special issue

On

NUMBER 4, 2009

life in information

Q&A: Bob Metcalfe
The past and future of the Web, networking, and energy

Tim Berners-Lee on his world-changing invention

The Web at 20

WEBB CHAPPELL

IN THIS ISSUE

CELEBRATING THE BEAUTIFUL MIND

ABOUT 10 MINUTES into the process of editing my colleague Gil Press's fascinating interview with Bob Metcalfe—the legendary co-creator of the Ethernet standard and founder of 3Com—I was struck by a revelation. This issue of *ON* is not only a celebration of the Web's 20th anniversary. It is also a celebration of "the beautiful minds," which, collectively, created the transformational technologies that now permeate our daily lives: the World Wide Web itself; the network and Internet technologies that form its foundation; and the ever-expanding constellation of apps, services, and devices that utilize the Web as a global platform for communications and computing.

There at the Creation If you read nothing else in this issue, I encourage you to read the Metcalfe interview and the Q&A with Sir Tim Berners-Lee, whose genius it was to define the "three adequate standards" (Metcalfe's words) that are the basis of the Web and account for its astonishing flexibility, longevity, and ubiquity. With birth dates that bracket the first half of the

JOHN GOODMAN

CELEBRATING THE BEAUTIFUL MIND

Baby Boom generation, these two men are the technology equivalent of first-generation rock stars. Their observations and insights on the genesis and evolution of the Web shine with the authenticity and intellectual wattage of those who not only were "there at the creation," but also helped spark the creation.

Future Focused Equally important, they both remain deeply involved in exploring how the Web can be harnessed to address some of the greatest challenges we face as a society. Metcalfe's vision for increasing the efficiency of energy distribution by emulating certain core characteristics of the Internet is compelling. Berners-Lee discusses how we can accelerate discovery and collaboration on a large scale by freeing data from today's information "silos" and allowing it to be linked together via the Semantic Web.

But wait! There's more! In addition to publishing these full-length interviews, we asked regular columnists Tim Devaney and Tom Stein to do "mini-interviews" with 20 members of the Inforati: the entrepreneurs and opinion makers who have played a critical role in dragging us all tweeting, IMing, and YouTubing into this next stage of the Information Age. Those interviewed include Craig Newmark (Craigslist), Jimmy Wales (Wikipedia), Dany Levy (DailyCandy), and Tim O'Reilly (O'Reilly Media), and they were all asked the same three questions:

- *How has the Web changed your life?*
- *How has the Web changed business and society?*
- *What do you think the Web will look like in 20 years?*

Characteristic of all beautiful minds, their responses—which are excerpted throughout the issue—are wonderfully frank and varied, often unexpected, and colored with flashes of humor and self-revelation. Many share a genuine concern for the two-edged nature of new technology, which can always be used for good and evil alike.

In addition to all these voices, this special issue of *ON* includes reflections and predictions from both regular and occasional contributors—Jim Champy, Rob Enderle, Jeff Nick, Sanjay Mirchandani, and Steve Duplessie—and from correspondents specially enlisted to describe how the Web is affecting life in ascendant economies and developing countries in Asia, Africa, and Latin America.

On this 20th anniversary of the Web, there's much to celebrate and reflect on and anticipate. And it's all powered by the beautiful mind.

Christine Kane
ONeditor@gmail.com

2on

PEOPLE

PLACES

PERSPECTIVES

DUMB AND DUMBER

"The Web is impossibly stupid. It's archaic. It doesn't do one percent of what it ought to. It's basically taking a model of a card catalogue and a few other items and slapping electronics on top of it. I think that the active Web, which I've blogged about calling Web 4, is a Web that actually knows who I am and who I know and leverages those connections on my behalf. It will speak up when I want it to and be quiet when I don't. It'll help me navigate people.

"A simple example is when I'm at a trade show and run into somebody, the Web ought to tell me when I last saw them. It ought to tell me that six steps behind me is somebody I went to college with. It ought to tell me that the booth I'm passing by sells [product] for three percent more than the booth down the hall, so I shouldn't even bother sticking my head in there. The Web knows all these things. It's just not good at telling me."

Seth Godin

Author and entrepreneur

→ *Godin is the best-selling author of 10 books about marketing and work including* Tribes, The Dip, *and* All Marketers are Liars.

The End of Print?

