The Evolution of the Internet: Emerging Challenges and Opportunities

On June 6, 2012, Internet pioneers **Tom Leighton**, Chief Scientist at Akamai Technologies and Professor of Applied Mathematics at MIT, **Sir Tim Berners-Lee**, Director of the World Wide Web Consortium and 3COM Founders Professor of Engineering at MIT, and **David D. Clark**, Senior Research Scientist at the MIT Computer Science and Artificial Intelligence Laboratory, discussed the future of the Web. The meeting, presented in collaboration with the Royal Society and the British Consulate-General, was the inaugural program in a lecture series on 'GREAT Science,' organized by the U.K. government's Science and Innovation Network to profile international science excellence. The following is an edited transcript of the presentations.

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Tom Leighton

Tom Leighton is Cofounder and Chief Executive Officer of Akamai Technologies and Professor of Applied Mathematics at the Massachusetts Institute of Technology. He was elected a Fellow of the American Academy of Arts and Sciences in 2003.

Both Sir Tim Berners-Lee and David Clark have had, and continue to have, an enormous influence on the Internet and how we experience it in our daily lives.

It is a real pleasure to be part of tonight's collaboration between the American Academy, the British Consulate, and the Royal Society. It would be very hard, I think, to find two more qualified individuals to speak about the future evolution of the Internet than my colleagues Sir Tim Berners-Lee and David Clark. Both Tim and David have had, and continue to have, an enormous influence on the Internet and how we experience it in our daily lives.

In 1989, when Tim wrote his memo outlining his ideas for creating a set of protocols to help scientists at multiple locations around the globe share information more easily, protocols that would later become the foundation for the World Wide Web, his boss at CERN in Switzerland wrote in the top corner, "Vague, but exciting."

Who knew then that it would take over the world and transform it? By inventing the Web and insisting on making the tools freely available to all, Tim fundamentally reframed the way we use and share information. Today we have Google, Facebook, Hotmail, Wikipedia, and even Wikileaks, and thousands of other websites and services that help us share information and that define our everyday lives.

Tim has continued to help guide the development of the Web as Director of the World Wide Web Consortium, which he founded in 1994. The consortium serves as a consensus-driven neutral forum for companies and organizations to agree on new common computer protocols.

Twenty years after conceiving a radically improved means of sharing documents, Tim is today focused on another large challenge: getting governments, organizations, and individuals to share large and ever-growing volumes of data. Making vast amounts of raw data freely available on the Web could have fundamental implications for government transparency, as well as for how scientific research is advanced in such areas as drug discovery, climate research, Web analytics, and many other fields.

Last month, the British government announced the creation of the Open Data Institute, which Tim will lead. This initiative will bring together business, the public sector, academic institutions, and developers to focus on novel approaches to harness open data.

MIT also is partnering with a number of organizations to develop multidisciplinary approaches to address the Big Data challenge.

David Clark's research has long focused on improving and evolving the architectural underpinnings of the Internet, making it work. As chief protocol architect during the development of the Internet in the 1980s, David helped shape the Internet as we know it today.

More recently, David has focused on reimagining the infrastructure that connects computer users around the world. He is thinking about ways to enhance and enrich users' experiences while also protecting them from some of the more nefarious ways that unscrupulous people seek to use the new technology.

Addressing such questions requires two kinds of responses: technical engineering solutions and social, or behavioral, components. The questions become even more complex when one considers that most of the investment that is shaping the Internet today comes not from government but from private-sector entities. David will offer his thoughts on the question, "What should we expect of a global Internet?"

Sir Tim Berners-Lee

Sir Tim Berners-Lee is Director of the World Wide Web Consortium and the 3COM Founders Professor of Engineering at the Massachusetts Institute of Technology. He is a Fellow of the Royal Society and was elected a Fellow of the American Academy of Arts and Sciences in 2001.

I would like to talk about technology and science, and then about policy, in particular keeping the Internet open. I have been fighting for that openness for a long time. I also want to talk briefly about how we can use the Net and the Web to really change the world.

When you introduce a change, there is a technical side and there is a social side, and the Web is as much a social creation as it is a technical creation. The Web works because when you click on a link two computers talk to each other and magically a copy of a document is delivered to your computer. But this does not work unless people make links.

