



# Roundtable Discussion: The Web We Look Forward to

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*Against the amazing backdrop of the Web's 25th anniversary, Computer asks experts to envision the Web's progression and influence for the next 25 years.*

**W**ith a quarter-century under its belt, the Web is now a well and widely known entity—it's almost completely transformed our lives and society at every level and in myriad ways. But what about its future? The Web's fuller potential, latent power, and how it will or could evolve over the next 25 years remain open for debate. To examine what opportunities and challenges lie ahead for the future Web, we recently held a roundtable discussion among a few experts. The panelists were

- › David Alan Grier, George Washington University;
- › Jeffrey Jaffe, World Wide Web Consortium (W3C), and;
- › Lee Rainie, Pew Research Center.

Please see the "Roundtable Panelists" sidebar for more information about the panel members.

Our discussion centered around the next 25 years of the Web, or the Web we look forward to. For the full roundtable discussion, listen to the podcast that accompanies this article at [www.computer.org/computer-multimediaa](http://www.computer.org/computer-multimediaa).

We hope the discussion inspires you to consider and help shape the Web's future.

## HOW THE WEB MIGHT EVOLVE

**Computer:** The Web's evolution, growth, and impact in the past 25 years have been nothing short of phenomenal. How do you think the Web might emerge in the next 25 years? You can answer the question in terms of near-, mid-, and longer-term view.

**David Alan Grier:** The short- and middle-term scenarios are more interesting to me. I think we're approaching commoditization of the Web and its services as well as of

## ROUNDTABLE PANELISTS

the Internet as a whole. We've seen this in other technologies when they move from being new to ubiquitous.

Although the Web has permeated the industrialized and wealthy world almost completely—reaching nearly every household, every business, and every kind of activity—we haven't yet seen the same level of permeation in the mid-tier countries, and certainly not at all in the poorer regions on Earth. However, we're going to reach a point, maybe 7 to 10 years from now, where we'll all have the same kind of Internet/Web infrastructure and the same kind of services, and most of our activities will be linked by this permeation.

**Jeffrey Jaffe:** The Web has been transformative of every aspect of human endeavor, including information sharing, education, commerce, and entertainment. I think that'll be taken to a new, even higher level in the future. Today's Web is primarily a consumer Web—how we as individuals all interrelate with one another—but I think in the future, the Web is going to become the platform, the technical platform, for vertical industries.

Whether it's publishing, entertainment, or telecommunications, every industry has a technical platform that it relies on. Increasingly, these industries are tossing out the platform they have and replacing it with the Web.

Look at the publishing industry: when it was created 25 years ago, the Web was a new kind of publishing platform that enabled everyone to be an author as well as a means for instant massive distribution. Although it transformed publishing, the Web also had a weakness: the typography that was available, the

quality of presentation in terms of fonts and images, wasn't good when compared with professional typography and typesetting. Nevertheless, 25 years later, we can basically do everything on the Web that publishers can do in print with specialized equipment. It took us a while to get here, but the Web has become the platform for the entire publishing industry.

Another great example is the way the Web is becoming the platform for the entertainment industry. Other examples include education with its massive open online courses (MOOCs) and the finance industry with online payment platforms.

**Lee Rainie:** In the next 7 to 10 years, the Web and the Internet will more generally become akin to electricity in

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the way people use it. It'll be less visible in some respects and be as essential as an appendage in our lives. The Web will not only integrate many of our activities, it will also facilitate integration of machines, artificial intelligence, and elements of the human condition.

We'll depend on lots of Web-enabled things like robotic activities and artificial intelligence, and they'll be increasingly woven into our lives. And the Web will also cause some social disruptions, but we don't fully know how it's going to work out—whether the disruptions will yield a better, wealthier society or have a negative impact on jobs and lead to social fallout.

The widespread impacts of the Web will be felt in ways not experienced before.

### AN INTERCONNECTED WORLD AIDED BY OPEN DATA

**Computer:** How do you think mobile phones, wearables, and the Internet of Things (IoT)—with billions of interconnected devices—will impact the Web and its applications? What applications might result from such an interconnected planet?