Dany Levy

Founder and Editorial Director of DailyCandy

→ *A lifestyle email newsletter with a focus on style, food, and fashion, DailyCandy has 3 million subscribers for its 28 editions*

ADAM MCCAULEY

"I'm ambivalent about the demise of print journalism. It's a great opportunity for DailyCandy, but at the same time—being a little bit of an old-school girl—I really like having something in my hands. I like reading a book. I like reading a newspaper. I like holding a magazine. I think that it's about the anticipation of waiting for the next issue to come out and be on your doorstep, and the thrill of getting it in your hands.

"It's the same thing with searching for a record in a record store. I remember, back in the day, having to stupidly sing a song to the guy behind the counter trying to figure out who the musician was. Now you just type in a lyric, and you can find it like that.

"With the Web, everything comes so easily. I wonder about the future and the human ability to research and to seek and to find, which is a really important skill. I wonder, will human beings lose their ability to navigate?"

Extra! Extra!

"The practice of journalism, far from being leeched by the Web, is being reinvented there, with a variety of fascinating experiments in the gathering, presentation, and delivery of news."
—Michael Massing

(R)evolution

"First we thought the PC was a calculator. Then we found out how to turn numbers into letters with ASCII—and we thought it was a typewriter. Then we discovered graphics, and we thought it was a television. With the World Wide Web, we've realized it's a brochure."
—Douglas Adams

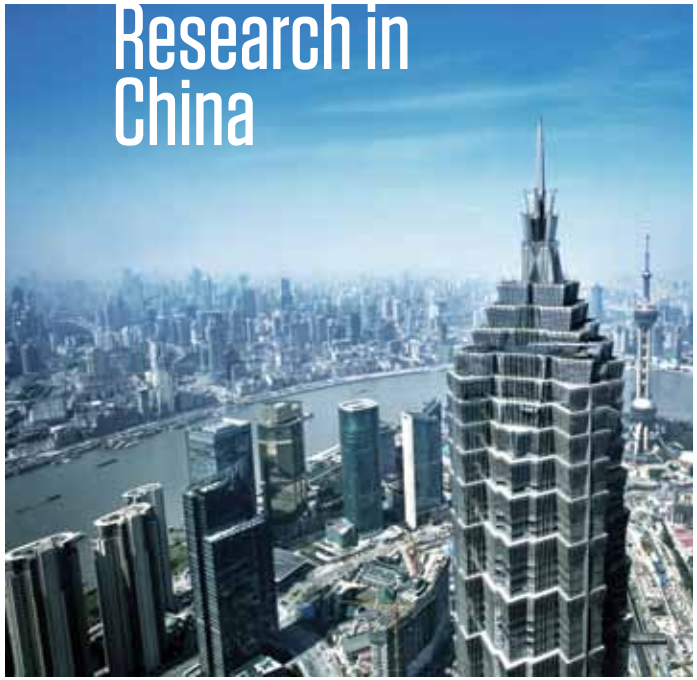
HOLOGRAPHIC ME

"With the Web, I've become a lot more digital. So as the years have gone by, I have gone from three or four meetings a day to zero meetings per day. Everything is phone calls, e-mails, Skype, and this kind of stuff. Cisco has TelePresence technology that makes it look like you're all in a board room, sitting around the table; they also have a thing where they do Star Wars-like Princess Lea holograms. That's my perfect world, when I can make a keynote speech in Mumbai via hologram. Truly the best will be when there is a 3-D hologram of Guy giving a speech. You can pass your hand through him. That's the ultimate."

Guy Kawasaki
Founder of Garage Technology Ventures and co-founder of Alltop.
→ *Kawasaki describes himself as "a firehose that answers the question: What's interesting?"*

CONNECTING

Education and Research in China



By Professor Hai Jin

The World Wide Web has become an important unifying force for education and research across China.

In 2002, China's Ministry of Education launched the China Education and Research Grid project, a grid-computing platform, which enables universities across the country to collaborate on research, scientific, and education projects. The ChinaGrid, which started with 12 universities and has extended to more than 40 currently, is the largest grid-computing platform in China. It lets users share some 2,000 different elite courses among all the disciplines and universities via a World Wide Web portal. ChinaGrid partners are connected through a common virtual hub that links them to the appropriate application resources—from life sciences research to video courses and e-learning.

The Internet has impacted my country in many other ways as well. Chinese society now heavily depends on the Web in all areas, including news online, streaming video, e-business, e-education, and online gaming. Especially in the cloud computing area, most activities are now on the Web, such as Google Gmail, Google Doc, and Google Scholar.

The Web is also an important tool for me to do my research. The first time I used it was in 1996, while I was a visiting scholar in Germany. It gave me a window to explore all the research materials I needed. Nowadays, I spend about six hours a day on the Web to do my research.