Why do people make links? They make links because they want people to appreciate the document they have created. And they want this for lots of reasons. Maybe every time somebody reads the document, the creator gets some money from advertising. Whatever their reasons for wanting people to appreciate the document, they try to make them of higher value by making links to other really cool things. To do that, the person making the links must try to second-guess the person following the links to figure out which links they will want to follow.

Although you can look at the Web as a technical system, perhaps a more reasonable or useful way is to look at it as a system for connecting humanity through technology.

So although you can look at the Web as a technical system, perhaps a more reasonable or useful way is to look at it as a system for connecting humanity through technology.

Traditionally, I have spent my time involved with the Web layer, which is different from the Internet layer. The Internet layer, which transports packets between different computers, was designed as a platform. One of the things that could be built on it was the Web. The Web is yet another platform that allows people to build more things.

The idea of having layers in the architecture has been very important because it has allowed people to work on different layers independently, without the whole thing having to be coordinated. So, I could invent the Web and write a new protocol, "http," the hypertext transfer protocol, and I could implement it. I could set it running on a computer, get it talking to another computer, without asking any of the people who ran the Internet.

Back in the days when you had dial-up modems, you would dial up, put the telephone down in its cradle, and connect at 300 bits a second. You could imagine the modem's crackle to be the bits going by. Later on you might connect at 1200 bits a second. Today we are at 300 million or 300 billion bits per second. But the way the Web works on top of the Internet is still the same. Web browsers will work at a link speed of 300 bits per second, or 300 million, or 300 billion.

That points to really good design of the Internet at the layer system. It has allowed webpages to get more and more sophisticated. The specification for the markup language HTML, which I originally wrote down on a piece of paper, is now a thick document and has become HTML5. This latest version is very exciting, but basically it is a continuation of the development of HTML.

The real revolution with HTML5 is that every webpage can now be its own computing platform. A webpage can now run a program, and when webpages can run programs, then suddenly the world is a lot of webpages talking to each other and to servers. From the point of view of art, culture, and business, as well as computer science, all kinds of interesting things can happen.

If you can make the Web work on mobile devices, then you can get it to people who do not have Internet connections by wire. A lot of people now use the Web on mobile devices, and not just executives. In developing countries, a remote village might not have wired Internet, but they might have mobile. Maybe one person in the village will save up and spend a ridiculous portion of their annual income on a smart phone. Suddenly the whole village has access to information, the ability to communicate and put itself on the map.

What I do not want to see is the people who actually run the Internet filter it for commercial reasons. And plenty of governments already filter the Internet. They block sites for political reasons, for stability reasons.

A few of us have noticed that the Web is getting quite big. One estimate I saw put the number of webpages at about ten to the power of eleven. That is more webpages than there are neurons in the brain. (Of course, while webpages are constantly being added to the Web, your brain is alas constantly losing neurons!)

The Web is a very complex thing. We all depend on it, and we assume that it is going to work. When we get up in the morning we expect we will be able to find the weather, and we will be able to buy things, and the market will be relatively stable. That is, if we saw something on eBay yesterday, we know we can go online and buy it tomorrow. We assume that when we look on Twitter we will, most of the time, see things that are useful, that help us get a realistic idea of what is going on.

But nobody had done the math to show that that would always be the case. Nobody had done the math to show that tomorrow Twitter will still be broadcasting truth rather than fiction. Nobody had shown that it would not become socially unstable, that it would not, in fact, become more of some form of a massive conspiracy theory. And meanwhile, the people who are connected through Twitter are also people who make decisions as to how to invest money as part of the world's economic system. And when people invest as a function of what they see on the Internet, suddenly the economic system is now a very complex system of people connected by Twitter. (Can you imagine somebody investing because of what they saw on Twitter? Well, nowadays if you do not take Twitter into account when you invest, you are probably making a mistake.) But what happens to the whole system when people start taking Twitter into account when they invest?

Questions like this led some colleagues and me to suggest that people should study Web Science, and now there are Web Science labs around the world, with Web scientists, conferences, and journals. Web Science is like cognitive science for the brain. It is very multidisciplinary, and because it brings together people from all disciplines, I encourage all of you, whatever your discipline, to spend some time thinking about how your discipline relates to the study of the Web.

