The Code in Law, and the Law in Code

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Cyberspace has an architecture; its code — the software and hardware that defines how cyberspace is — is its architecture. That architecture embeds certain principles; its sets the terms on which one uses the space; it defines what's possible in the space. And these terms and possibilities affect innovation in the space. Some architectures invite innovation; others chill it.

In 1964, a Rand Researcher named Paul Baran proposed to the Defense Department a design for a telecommunication network that was very much like the design of the current Internet. It was not quite the architecture of the Internet, and Baran was probably not the first to propose such a design. But the idea was radical and important enough that the Defense Department asked their network experts to comment on the design.

Their experts were AT&T. AT&T didn't like the plan. As AT&T executive Jack Osterman said of a plan "First it can't possibly work, and if it did, damned if we are going to allow the creation of a competitor to ourselves."

Allow.

The telephone network had a particular architecture. That architecture embedded certain principles. Those principles were that the network owner — AT&T — got to decide how the network would be used. The network centralized that decision, and this centralized design was supported by the regulations of the FCC. Until the late 1960s, and not fully until the breakup of AT&T 1984, the network owner had the power to decide what kinds of innovations would be *allowed* on the telecommunications network. The architecture embedded this power to decide.

This principle affected innovation. Innovators knew that before their ideas about how a telecommunications network should-be-used would be adopted, AT&T would have to approve

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[†] This text was the basis of a lecture given at the pcForum 2000, Phoenix, AZ. It is not intended, and does not read well, as a printed text.

their ideas. They knew their ideas would need the *permission* of someone else before they would run, and they knew that this someone else had an interest in the existing model of telecommunications. Some new ideas would be consistent with that model; no doubt they would be embraced. But other new ideas would be inconsistent with this model. They had a snowballs chance in hell. Any rational innovator — or at least, those with a bottom line to support — would turn their innovative energies elsewhere.

At the core of the original design of the Internet is a different architectural principle. This principle has a different effect on innovation.

First described by network architects Jerome Saltzer, David P Reed, and David Clark in 1981, this principle, called the "end-to-end" argument, guides network designers to place intelligence in the network at the ends, and to keep the network itself, stupid. Stupid networks, smart applications.

While this principle was first described in terms of efficiency, it soon became clear that it entailed an important corollary. This is the principle of competitive neutrality. What end-to-end meant was that the network was not in a position to discriminate. It was not capable of deciding which kinds of applications should run, or what forms of content should be permitted. The network was stupid; it processed packets blindly. It could no more decide what packets were "competitors" than the post office can determine which letters criticize it.

This architecture has an effect on innovation. It encouraged innovation. Innovators knew that if they designed a new application or new form of content, the network would run it. Even if the new application challenged the dominant network application, the network would run it. The test of success thus was not whether the innovation fit with the business model of the network owner; the test of success was whether the market demanded it.

End-to-end thus architected innovation.

Thus two architectures for telecommunications: With one (the old telephone network) decision making about innovation is centralized; with the other (the Internet under end-to-end) decision making about innovation is decentralized. With one, a single committee or soviet decides which innovation is best; in the other, a market of many decides which innovations are best.

And thus some might ask: How did we get from the old telephone architecture to the architecture of end-to-end?

At an eCommerce conference on the west coast last year, a senior lawyer for a major Internet technology firm delivered a lunch time talk. He had two points— one prescriptive, one descriptive. The first was a chant: The most important thing, he said, was that "we keep government out of the Internet. Regulation," he said, "will kill the Internet."

The second point was some corporate bragging: he described, with great pride, how his company had developed online tools to file for patents; they were filing and receiving patents now at a record rate.

The view of this lawyer is not uncommon. Many believe the net was born from a world of no regulation; many resist regulation in its future. Likewise with this view about patents: many see patents as an important part of the Internet's future; many are eager to encourage their rapid growth.

Many think this — and many are wrong. The net was not built in an Eden of non-regulation; instead it was a heavy handed form of regulation that made the Internet possible. Nor will we escape regulation in its future. The only question is what form that regulation will take — will it be like the regulation that gave us the Internet originally, or will be like the regulation that this Internet lawyer would push.

For this lawyer is obviously pushing regulation. I know he didn't see it like this; nor did most in the audience; but there is no way to understand a patent except as a regulation. An overworked, underpaid, pressured to issue patent official reviews an often incomplete yet smartly incomplete patent application, and decides (on I am told less than 8 hours consideration) whether to issue a

government backed monopoly that will extend for practical one score years. A right to have the government stop another from using an idea; a power to force others to get permission before they use an idea; an architecture — this time a legal architecture — for centralizing the creative process. For locating it in the hands of a few; for requiring others, Oliver Twist like, to get permission before these "inventions" can be used. To move from a world where technologists innovate to a world where innovation is licensed.

The point is not therefore to reject patents because they are regulation. The point is to compare different kinds of regulation. And my aim this morning is to get you to see first how the Internet was born because of one kind of regulation, and second, to see how the Internet is changing because of the emergence of a different kind of regulation. The extraordinary innovation that defined the Internet that was came from a particular architecture — both legal and technical; this architecture is changing, and I want you to see how this change threatens this innovation.

First about the regulation that gave us the Internet.

I've described the architecture of end-to-end, and I've argued that it inspires innovation. But end-to-end is not a law; it is not a crime to build technologies that would violate its rule. The principle is a norm that guides network design. Nothing compels anyone to follow this norm. The MIT folks might not like you, but you won't go to jail.

But there is one place on the net where in effect, the norms of end-to-end are a law. One place, that is, where to deviate from this principle is to violate a regulation. And in my view, but for this rule, we would not have the Internet we have today.