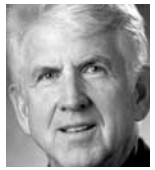
With the continued emergence of cloud computing, the Internet will play even more important roles in all areas of people's daily lives in the future. Mobile devices and smart phones will transform web technology, making it ubiquitous.

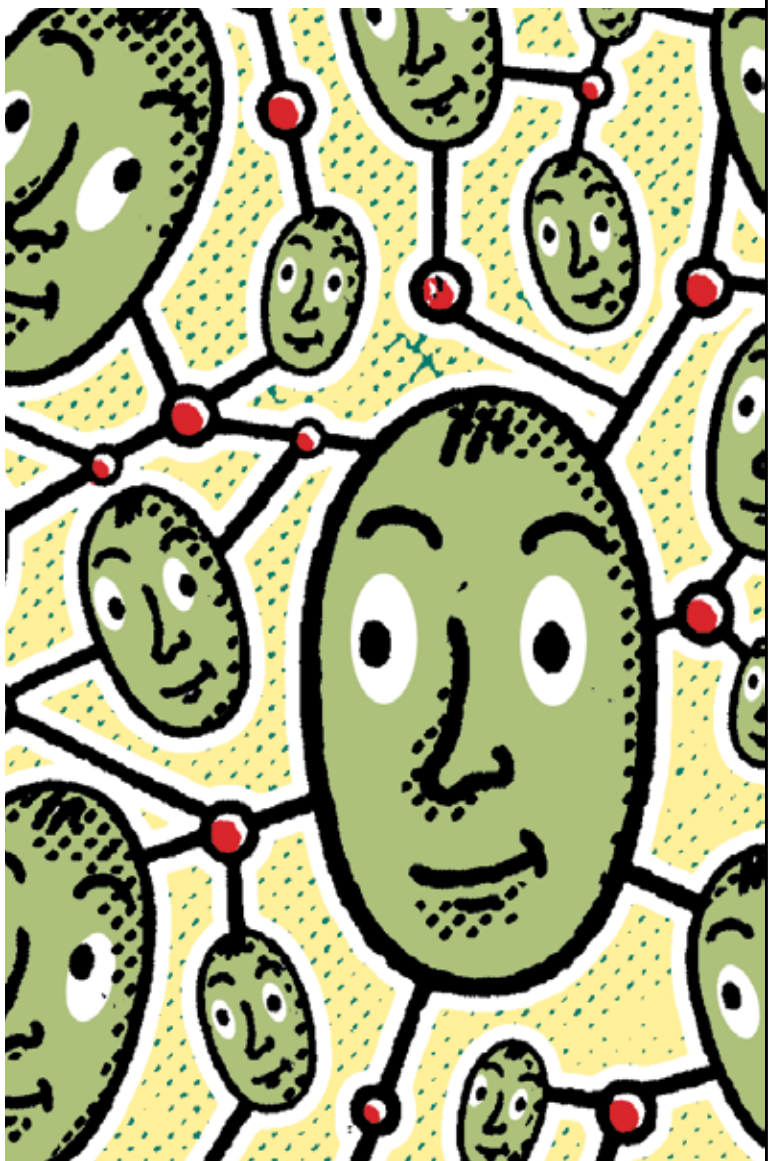
PROFESSOR HAI JIN *is dean of the School of Computer Science and Technology at Huazhong University of Science and Technology, Wuhan, China, where he also serves as director of the Cluster and Grid Computing Lab and the Services Computing Technology and System Lab.*

Bob Metcalfe has been involved—as a direct catalyst or a prominent observer—in a number of key milestones spanning the evolution of the IT industry: the birth of the Internet, the invention of Ethernet and local area networks, and the rapid adoption of the World Wide Web as the platform for linking information and people. Today, as a partner in Polaris Ventures, he invests in clean, low-cost energy solutions.

FROM ETHERNET TO ENERNET:

BOB METCALFE on STANDARDS, SERENDIPITY, and STUBS





CHRISTIAN NORTHEAST

METCALFE

IN THE 20 YEARS SINCE THE INVENTION OF THE WORLD WIDE WEB, WHAT HAS SURPRISED YOU MOST?

BOB METCALFE: Tim Berners-Lee invented the URL, HTTP, and HTML standards. None of them is particularly impressive; so many high-tech people have found them to be in some way deficient. But Tim came up with three *adequate* standards that, when used together, ignited the explosive growth of the Web. The power of good standards is they leave you with no options. As we used to say about Ethernet, "anything which is not prohibited is mandatory."

