somebody will somewhere begin to recognize that societies pay pretty heavily for Windows too.

WORTHINGTON: I didn't realize the French government was interested in the idea.

MOGLEN: No, there's legislation pending: a couple of senators who are interested in the idea. But, again, massive amounts of resources are going into this. People are going to give up eventually. I don't know how long it will take.

WORTHINGTON: We'll see. We should have this conversation again twenty years from now.

MOGLEN: Oh, we'll all be having this conversation constantly.