**Jaffe:** At the World Wide Web Consortium (W3C), we're examining both the opportunities and risks that the IoT presents. If you look at the way people talk about the IoT, a lot relates to specific application areas—for example, medical devices and medical applications, or activity-monitoring sensors installed in the city so that city managers can make more intelligent decisions about deploying resources. In the factory, the IoT is used to improve the supply chain. Our concern at the W3C is that all of these “things”—many of them dedicated to individual application areas like smart cities or smart factories—might get stove-piped, which is the opposite of what made the Web so successful.

Instead, what's made the Web successful is its openness—technology, data, information, and access that's open to all. We need to ensure that data in the new, highly interconnected world is available in open formats for everybody to use, while safeguarding privacy online. We recently started a Web of Things (WoT) activity within the W3C. We're focused not on the interconnectivity or application level, but on maintaining the openness of data and interoperability so that, for example, a sensor could be used for multiple applications over time. We think that will be a powerful enabler in the IoT world.

**Grier:** I think what would be interesting to examine is how IoT deployment transforms organizations focused on production, goods and services, education, and healthcare.

The Internet has made it easier to create two kinds of institutions: large-scale democracies and large-scale markets, both of which were very difficult to create before. When we wanted to provide a service, or when we wanted to do something that involved getting consensus from a large number of people or managing the complex interaction of a large number of people, we had to build a big “vertical” corporation—called vertical industry—to do it. And indeed that need drove vertical corporations.

The Internet lowers the costs for numerous things and also spreads them very broadly. It simplifies how we get together and reach a consensus. We can trade ideas, we can trade information, and we can trade services without being part of a big organization.

The institution that intrigues me the most is GitHub, which has been around for about three years. It engages a large number of people, not only in an open source software project but in other open source collaborative activities that involve many people who aren't related to one another except through an Internet site or through something on the Web.

As we look ahead, I think those technologies that enable people to exchange things and work jointly and collaboratively to share their little bits of data in a way that can—when all combined—yield large amounts of useful information will be fundamentally transformative. It will, I think, also weaken some of the big institutions that have grown up to support specific activities. Education and

healthcare, for example, are primed for major Web-enabled transformation.

**Rainie:** Let me underline that point: the value of GitHub was dramatically illustrated recently with the revelation that it had been subjected to substantial denial-of-service attacks in recent weeks. I think relatively soon, the IoT is going to spread far and wide into so many places that people will be using it without knowing anything at all about the underlying infrastructure of the things they're doing.

For instance, people will produce so much more information from the things they wear or the data streams they leave behind that there will be a bodily component to the IoT. For instance, the rooms we'll walk into will be connected rooms, and they'll know who we are and anticipate our moves and serve us up a variety of things.

Cars are increasingly connected among other cars and mobile devices, and soon they'll be self-driving. Communities will start taking advantage of smart systems. The result of this evolution will be the creation and availability of more data. And data will become part of an infrastructure to be exploited, analyzed, anticipated, and involved in value creation as well as some social and political disruption.

### NET NEUTRALITY AND WEB ACCESS

**Computer:** Let's focus on a major issue for many people around the world: Net neutrality. There's been considerable concern about this and the associated government regulations over the past few years. Are you concerned about whether this is being adequately addressed? Do you think neutrality and access are going to get better in the next few years?

## AS WE'RE SORTING OUT NET NEUTRALITY, THE WEB WILL CONTINUE TO DRIVE THE WORLD ECONOMY, SO THERE WILL LIKELY BE STRUGGLES AND BAD DECISIONS.

**Rainie:** It'll be a key area of discussion and action for the foreseeable future—how to address the particulars of Net neutrality, how to achieve broader governance structures and protocols, and how basic things will work. A lot of respondents to our surveys placed Net neutrality at the top of their list of things that they're worried about. As regards integrated and open communication between people and devices, there's a counter narrative that says some powerful institutions won't allow this to happen and might even clamp down on the flow of information to have a greater role in determining who gets to know what and who gets access to what for free or at what price.