All the fun things that happen on the Web, all the protocols people have designed to run over the Internet, all those depend on the Internet actually working. By that I do not just mean that I can get to some website. For me, it is really important that I can get to any one. It is really important that if I am trying to figure out, say, who I am going to vote for, that I should be able to get to any party's website.

I also do not want to click on a link for, say, an independent Moldovan film (perhaps I am a Moldovan expatriate) and find that I can't watch the film because I get my Internet from my cable company and it has the old-fashioned belief that it should be telling me which movies to watch tonight. "Have you seen the selection of twenty movies we've got for you tonight? It's really exciting." "No, I want to watch this Moldovan one." "Oh, well, sorry, but that website has not partnered with us."

What I do not want to see is the people who actually run the Internet filter it for commercial reasons. I don't want to see governments doing that either. And plenty of governments already filter the Internet. They block sites for political reasons, for stability reasons. And it is not just the governments you are probably thinking of.

For example, the United States will block the website of a foreign company that it believes has been selling, for example, fake Ralph Lauren products, because they violate the trademark of an American company. This will happen without the accused company ever being taken to court. Sites just get taken down by the U.S. government. Yet we were shocked when the old regime in Egypt disconnected Egypt from the rest of the world. But a lot of people, when they saw that happen, started to realize we should think about who can disconnect us.

Lots of countries are putting through rules that will allow the government – different parts of the government for different reasons – to disconnect arbitrary people from the Internet. In France, they have it in for families whose children steal music. If a child is accused three times of stealing music, the entire family can be isolated, removed from the Internet.

We are realizing that access to the Internet is not just a luxury. The gap between those who are connected and those who are not is so large that if you disconnect someone's house it is a little bit like imprisoning them. The arguments about access to the Internet start to sound like the arguments we have about human rights.

The UN's Universal Declaration of Human Rights mentions being able to access and impart information, but it doesn't really encompass all the things you can do on the Internet. So, a lot of discussion is taking place about whether we need

to translate the declaration into something which actually explains what that means in the age of the Internet.

At the simplest level, it means nobody should be spying on what I do, and nobody – not large governments, not large corporations – should be filtering who I can connect to. The fundamental point is that the Internet – the ability to be part of the information society – now has to be considered as a human right.

So, when we have access to it, how should we use it? Well, we should put data on it, including government data, as the Open Data Institute in the United Kingdom is doing. Scientific data is also very important. When you publish a paper, what should you do with the data you used in that document? You should make it available so that others can reproduce your results.

When data is referenced by journals, access to the data behind the articles should be free, because the data have more value and are more exciting when you can connect them to other data. Some of the large challenges in science might not be solved until we can get a lot of data linked together on the Web.

How else should we be using the Web? The first year this thing was popularly visible, and people started using it, everybody exulted over the fact that the Web breaks down barriers: it allows you to look at a website of somebody in another country, a site that might be in a completely different language. With the Web you can go anywhere in the world, free yourself of the constraints of this town, this city, this state, this country.

But I ask you to think about whether you have actually done those things today. When you put a group of kids in front of an Internet-connected game machine on which they can not only play a video game, which is very exciting, but can play with other people on the network and with other people anywhere in the world, chances are they will actually play with the boy next door. Kids will play with their existing friends on the Internet, but they won't actually be discovering and making friends with people in other countries.

Social networking sites will typically suggest connections. If a person wants to connect with you, the site might suggest that while you are connecting with them, why don't you also connect with this other person, because you have a lot of friends in common.

What is wrong with this picture? If you find all the friends of friends and make them into your first-class friends, all one thousand of them, then your social graph, the interconnections that bind you together, will be a very tightly knotted lump. Going to a party will be great because all the people you will meet there will be people you already know. It will also be a terrible party, because you won't meet anybody new.