Think about that. We designed some plumbing at the lower levels of the hierarchy, and 17 years later Tim comes up with the World Wide Web, which Ethernet and TCP/IP carried just fine. That's the surprise. What this has demonstrated is the efficacy of the layered architecture of the Internet. The Web demonstrates how powerful that is, both by being layered on top of things that were invented 17 years before, and by giving rise to amazing new functions in the following decades. Based on the artfulness of the design of the interfaces, you give rise to serendipity.

In the design of his standards, Tim nailed down both expressive power and simplicity, allowing people to easily get started. It's those three standards plus Mosaic, which added visual and graphical veneer, plus the evangelical verve of Tim Berners-Lee himself that were probably all pivotal in that early takeoff.

> "The Web demonstrates how powerful [its architecture] is, both by being layered on top of things that were invented 17 years before, and giving rise to amazing new functions in the following decades."

What has been a disappointment in the context of the World Wide Web—something you expected that didn't pan out?

There's no room for that. The Web has been so successful, there's nothing disappointing about it. Tim Berners-Lee tells this joke, which I hasten to retell because it's so good. He was introduced at a conference as the inventor of the World Wide Web. As often happens when someone is introduced that way, there are at least three people in the audience who want to fight about that, because they invented it or a friend of theirs invented it. Someone said, "You didn't. You can't have invented it. There's just not enough time in

the day for you to have typed in all that information." That poor schlemiel completely missed the point that Tim didn't create the World Wide Web. He created the mechanism by which many, many people could create the World Wide Web.

And the mechanism to connect not only information, as was his original vision, but now also connecting people with Web 2.0 applications. You recently started to use Twitter. Why?

I'm using Twitter because one of my partners, Mike Hirshland, accused me of having a generational problem. Young, hip people use social networks, and old farts don't.

I used to be on the other side. I was helping to introduce LANs when there were all these old farts who thought that punch-cards were the way you did computing. The joke was that Ethernet would be adopted one funeral at a time. These people had to die. There was no way of changing their minds. So, I understand generational ossification. When my partner accused me of it, I decided to participate in this phenomenon so as to better understand it.

I'm beginning to find uses for Twitter. By tweeting my weight, I have involved my followers in a support group to help me lose weight. Knowing that I'm going to be tweeting my weight bears on my behavior. So there's one application—the support group application.

My daughter is about to graduate from college, and she's looking for a job. I have tweeted this fact, and I'm actually getting inquiries about my daughter from people who might want to see her résumé. So, that's the job search application.

One of my hobbies is math puzzles, and I tweet them now and then. The most response I've ever gotten on Twitter was when I tweeted the fact that 111,111 squared equals 12,345,678,987,654,321. Then I noticed that in a lot of the re-tweets there was a tag that I was unaware of: number sign, nerd porn—this particular fact was considered nerd porn.

In the early 1990s, you argued in an* InfoWorld *column against wireless computing, advising readers to "wire up your homes and stay there."

Let's divide that into two discussions. I think that "wire up your home and stay there" is truer than ever. We're at a time now where energy conservation is the next big thing, and one of the opportunities we have is the substitution of communication for transportation.

But you ask about one of my regrettable columns. In the early 1990s, there was a wireless bubble. There were a bunch of companies touting their modems

and wireless mobility. But the modems didn't work very well, and they were bigger than the computers. I said that wireless mobile PCs would be like porta-potties: Porta-potties are good and useful things, but as a general rule, the bathrooms that we use have pipes. So yes, there will be some wireless computers, but mostly we'll use pipes because pipes have so much more capacity. I was right about it in 1993: That bubble burst, and all those mobile wireless companies went away.

I went on to say in my column that wireless computing will *never* be important. That's where I went wrong, because along came Wi-Fi. When I was writing my column, I was often torn between being right and being interesting. Many columnists make the mistake of trying too hard to be interesting. You use various forms of hyperbole, like "There will never be anything like this." Well, maybe there will be. But that's not nearly as interesting as these hyperbolic comments.

I would like to point out that there is a figure of speech called hyperbole. It's a Greek word. It's been around for a long time, so I offer it in defense of some of my hyperbolic columns.

Around the same time, George Gilder coined the term "Metcalfe's Law" to describe your idea that bigger networks are better. In the context of the layered architecture of the Internet, don't you think one can apply "Metcalfe's Law" to the layer of networking computers (the Internet), the layer of linking information (the Web), and finally, the layer of connecting people (Web 2.0)?