But there's another broader concern that the Web structure itself will become fractured, and that people in different parts of the world will have different experiences with information. People worry the Internet and the Web won't be open, and that information will be considerably limited and expensive. They fear material will be restricted or metered in some way, disrupted by the forces of either government or corporations or whomever. In the American legal system, the battle over Net neutrality is still going to play out even though the Federal Communications Commission (FCC) rules affirming Net neutrality are being settled. We'll see some of the hottest policy disputes over this in the years to come.

**Jaffe:** I'm pretty concerned about certain government regulations and how they're made. The Internet and the Web are very complex infrastructures designed by and pretty well understood by engineers. I'm not sure legislators and regulators fully appreciate

how one regulation might affect the overall ecosystem.

One of the W3C goals is to present a "Web for all." We think that everyone should get the same access to the Web, but in some countries there are restrictions on people's usage of the Web. In those countries, governments might expect that to be beneficial, but it might have unintended consequences. For example, once people are deprived of access to useful information, they're not able to be as effective in their jobs or decision-making. As a result, they aren't able to be as effective as citizens.

I would advocate for increasing the dialogue between legislators and regulators and the technical community. Governments need advice from the technical community on policy issues in which the technology is extremely important and germane to the way laws and regulations are set up. I'm very concerned that without that communication, regulatory decisions will be made without fully appreciating the consequences of those decisions.

**Grier:** The Internet will be the foundation for much of the world's economic activity and productivity. So there's going to be a big fight over it because we're talking about trillions and trillions of dollars per year of income.

The Internet can be divided into three broad baskets of things:

- › services and infrastructure overseen by national governments, for example, the FCC in the US;
- › services largely between tier 1 networks—these are typically governed by contracts because they operate outside national borders; and
- › key institutions that are truly

international, such as the Internet Corporation for Assigned Names and Numbers (ICANN).

And I think we're going to see national entities exerting their control over the Internet in the same way they do over their economies. We have wide-open capitalist economies, we have socialist economies, and we still have some mercantilistic economies—that's going to produce a fairly lumpy Internet. Thus, our assumptions about how the Internet works in one country versus another are going to be very, very different.

Outside the technical community, certainly in the US economic community, everyone equates Net neutrality with freedom of speech, and very few countries have freedom of speech the way the US has freedom of speech. So as long as the US and its technical community insist upon that freedom, we're going to have a fight over it. I think that's going to be a fight for a long time to come.

As regards to understanding the consequences of the Net, even seemingly minor decisions can have significant national and even regional impacts. A cute example: two years ago, Pakistan decided it didn't like YouTube and routed everyone in Pakistan on YouTube to a null site, but this action temporarily limited access to YouTube in South Asia because it appeared to be a shortcut to the YouTube site and hence was propagated to the routing tables of other countries.

The action of an individual, a company, or a country affects our neighbors even when it isn't intended. As we're sorting out Net neutrality, the Web will continue to drive the world economy for the foreseeable future, so there will likely be struggles and a lot of bad decisions.



### LUMPY WEB

**Computer:** Let's turn our attention to the Web's social implications. Do you think 25 years from now we're still going to have issues with people not being connected, a continued split of rich versus poor, and different parts of the world each having their own Internet and becoming more islands on the Web?

**Grier:** Not so much islands as lumps. There's a phrase going around the Internet: "the government has formed the lumpy Internet." That's a good way of describing it. There'll always be a gap between rich and poor because the rich have more assets, and they're more interested in controlling the Internet and better able to explore it.

We talk a lot about security and privacy on the Internet, as well as how siloing and other things are bad. But we can't know everybody. We have to put silos around activities, or we get no activities. We end up worrying so much about information around the world and activities around the world that we can't concentrate on what we need to do. I think we're in the process of determining the balance between privacy and openness, between security of one's self and the need to engage the community and others.

The Internet and the Web are as disruptive as the Industrial Revolution was in the United States and Great Britain in the mid-19th century. Through these disruptive times, we've built new societies and come up with new ways of interacting with one another and thinking about ourselves, our privacy, and our role in society. These changes might continue through the next 25 years or more.

**Computer:** Will everyone in the world be connected to the Web in 25 years?

**Jaffe:** I'm not much of an economic prognosticator; I'm a technologist, so it's hard for me to make that prediction with a lot of authority. But human history suggests that there will always be rich and there will always be poor—so there will be some gaps.