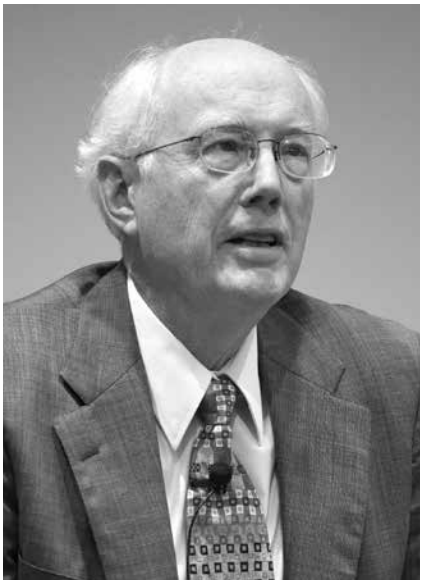
We are realizing that access to the Internet is not just a luxury. The gap between those who are connected and those who are not is so large that if you disconnect someone's house it is a little bit like imprisoning them.

We should start to think about what I call "stretch friends." When as a child you apply to college, you pick several safety schools and maybe one or two that are more of a stretch. The stretch colleges are going to be hard to get into, but if you do really well, then maybe you will make it. A stretch friend is the friend that every now and again you pick, or the system suggests to you, saying, "You know, you are friends with so many people in this Academy, this town, this field, this gender, this religion, and I can suggest a lot more of them, but just today I want to introduce you to somebody who is similar on many axes, but he is in Iran." Or "But he is Catholic." Or "But she is a woman."

The idea is to make an extra effort to connect with somebody who is on the other side of a boundary because I think we need more of this. If you look at sizes of all the groups that are on the Internet and at sizes of interactions, you should ideally, I hypothesize, find a power law, perhaps a Zipf distribution. There should be some very large groups and some smaller ones, with people dividing their time between various different communities, of different scales.

Out of all the groups of various sizes, you should then get a lot of emphasis on the national group, and then less emphasis, say, on the American Academy, and maybe just a little emphasis on, if there were such a thing, a Massachusetts Academy, or an Academy in a foreign country you have never been to. We need to take some of the emphasis on the national and move it. We need to stretch.

This is the master plan: Everybody makes one stretch friend a week and bit by bit, in the pubs and in the bars, people discuss what their stretch friends think and how and why they have such strange ideas. And bit by bit we start to understand where the other people are coming from. And bit by bit we stop feeling we ought to invade them. Bit by bit we move toward a world that is generally more peaceful.



David D. Clark

David D. Clark is Senior Research Scientist at the Computer Science and Artificial Intelligence Laboratory at the Massachusetts Institute of Technology. He was elected a Fellow of the American Academy of Arts and Sciences in 2002.

For normal users, the Internet experience today is defined by applications, not by the fact that it carries packets. . . . Most people today equate the Internet with Facebook and Twitter, *World of Warcraft*, virtual worlds like Second Life, or Google, or Yelp, where you can go to rate almost anything.

Tim and I did not coordinate, but it turns out his talk is a great introduction, because I want to talk about some pragmatic issues having to do with the openness of the Internet, especially in the global context. But since he pointed out that many of our friends are local, I have to tell you my own personal story of U.S.-U.K. relations. My son, who is an avid *World of Warcraft* player, found a very interesting player that he greatly enjoyed, and after a while he figured out that the player was a woman, and he ended up marrying her. She's from England. So, not all our friends are next door. In fact, if you sort the world according to your prowess in *World of Warcraft*, you may discover that the person you are talking to is not the kid next door but a woman from Oxford, England.

I started out in the 1970s as a purely technical engineer. I designed protocols. I wrote TCP – that is part of the Internet software – for the IBM PC. Sometime in the 1990s I had a revelation, which was that technologists were not in charge. I realized the people who invested were in charge, and I responded to this by hiring an economist, which caused my colleagues to think I had taken leave of my senses.

When we first built the Internet, it was a technical system and was defined by technical standards. And that is really all that constrained it; it did what standards do, which is to work the same everywhere. The first applications, such as email, were by and large used by a fairly homogenous population, and they worked the same everywhere.

So this wonderful little vision emerged that perhaps the Internet was a homogenous global platform for human interaction. This led to some naive and overly optimistic fantasies about the future of the Internet. One of the spokesmen for the early vision of the global Internet was a man named John Perry Barlow, who wrote, "Governments of the Industrial World, you weary giants of flesh and steel, I come from Cyberspace, the new home of Mind. On behalf of the future, I ask you of the past to leave us alone. You are not welcome among us. You have no sovereignty where we gather."