This place is, ironically enough, the telephone network. For recall how we got from the network that silenced Paul Baran to the network we have today. We didn't get here because enlightened businessmen chose to re-architect their telephone network to "allow the creation of a competitor to themselves." We got here because an activist DC Circuit couldn't stomach the excuses that the AT&T/FCC offered for their conspiracy against competition, and because a Reagan justice department finally brought this conspiracy against competition to an end. We got

here because government broke the telephone company up, and forced upon it a set of regulations which together in effect replicate the principle of end to end. The telephone network is not allowed to discriminate in the kinds of service or content it allows; it must make its wires available to new ideas; it must allow competition to itself. It must do this not because it chose to impose this limit on itself; it must do this because a regulator forced it to.

This was regulation, and the consequence of this regulation has been profound. For without the ability of ordinary consumers to connect to the Internet, there would have been no Internet revolution. Universities were the initial net; universities are fun, but they don't fuel revolutions. What was required before there was a revolution was the assurance that a market could connect, and that the connector — the network — would remain neutral about the uses to which that connection could be put. It was the existence of an end-to-end network, to which millions could connect across another network that through regulation was in effect end to end — that explains the Internet revolution. And we would never have reached this revolution without the decentralizing, innovation enhancing regulation by government.

The law imposed a rule upon the architecture of narrowband, and this architecture of narrowband inspired the innovation that the net has produced. This was regulation to decentralized innovation; it was regulation that made the net possible.

We are now in the middle of a debate about the rules that should govern the next generation of the Internet — broadband. On one side of this debate are those who say, that it is the market, and not government, that should decide about open access; that the government should not start regulating now. And on the other side is what's called the open access movement, which is nothing more than end-to-end applied to broadband. Open Access supporters somewhat defensively call upon on the FCC to impose a requirement of open access in all new broadband services — whether cable or wireless, and continuing to do so with DSL.

But I don't get the defensiveness. We have an example of a regulation that has produced wild innovation in narrowband. The question is whether it should apply to broadband. I don't get why not. We have an existence proof of an extraordinary amount of

innovation flowing from a particular form of regulation. Here regulation worked — yet the trend in DC is to give it up. The leadership of the FCC says that we should leave this question the rule of the market. Narrowband wasn't governed by the rule of the market; but, the FCC believes, broadband should. And this means we are retreating on a commitment that made possible the most dramatic growth in innovation that this nation has seen.

But this is not because we've given up on regulation. For in the context of patents, the passion to regulate rages. Some 40,000 software patents now float in the ether; a new industry of patent making was launched by a decision of the federal circuit in 1998 — the business method patent. Gaggles of lawyers, my students, now police the innovation process in Internet industry. 5 years ago, if you had a great idea, you coded it. Today, if you have a great idea, you call the lawyers to check its IP.

This change is the product of regulation. And while in principle, I'm in favor of patents, we should not ignore the nature of the change that this creates. Unlike open access, the regulations of patent don't decentralize the innovative process. They do the opposite. Unlike open access, the regulations of patent don't increase the range of those who might compete; for the most part, they narrow it. Unlike open access, patents don't broaden the architecture of innovation. They narrow it. They are part of an architecture — a legal architecture — that narrows innovation. And this narrowing is a product of governmental regulation.

So here's the odd state of our present political culture. We think the Internet was created without regulation, and so we resist regulation in its future. We don't stop to understand how patents are a regulation, so we are aren't concerned about them in our future. But the regulation that we miss is regulation that inspired innovation; and the regulation that we are creating is a regulation that can undermine innovation. The question isn't whether we are regulating. The question is what form of regulation we pursue.

We are changing the mix of regulation that defined in Internet as it originally was; and this change will affect the innovation of the Internet as it originally was. As it centralizes innovation, as it returns strategic power to networks, as it increases

the costs of others in the market, this new mix will weaken the innovation we now know. It will cool the revolution; it will draw it to a close.

It is my brand to be pessimistic. I tell stories about how an architecture that we all respect is being compromised. People read these stories; they liken them to Stanley Kubrick films. And I've been told that brand-identity is key, and one should not confuse the brand.

But I want to end this morning — contrary to my brand — on a somewhat hopeful note. For the fact is that we are beginning to see a split in the Internet business community — a split between the old and the net, on precisely these principles of innovation and architecture. For while AT&T continues to insist on its right to build a closed network, Steve Case of AOL has, to his great credit, committed what may become his cable network to the principles of open access. And while lawyers rally the troops to defend the sanctity of patents, Tim O'Reilly got Jeff Bezos to see that there was a threat to this economy presented by this explosion of patents. These two companies — symbols of innovation in Internet space — have both, by words at least, signaled a commitment to principles of the original net — the law in the original code of the net — that made innovation possible.

My cynical friends tell me not to read too much into the press reports. Case's promise is not binding; Bezos has not promised not to enforce his patents. But I think nonetheless that these events mark promise. They signal the young defending the culture that created them, against the old who are scrambling to recreate a culture they can control.

I have great respect for those who have taken these first steps to defend the original architecture. I would have genuine hope if they were joined by someone credible in government — in particular, the chairman of the FCC. But I fear that my pessimism will become reality if we can't move beyond these idiot rhetorics of pro and anti regulation.

The architecture of the net is changing. What it is becoming, as Kevin Werbach said, it is not the Internet. We should be doing what we did to preserve the innovation that we have seen, by regulating to protect innovation, and by being skeptical of

regulation that enables others to capture the field. We should defend the law that was in the original code; we should preserve the principle that gave us this revolution of innovation.