We as a civilization have to bridge those gaps. The Web is what I'd call a leapfrog technology: you might not be able to get on the Web, but if you can, then all of a sudden you're part of an advanced society. Once you've leapfrogged, you'll have phenomenal access to educational resources and consumer and financial markets, no matter where you are. And you can easily interact with other people and solicit advice on how to make your dream come true or how to make your business better. I'd like to see the governments and philanthropists of the world put more focus on this to try and bridge the gap.

Several years ago, Sir Tim Berners-Lee started the World Wide Web Foundation as a sister organization to W3C, with the goal of creating the Web that we want—certainly part of that is solving the affordability problem.

**Computer:** Will the Web remain lumpy 25 years from now?

**Rainie:** The reality will be that people's capacities to navigate the Web will be overlaid with class issues. So, if you're a smart, discerning searcher—you know how technology can serve your personal goals or make you a more productive person or help you learn the things you need to learn—that set of skills, that literacy will serve you well in an economy that will radically change in the next 25 years.

If you're more passive and you can't distinguish good information from bad, there's every reason to think that

you're going to be in a much worse position than people who are the opposite of that. To address this, we need to equip people with new kinds of tools and cultivate new kinds of instincts to foster new literacies.

People are also concerned with privacy and personal autonomy. The technology community is working on some exciting tools to give people a sense that they're in control of their identities, the information they provide, and how both are treated after being spread out into the wider world. I'm optimistic that we can find ways to deal with these issues as we reinvent the way we interact as humans and communities.

### WEB ACCESSIBILITY

**Computer:** Let's talk about the issue of Web accessibility?

**Jaffe:** In the context of those who do and those who don't have access to the Web, we also need to pay attention to the needs of the disabled community. So, at W3C we have a major initiative called the Web Accessibility Initiative, or WAI, and it's dedicated to the proposition that everybody—whatever their disabilities might be (cognitive or hearing or vision, and so on)—should get full access to the Web experience.

In many countries, vital government services as well as other key aspects of society are only available on the Web. So, unless we ensure that there's full access to information for people with disabilities, we could cut out an important fraction of our population—an estimated 15 percent—from having vital access to services in our society. W3C is redoubling its efforts on Web accessibility so that people facing a variety of challenges can still access information.

## ROUNDTABLE HIGHLIGHTS

### SHAPING THE FUTURE WEB: WHAT WE CAN DO

**Computer:** What can we as technologists or computer professionals do to help shape the future of the Web and ensure that future developments make the world a better place?

**Grier:** Equal access to services for everyone is a lovely plea. A number of communities are very proud of putting government services, activities, and all sorts of things on the Web. However, all of a sudden they realize that 30 percent of their population is now disenfranchised.

We have to make sure these services are accessible, and that we spend our time not only developing them, but teaching them, promoting them, and making sure that they're deployed in a way that's equitable.

**Rainie:** There's a lot of effort in the technology community already, so I'd just encourage doubling down on this effort to solve or mitigate privacy and security problems. I've heard Vint Cerf say a number of times that the Internet wasn't designed with privacy, security, and trust issues as the center of it, because the people who designed it knew each other, trusted each other, and didn't think in very grand terms that bad actors doing very bad things would be able to exploit these same protocols. Some of the inhibitions that people have about using the Web and some of the concerns about how the "lumpy" Web will unfold can be softened by placing security and privacy concerns at the forefront of what technologists are trying to do.

Technologists may have to act as humanists as well. Several studies have shown that the Internet has been socially, politically, and economically

disruptive. More of that disruption is on the horizon as the basic interactions of humans and institutions get reconfigured. However, we haven't yet worked out the norms and legal frameworks for how to be both public and private, how to be intimate and available to lots of people, or how to be civil in an environment in which it's so easy to be nasty to one another.

