Change needed in telecom regulation: researchers

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Graphic: Christine Daniloff

The Internet has had an obviously revolutionary effect on the way people find and disseminate information; but it's had no less revolutionary an effect on the organization of the telecommunications industry. Where the industry was, in the past, dominated by a few huge companies with aligned interests, it's now a tumult of startups charging hard in different directions. Google and Facebook became billion-dollar companies with virtually no control over the networks on which their services depend, and there's no guarantee that their interests will converge with those of Verizon and Comcast.

In this new environment, argues Chintan Vaishnav, a postdoc in the Computer Science and Artificial Intelligence Laboratory, regulatory

bodies, too, need to adopt a new approach. The weekend of Oct. 1, at the Telecommunications Policy Research Conference in Arlington, Va., Vaishnav presented a thoroughgoing mathematical analysis of the effects of regulation on the telecommunications industry to an audience of regulators and other academics. The upshot of his analysis: In the Internet age, regulators need to concentrate more on building consensus among disparate economic actors; at the same time, they need to prevent companies from accumulating such dominant market positions that they stifle competition.

In the social sciences, emphasizing consensus building is not a radical idea. But, Vaishnav explains, “It’s a sea change for the regulator, because they have no consensus-building capability in their organization. They only have a policing capability. The challenge today is just to get people to agree that this is necessary.” Vaishnav hopes that the mathematical rigor of his analysis will help promote that agreement.

The purpose of a regulator, Vaishnav says, is to balance societal objectives with economic vitality. In the case of telecommunications, the central social objectives are emergency communication, access for the disabled, and law enforcement. But today, meeting those objectives is much harder than it used to be. The old telephone infrastructure guaranteed access to emergency providers to anyone who dialed 911, but many of the computer applications that enable voice communication over the Internet don’t. Similarly, federal agents trying to track down terrorists used to just subpoena phone records; but if the terrorists are using different voice applications, text services, and Web servers, with data traveling over multiple networks managed by yet other companies, who does the subpoena go to?

Thus far, the Federal Communications Commission has been loath to regulate the Internet. Precisely because the telecommunications ecosystem is so much more complex than it used to be, no one is certain

what effect regulation might have. To help answer that question, as a doctoral student in MIT's Engineering Systems Division, Vaishnav built a sophisticated mathematical model of the relationships between the various economic actors in the telecom industry. As a postdoc, he has continued to refine the model in collaboration with both Charles Fine, a professor in the MIT Sloan School of Management, and with CSAIL's Advanced Network Architecture Group, led by David Clark, who was the Internet's chief protocol architect in the 1980s.

Vaishnav's model identifies five factors that drive the telecom industry: corporate strategy, customer preference, technology innovation, regulatory policy, and industry structure. In the model, changes in any one of those factors cause changes in the others. But the model also breaks each of those factors into similarly interrelated but finer-grained factors, which are in turn broken into even finer-grained factors. For instance, customer preference is determined by product features like price, quality and innovativeness, as well as so-called network effects that depend on the number of people using a given product. But those features are determined by deeper considerations, like the time and money required to improve the product features, that maximum gains that any one improvement could conceivably provide.

Where the economic literature already described systematic correlations between such features, Vaishnav incorporated those correlations into his model. Where it didn't, he interviewed engineers, telecom regulators, and managers at technology firms to determine what, in fact, the correlations were. Once he had mathematically described this dense thicket of correlations, he validated the model against historical data, ensuring that it accurately predicted the effects of changing market dynamics on four outcomes: compliance with regulation; the cost of enforcing and coordinating compliance with regulation; competition; and innovation.

Finally, he performed simulations using data that describe today's Internet and found that, without changes to the regulatory framework, it was impossible to optimize all four outcomes. In particular, consensus building emerged as a way to keep down the cost of compliance under conditions that were otherwise conducive to competition and innovation.

"Chintan's work I think is the first example I've seen of a comprehensive examination of some of the interaction effects that go on in this sort of regulatory ecosystem," says Mark Bykowsky, a senior economist at the FCC. "What he has is a system of differential equations, and when you solve those differential equations, you get a certain market outcome. But the equations are all interrelated. So A affects B, B affects C, C affects A, and things like that." But while the model does demonstrate the value of consensus building, Bykowsky says, "solving that sort of coordination problem — that sort of consensus building — is an extremely difficult problem, and one that needs a lot of additional work." According to Bykowsky, the FCC has, in fact, experimented with trying to build consensus among relatively small numbers of Internet companies around the vexed topic of Net neutrality, and the results were discouraging.

But Vaishnav agrees that consensus building is hard, which is why it's the topic of his ongoing research. He's currently investigating historical cases in which disparate economic actors with competing interests did, indeed, eventually arrive at consensus, to see what lessons they might hold for the Internet age. One example is the standardization of the shipping containers that carry retail goods around the world, which need to be transferred among trains, trucks and shipyards in different countries with different specifications. "It's a classic case like the Internet itself," Vaishnav says. "The Internet has packets that standardize how the data should be packaged so that they can go over a variety of networks. Similar is the case where you ship things from country A to country B."

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