Heady stuff. John is an interesting character. He is a cattle rancher from Wyoming, founder of the Electronic Frontier Foundation, and a lyricist for The Grateful Dead, which is an interesting mix of professions.

Now, whatever he or anyone else thought back then, this is not the Internet we have today. Sovereignty is asserting itself, and along with it comes laws and policemen and criminal prosecution. We have regulation, and at the international level we have a lot of disagreement about what the Internet should be. Even Barlow now says of his earlier statement, "We all get older and wiser."

So, what do we have today? For normal users, the Internet experience today is defined by applications, not by the fact that it carries packets (only geeks send packets for the fun of it . . . which means I am not a normal user). In the old days it was defined by email, and before the Web was invented people thought the Internet was synonymous with email. Now – thank you, Tim – they think it is synonymous with the Web. Most people today equate the Internet with Facebook and Twitter, *World of Warcraft*, virtual worlds like Second Life, or Google, or Yelp, where you can go to rate almost anything.

The fact that the Internet can carry packets of bytes between machines anywhere has little to do with the global character of the Internet. What we are concerned with is the experience, not the technology. So, today we are no longer as homogenous as we were in the heady days of John Perry Barlow. We are diverse with respect to language and culture. We are also diverse with respect to

motivation, which is to say we now have a problem we call "bad guys."

Bad guys do all kinds of creepy things, right? They send spam, and they steal credit card data, and they commit fraud and extortion. They sell child pornography, break into companies, steal secrets, destroy computers.

The good guy/bad guy diversity gets all the attention, but I think that diversity in language and culture may be more fundamental. Websites today are localized. Google doesn't look the same in every country. If you search for something in another country, the answers are not just in a different language; you get different answers.

This sort of diversity in the Internet experience has to do with localization of content in order to make it appealing to different people. It is sort of like subtitles in foreign movies. But what does this have to do with sovereignty? Well, the most visible and discussed example of sovereign intervention in the local Internet is China, which is widely known to censor content and shape the Internet experience in many ways.

But I do not want to start by talking about China. Instead let's talk about a country that is closer, both geographically and culturally. France has a law that says it would be an affront to any French person to encounter Nazi memorabilia; it is thus illegal to sell Nazi memorabilia in France. Under that law, France sued Yahoo because Yahoo had an auction page containing Nazi memorabilia that was visible to a French citizen.

Lawsuits were filed in France, as well as in the United States. The countries got into it. It was a horrible tangle, but some interesting issues came up. Yahoo's first defense was, "We can't tell where somebody's coming from. They just show up and download the webpage. We don't know whether they came from France or England or Iran." Well, maybe not. They lost that argument very quickly, because experts brought in by the French government said, "You can tell with reasonable precision. You can't tell perfectly, but if you're already localizing Web content, how can you say you can't tell where somebody's coming from?"

Even more interesting, toward the end of the lawsuit all of the actors, desperate not to create a precedent, backed down. Yahoo's position changed, and they declared, "This is so difficult and tedious and frustrating, we will just stop selling Nazi memorabilia everywhere."

What should we make of that? One answer is that it is no great loss. How many folks care about buying Nazi memorabilia? Of course, if I could produce somebody from the ACLU, they would say, "Remember, it is in the defense of unpopular causes and unpopular speech that we sharpen, refine, and invigorate our own sense of free speech and our First Amendment rights."

The contest between the United States and China over the character of the Internet is far more than just rhetorical. We hear a lot about the Chinese breaking into computers in America. We assume it is the Chinese, but who knows. They steal things, conduct industrial espionage.

That is a rather American comment, and I understand that. But I am still a little uncomfortable that the action of a French court indirectly caused the removal of content in the United States. You might ask, "How many other examples of this are going to happen?" Well, the country of Thailand objected to a YouTube video that was offensive to the king of Thailand. Pakistan objected to a YouTube video that was offensive to Islam, and in the Australian courts a man won a lawsuit for being libeled in an article that would have been quite acceptable in an American newspaper.