That's a great point. I'd never thought of it that way. It wasn't even called Metcalfe's Law when I first used it. It was a slide in a 3Com sales presentation. The goal of the slide was to give people a rationale for building bigger Ethernets. I drew a picture that put the three-node network below a critical-mass point, arguing that you needed to get to some higher number to achieve critical mass. That was the diagram that I gave to George Gilder in 1993. He called it "Metcalfe's Law," for which I'm grateful. The value of the network grows as N-squared—"N" being the number of machines connected to the network.

Networking PCs was a novel idea at the time. So what did you tell people they could do with the network?

When Ethernet first came out, our sales proposition was PFMTS—Print, File, Mail, Terminal, Stubs.

You may remember the IBM PC XT that came out in 1982. It had a 10-megabyte disk on it. No one could imagine what you'd do with 10 megabytes on your disk. So the idea that you might want

METCALFE

“I’m using Twitter because one of my partners ... accused me of having a generational problem. Young, hip people use social networks, and old farts don’t,” says Metcalfe, pictured here atop Mount Kilimanjaro.

to buy one PC with a 10-megabyte disk on it, and then share it over the LAN with cheaper diskless PCs, had traction. The same thinking applied to laser printers that were new and expensive. So share the printer, share the disk.

I like to think about it as shifting gears. The second gear was LAN e-mail. The big e-mail carriers of the time, like AOL and MCI, didn't consider it e-mail, because my e-mails never left the building. But already in the early days of the Internet, we observed heavy e-mail traffic between Internet nodes within the same building. We called it "incestuous traffic"; it was surprising, even embarrassing, because Internet e-mail was originally conceived for long-distance communications.

T stood for terminal. There were all these minicomputers and mainframes still around in those days. You couldn't throw them out, and all of them had dumb terminals. People would have a dumb terminal on their desk, and then they would have a PC on their desk. That didn't make any sense. So you'd just write software that allowed your PC to be a dumb terminal so you could access the minicomputer or the mainframe.

Stubs were the APIs for accessing the underlying networking functionality, opening connections, closing connections, etc. This is the serendipity idea again. One such new idea came from Novell, which used the stubs to share access—not to a file, but to a database. This led to the first use of multi-user accounting systems that ran on top of the LAN. That's how NetWare got its foothold and eventually blew past 3Com's operating system.

You have been drawing interesting analogies from your experience with Ethernet and the Internet to what you invest in and speak about nowadays: Energy or what you call the Enernet.

I've been on this Internet speaking tour, a two-year book tour without a book. I felt I had a valuable contribution to make, looking at how we built the Internet and extracting the lessons from that, and then applying them to energy so we could solve energy problems sooner, better, faster. I think there are a lot of lessons to be learned, such as the value of decentralization, designing for abundance, or over-reliance on Washington.

I used to defend that analogy. I've now come full circle: I believe that energy is the Internet's next killer app. We did mail, we did telephone, we did commerce, we did publishing, we did newspapers (we're about to kill newspapers), and now we, the Internet, is going to solve energy. For example, they talk about a smart grid. A smart grid is a bunch of folks out there who want to build new networks to solve energy

and they call it the smart grid. But instead of building an entirely new network, another silo, why not use the Internet as the control plane for the smart grid?

But it's even deeper than that. That is, the very structure of the energy network— the actual transmission and distribution—needs to be like the Internet. So, it needs to be de-synchronized. Right now, to put energy on the grid, you need to synchronize frequency and phase to get onto it because it clicks with this 60-hertz centralized clock.

What the Internet did for communications was to take the clock out and put the clock in the packet so there wasn't a big global ticking clock. I sent you the clock, and you were able to tick the bits at the rate that I told you to, so we de-synchronized the Net. We will end up de-synchronizing the power switching network and end up with power packet switching, like the Internet.

What's more, the other thing we did to telecom is we added storage. The original Internet had no storage in it. Then these geniuses came up with the packet switch, with core memory for storing packets. Then we added disks to our computers. If you look at the Internet now, there is storage everywhere. So we're going to "storify" the energy network. Right now, they have no place to put energy, so when they have excess energy, they don't know what to do with it. Also, if renewables such as solar and wind are going to play any role, you need storage. I think storage is going to be big in this new energy network we have to build.

What will the Web look like or should look like in 20 years?

Thinking about the future of the Web or the Internet, I came up with a three-by-three matrix. On one axis are the three new kinds of traffic that the Web has to deal with: video, mobile, and embedded. On the other axis are the next three societal applications that the Web has to solve: energy, healthcare, and education. I look in each of those nine boxes for companies, opportunities, and progress.

Those three kinds of traffic have started arriving, but we have a long way to go. Video is brand new on the Internet, as far as I'm concerned. The mobile Internet has arrived, but it's still happening. Then there's embedded traffic. Ten billion microcontrollers are shipped every year, and only a tiny fraction of those are networked. Then there are the three new killer apps—energy, healthcare, and education—just sitting there. The Web has got to solve all three of those problems.