The discussion on the future Web postulates exciting prospects as well as some challenges in realizing the Web's underlying potential. The panelists outlined their thoughts on how the Web will rise to new heights:

- » In the next 7 to 10 years, the Internet and Web will permeate even poor countries.
- » The Web will continue to be a transformative platform, and many "things" in our world will be interconnected. The Web will be as essential as an appendage in our lives.
- » The Web will not only integrate many of our activities, it will also facilitate integration of machines, artificial intelligence, and elements of the human condition.
- » We're approaching commoditization of the Web, its services, and the Internet as a whole.
- » We need to ensure that data in the new interconnected world is available in open formats for everybody to use, while safeguarding privacy online.
- » How to address the particulars of Net neutrality and how to achieve broader governance structures and protocols will be key areas of discussion and action for the foreseeable future.
- » To better understand how one regulation might affect the overall ecosystem and policy implications, there's a need for increasing the dialogue between government legislators and regulators and the technical community.
- » Everybody, whatever their disabilities might be, should get full access to the Web experience.
- » To fully harness the Web's potential, technologists may have to act as humanists as well.
- » Web security isn't just a technology issue, it's a human issue as well. Even very secure, private infrastructures can become insecure and public if they're misused. Hence, we need a fundamentally different approach to address cybersecurity and online privacy issues.

Computer professionals can help address this need.

**Computer:** Finally, is there anything else that any of you'd like to add or highlight that we haven't touched on in today's discussion?

**Jaffe:** I'd like to talk a bit more about security and privacy. Lee, quoting Vint

### ABOUT THE MODERATORS

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Cerf, almost characterized our problems there as an oversight. We didn't need security and privacy in the good old days because we all knew each other, and I think that might have been true a long time ago, but if that were the only problem, we would've solved it by now.

There's a deeper problem when it comes to fixing security and privacy issues. Unlike some other technologies that facilitate new ways of doing things or have huge potential for profit generation—like graphics, online video, and social networking and collaboration—security and privacy technologies and measures don't have similar appeal. Having proper security and privacy is more a characteristic of the infrastructure itself than a separate business opportunity. You can also have very secure, private infrastructures that become very insecure and very public if they're misused.

And for that reason, we need a fundamentally different approach. We need to find new mechanisms for society to invest in technologies and education to ensure better understanding of how to keep material private because the investment models we've used for the Web in general, which have been enormously successful, don't scale for this particular kind of problem, which is an important thing to keep in mind as we think about the future needs of this infrastructure.

**Grier:** That's a very important point, and it's one that we overlook because we think of this as a technology and


not a massively socially disruptive force. At the onset of the Industrial Revolution, people moved from farm to factory or towns nearby. This move called for a whole new way of living, one that wasn't centered on an immediate family and tight community but on big, anonymous cities with people interacting in different ways. To facilitate the move, we set up a large number of transitional institutions like the YMCA, but there's nothing equivalent to that on the Web. Perhaps we need institutions to teach people how to behave on the Web or how to think about their rights, their privacy, and the effects of their actions. And if computer professionals and businesses can in any way contribute to the development of these kinds of institutions, we'll have done a good deed.

**Rainie:** I hear conversations in a variety of places that are aligned with this suggestion. At Pew Research, we do a bunch of work related to libraries, a highly disrupted institution that's been transformed by the Web. This work isn't focused on social support or filling in for social disruptions, it's looking at how libraries might become platforms for learning, rather than just being information repositories.

It's facilitating interactions rather than being the host of them, being the enabler of people learning rather than the place where learning takes place. There's a lot of change going on in libraries, so thank you for pointing out that there's probably a new set of social structures to be

thinking about as institutions reinvent themselves.

There's some hope in the principles behind the open source community as a productive agent, as a mobilization agent, as a learning agent, and so on. This is a kind of structure that we haven't quite seen before, but there are probably other ways to address the real, social, and human needs—not just in terms of learning and disseminating insight to the world but by helping humans be the nicest version of what they can be. It'll be interesting to watch how crowdsourcing, open source communities, do-it-yourself groups, amateur experts, and nonhierarchical groups will change our thinking and our ways of doing things.

**Computer:** David, Jeff, and Lee, thank you so much for your time and your thoughts. To our readers and listeners, we hope you enjoyed this roundtable discussion and that it inspires you to raise the Web to new heights by exploring and harnessing its untapped potential. 



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