How much content is going to be removed from the Internet if the Internet is truly global? We could see these cases as "edge conditions." The Internet mostly works the same in France as it does here. Free speech mostly survives. But clearly, as John Perry Barlow said (although there is some doubt about who said it first), "Freedom of speech is a local ordinance in Cyberspace."

The country that defines the other end of the spectrum is China. The ministry responsible for control of content reports that its productivity has increased to the point where it is removing a million pieces of unacceptable content per day. Here in the United States, this has triggered a certain amount of outrage.

We responded by scolding the Chinese. We said, "You shouldn't do that." Hillary Clinton gave two speeches on U.S. views about the future of the Internet. She called for a global commitment to Internet freedom and offered a passionate, compelling statement of our values: "The rights of individuals to express their views freely, petition their leaders, worship according to their beliefs, these rights are universal, whether they are exercised in a public square or an individual blog." And she went on to say, "The United States supports this freedom for people everywhere, and we have called on other nations to do the same."

Of course our tolerance for diverse speech ends quickly when it violates our

Would we – "we" being the United States and countries with whom we largely share values – be better off if we do not try to force the Internet to be the same everywhere but instead allowed some of the boundaries to be hardened so that we can have the Internet we want at the cost of letting others have the Internet they want?

laws. The difference is that the laws we tend to enforce in this country, as Tim suggested, have to do with the distribution of illicit copyrighted material. I don't know whether we take down a million things a day, but we certainly prevent and suppress large quantities of content on the grounds that it may not be appropriately approved by the copyright holders.

The Chinese have an interesting reaction to this. The Chinese say, "Well, you enforce your laws vigorously. We enforce our laws vigorously. It's completely symmetric. You don't like our laws very much. We don't like your laws very much, either."

Each party is offended and threatened by the laws and actions of the other side. The only difference is that we think our laws are better than their laws. We refer to things like the UN Declaration of Universal Human Rights to make our case.

But the contest between the United States and China over the character of the Internet is far more than just rhetorical. We hear a lot about the Chinese breaking into computers in America. We assume it is the Chinese, but who knows. They steal things, conduct industrial espionage.

What do we do? We defend our values. The U.S. government, particularly the State Department, pays private-sector companies to develop anticensorship content – applications – programs you can run on your computer to try to get around the barriers the Chinese put up. Then we give the software to Chinese dissidents and activists.

The Chinese reaction to this is not, "Oh, you're defending free speech." The Chinese reaction is, "You are engaged in active regime destabilization." They start muttering about cyber war.

Now we are into issues that are above my pay grade. As Tim said, if you want to talk about violations of human rights or how much energy the United States should put into defending commercial copyright holders, those are high-level questions. Because I am here to talk about the future of the Internet, I want to ask a more low-level question. Would we – "we" being the United States and countries with whom we largely share values – be better off if we do not try to force the Internet to be the same everywhere but instead allowed some of the boundaries to be hardened so that we can have the Internet we want at the cost of letting others have the Internet they want?

Would we – not the whole world – be better off? What I just asked is a very dangerous question, because it is ideologically imperfect; it allows for the possibility of pragmatism as opposed to a passionate defense of universal open networks.

The important question to ask is, how is this going to play out? The private sector is largely responsible for many of the things that are partitioning the Internet along regional boundaries. I already mentioned that websites get localized. Another thing that happens, my children report, is that more and more when they try to download legal copyrighted material they get a statement saying, "You cannot download this because it is not licensed for distribution in your country."

All of a sudden we are beginning to see content, especially commercial content, sitting behind country-specific walls. So while at least some of the governments in the world are calling for an open Internet, other governments and the private sector are busy building an Internet with strong jurisdictional-dependent behavior.

Do we care? I think there is an interesting intellectual conundrum here. While we praise the open Internet, we also praise its generality. Tim said, "There was this platform, and I just built the Web on it." I said, "That's great!" Somebody else can come along and build the other Web. And we say, "That's great too!" We love its generality.

But that doesn't mean you have to run the same Web I do. If we can run anything on it, and I choose to run one thing and you choose to run another thing, do I have a complaint? Should anybody object?