What will the Web look like in 20 or 30 years? It will be comfortable with those three new modes of traffic, and it will be solving those three problems. ▪

This I Believe

ADAM MCCAULEY

Craig Newmark
Founder of Craigslist
→ *Through his personal blog, social networking channels, and speaking activities, Newmark uses the Web as a platform to support social causes important to him.*

"Personally speaking, the Web allows me to connect to a lot of people in a lot of ways, frequently social but also involving things that I believe in: for example, support for veterans of Iraq and Afghanistan, support for serious peace between Israel and the Palestinians, and, most importantly, the transformation of American government.

"There are now tools like 311 that allow people to get everyday government things done, like getting a pothole fixed or the garbage removed. More abstractly, people are experimenting with how to use the Web to get ordinary citizens involved in the creation of government policy. The idea is to complement our system of representative democracy with a system of online grassroots democracy.

"Mostly what I do to participate is chat with people in Washington and then spread word of these new experiments through the social media. So, I use Twitter. I use Facebook. I'm just one guy helping out. We need a lot more, but it's happening."

PAY AS YOU READ?

While 68 percent of the publishers responding to a 2009 survey sponsored by the American Press Institute said they thought readers who objected to paying for online content would have a difficult time replacing the information they get from newspaper websites, 52 percent of readers said it would be either "very easy" or "somewhat easy" to do so.

GENIE ESCAPES BOTTLE

"I think the defining moment for me came in 2004 to 2005 when I was doing traditional public relations. I had started to blog—blogs were just emerging; they weren't in every niche yet—and I decided to do a fun experiment. I said, 'I bet I can stay up to date on sports and politics and tech and national news by just reading blogs and nothing else. I won't read any traditional media or watch any TV. I won't even look at the ticker in Times Square.' I said, 'Let's try this for a week, and you give me a current events quiz at the end, and let's see if I get a passing grade,' which I did. It actually made national news. After that, there was no putting the genie back in the bottle. I wasn't going to do traditional media relations anymore."

Steve Rubel

SVP, director of Insights for Edelman Digital

→ *Through his Steve Rubel Lifestream site, Rubel comments on emerging technologies and trends.*

Jumping the Gate

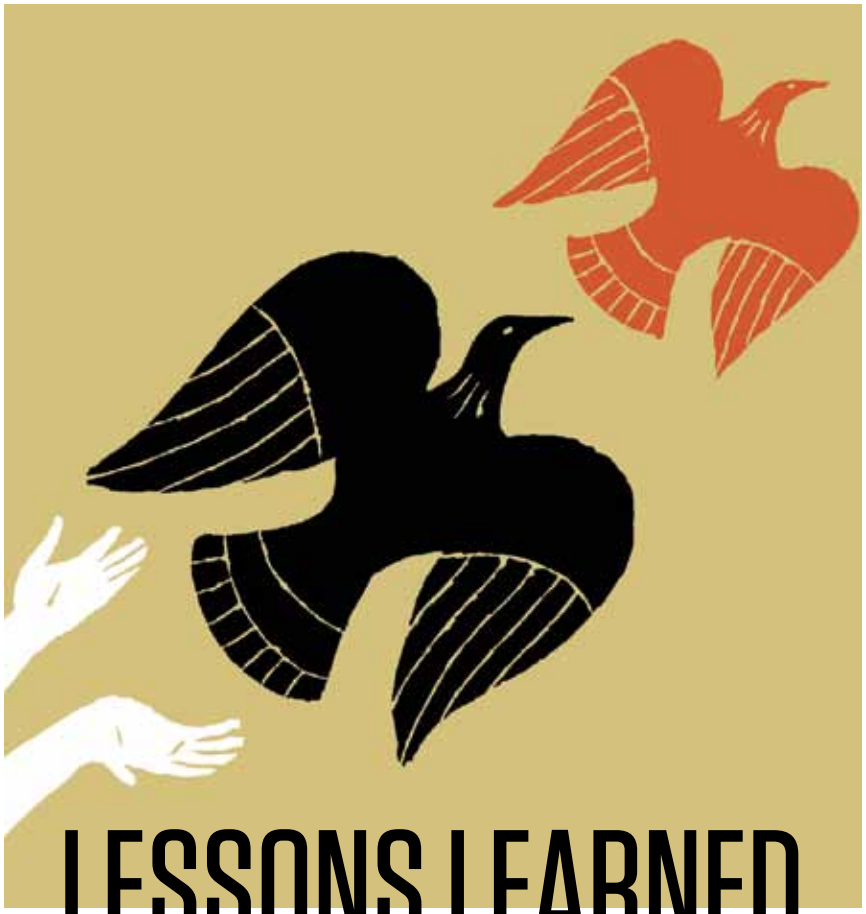
"One impact of the Web is it allows you to gate jump, which is an expression my co-author Julien Smith and I use a lot: gate jumpers versus gatekeepers. We look at the Web as this set of tools that allow people to try any idea without a whole lot of expense but with the opportunity to let your passion come first. The example that we use is Perezhilton.com, which is a pop culture site where essentially he says mean things about stars all day long.

"He had approached *People* magazine to work there, and a lot of the lesser pop magazines, and they said, 'No, not really.' Now he's handing them their hat as far as web traffic on any day, and he's got a much smaller operation. So, one of the things I say is he makes by far more revenue per employee than any of those people because he only has like six employees. The Web does that all the time. Any- one can start anything with very little money, and then it's just a meritocracy in terms of winning the attention wars."

Chris Brogan

President, New Marketing Labs

→ *Brogan is a social media expert and co-author of the best-selling book,* Trust Agents.



ADAM MCCAULEY

LESSONS LEARNED

Launching Two WWW-Era Startups

By David Vellante

This is the story of how my colleagues and I started two companies in the Web era with virtually no outside money. Over the 10-year period in which we built these companies, we witnessed a dramatic evolution in software development that drove us to apply two completely different strategies to help IT managers make better decisions.

I left IDC in 1999 near the peak of the Internet bubble. I felt like a latecomer to the software startup game, and things were moving very fast. Netscape (as we knew it) had come and gone, AOL was the granddaddy of the Internet, and Yahoo was about to buy Broadcast.com—a firm with a $50 million revenue run rate—for nearly $6 billion. Web software at the time was plagued by performance and quality problems, but these were largely overlooked because of the access and version control benefits users received.

No Dot-Com, No Money

We set out to stake our claim with a plan to build enterprise software to analyze IT portfolios and improve the performance of technology investments. We needed money, and VCs seemed a logical route. So we wrote a business plan and started shopping it. The only thing the VCs wanted to know was, "How are you a dot-com?" Unfortunately, we didn't have a good answer, and while we received some term sheets, we passed.

This was 1999, and we were not to be stopped. In a few months, we raised more than $2 million from prospective customers, without giving up a dime in equity. (Sometimes I miss 1999!) Our mindset was a bit different than "build it and they will come." It was more like "Make the sale

and then design, build, test, and ship the software." We had initial product shipping within six months, and over the next several years, we spent many millions of dollars perfecting the software and making it scale into an enterprise suite called Precision IQ. We considered ourselves a capital-efficient business and were very proud of our technical achievements and the excellent client base we'd built.

Fast forward to 2006. We reexamined the technology research business and began envisioning models like Wikipedia and Facebook applied to the analyst business. We saw the confluence of software technology, community expertise, and content, and we thought the time had come for peers to interact and assist each other in making better technology decisions.

Wiki World

In early 2007, we decided to deploy Mediawiki, the same open source software used by Wikipedia to support its many millions of users. We knew the software scaled. Also, it had many features that allowed us to track changes in real time, collaborate with users, and manage content versions. It was incredibly powerful, and the code was available for free. The "V8 moment" for us was that once we'd settled on Mediawiki, inside of a day and for less than $5, we had a fully functioning version of the software, customized for our new community. Wikibon was born.

From this experience, we learned two major lessons about the power of the Web-based open source model:

Instead of writing a business plan, you can very quickly deploy a product and launch a business. The business itself is the initial plan.

Software development is no longer a barrier to entry for entrepreneurs like us, but speed is. Competition has been popping up in many forms, which is good confirmation that we're on to something. But it brings challenges and threats that are constant reminders of the need for speed.

It's been amazing to watch the evolution of software since 1999. I realize, however, that much more will be done in the next 10 years. The online and physical worlds will begin to collide as millions of mobile devices provide inputs to the Web. Further, the Web's collective intelligence will be harnessed by software that provides context to a user base with an insatiable appetite for information. Expect the pace of development to be nonlinear as the number of sensors on the Web increases by orders of magnitude.