Perhaps you have heard of the "Great Firewall of China," which is what the Chinese created to keep out objectionable content. This is not how they remove a million things a day. They do that with people, a lot of people, because it takes a lot of people to remove a million pieces of content a day.

What the Chinese did is to define the Chinese experience by blocking popular applications that we take for granted, like Facebook and Twitter, replacing them with locally developed versions. We run our Facebook. They run their Facebook. We run our Twitter. They run their Twitter. Their applications are tailored for use by Chinese speakers, and they are very popular, but they include tools that can be used to limit unacceptable content and conversation.

So, even if we have a global Internet at the packet level, we have a partitioned Internet at the level of what I would call "the user experience." Does this really matter?

Henry David Thoreau said, "Our inventions are wont to be pretty toys, which distract our attention from serious things. We are in great haste to construct a magnetic telegraph from Maine to Texas, but Maine and Texas, it may be, have nothing important to communicate."

I would say that the partitioning of the Internet, the blocking of Facebook in China, the issue of Nazi memorabilia, and other issues at the edges do matter. But I think most Chinese and most Americans are not bothered by the fact they can't friend each other on Facebook. If you are trying for a stretch friend, you can find one in Russia and in many other countries, but you will discover you can't find a stretch friend in China. To a small set of people, this is a real loss and something worth fighting for.

The question we should ask ourselves is, "In arguing for a global Internet, in fighting for the Internet we want, what price does the Internet itself pay?" The price could be high.

The Internet today is largely governed and constructed by the private sector, the Internet service providers, the companies like Akamai that get together and build the Internet. But a lot of countries, including China, are uncomfortable with this, and have argued that government should be in charge of the Internet.

The International Telecommunications Union, or ITU, is a regulatory division of the United Nations. A long time ago it defined the rules by which telephone systems connected internationally. Before that, it defined the rules by which telegraph systems connected internationally. Their charter specifically precludes them from having governance responsibility of the Internet. But in December 2012, in Dubai, they will hold a plenipotentiary meeting at which they are going to change their charter to give themselves governance of the Internet.

The ITU is a treaty organization, which means that when pronouncements are voted on, each state gets one vote. Further, the presumption is that because of the treaty, countries will pass local laws that translate ITU pronouncements into national obligations. So, what they are trying to do is regulate the character of the international connections that make up the global Internet.

There are a variety of reasons they want to do this, and one of them is very painful. In part it has to do with the Chinese preference for having a much more regulated Internet, and in part it has to do with money. An economist friend of mine told me that to understand the future of the Internet, you have to remember that the Internet is about routing money. Routing packets is a side effect. I said, "We didn't design money-routing protocols." And he said, "You really screwed up."

In the old telephone system, when I called your country, the telephone company in my country paid your telephone company to deliver the call. This was called a "termination charge." Maybe you remember when international phone calls cost a dollar a minute? It probably cost them three cents a minute to terminate that call.

Where did the rest of the money go? Well, telephone companies belonged to the states. The money flowed into the general coffer. In the developing world, it was a major source of hard currency. But Skype has killed that money flow. Now they are really annoyed. So they get this clever idea: Why don't we regulate international connections so that when I send packets to you, I have to pay you to deliver them, and you get to set the rate.

If this happened, it could fracture the Internet even more profoundly than the Great Firewall of China. Think about Tim's comment about open data. We should give it away freely. But can I really afford – as MIT with Open Courseware or a government with open data – to make that data available if I have to pay not only for the computer that attaches to the Internet but a termination fee as well to deliver my data to a foreign country?

This is a worst-case story; it may not work out this way. But I find it an utter travesty of the vision of the Internet that some of us talk about its power to transform society through its open access to information and other people think of it as a machine for pumping money into the developing world.

I think the Internet will continue to be a vitally important tool for society, but, pessimistically, I think a number of countries will not buy into the religion. They are going to take steps that will greatly impair the value of the Internet.

Therefore I ask the pragmatic question, which is dangerous because it is ideologically not extremist; it doesn't advocate openness before everything else: Should we be careful to protect the Internet we want, picking our fights so as not to compromise that goal even as we argue for the ideal of the global open Internet? If in the end we discover we are not getting a lot of traction globally, we should simply say, "Fine, we will have the Internet *we* want." ■

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