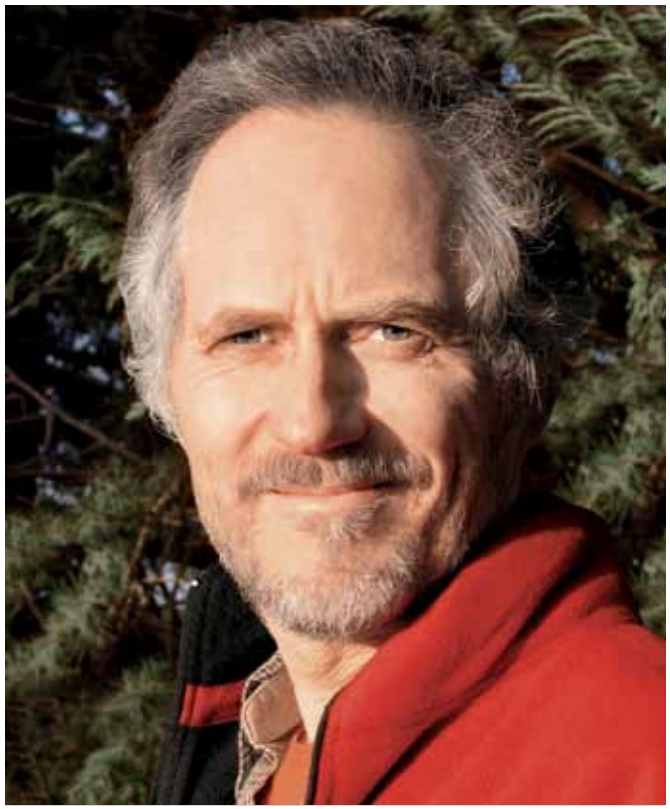
Sometimes I'm not sure if I should be excited or scared. But one thing's for certain: I don't want to miss the ride.

DAVID VELLANTE *spent 15 years at IDC, was the CEO of two startups, and is a founder of The Wikibon Project, a community of business technology practitioners. He can be reached on Twitter at @dvellante.*

Device Driven

Tim O'Reilly
Founder of O'Reilly Media

→ *An early evangelist for the Web, O'Reilly published The Whole Internet Users Guide & Catalog, which the New York Public Library named as one of the most significant books of the 20th century.*



"This next stage of the Web is being driven by devices other than computers. Our phones now have six or seven senses. The applications that are coming will take data from our devices and the data that is being built up in these big user-contributed databases and mash them together in new kinds of services.

"There is a program where you can hold up your phone to the radio and identify the song you're listening to. That's a sensor that you're carrying around with you. You can sign up for something called the Quake Catcher Network, which uses a distributed network of motion sensors that already exists in phones and laptops to detect earthquakes. There is an augmented reality app called Nearest Tube that is put out by a company in London. You hold up your phone and point it down one street and it says, 'There's a tube station in four blocks.' Point it down another street and it says, 'There's a tube station in 12 blocks.' Everybody thinks it's recognizing the street. In fact, it has GPS and a compass. What it's recognizing is where you are and in what direction your camera is pointing.

"Google knows where you are because the phone has a reporting app. They know where you're going because it's your next appointment in your calendar. It's able to recognize your voice because it has a microphone—ears for the application—and it has speech recognition. You say, 'Take me to my next appointment,' and bang! It is these cooperating databases and cooperating sensors that will enable augmented reality. I think real-time translation is something very much that Google is working on."

A New Kind of Intellectual Infrastructure

"In many ways, looking at how an idea unfolds through time gives you a much better sense of what that idea really is. For people who are interested in always being on the edge of whatever their topic is, they have to be able to reach out to understand what the current thinking is and to participate in discussions and development of those ideas.

"When I ran Xerox PARC, I had access to one of the world's best intellectual infrastructures: 250 researchers, probably another 50 craftspeople, and six reference librarians all in the same building. Then one day to go cold turkey—when I did my first retirement—was a complete shock. But with the Web, in a year or two, I had managed to hone a new kind of intellectual infrastructure that in many ways matched what I already had. That's obviously the power of the Web, the power to connect and interact at a distance. It gives you the ability to peer into embryonic ideas and watch or participate in their development, which is such a powerful way to really understand the structure of the idea."

John Seely Brown

Self-described "Chief of Confusion"

→ *The former chief scientist of Xerox Corporation, Brown thinks, speaks, and writes on topics that include the management of radical innovation, digital youth culture, and new forms of communication and learning.*

SPINAL TAP

"We're going to see some really interesting applications based around the fact that every single one of us right now is walking around with a pretty fascinating platform we call the cell phone. It's a mobile computer that does voice input, that does voice and sound output, that can take video, that has GPS and a compass on it, and that is connected to the Internet.

"When I start thinking 20 years out or even further, I can't wait to get that implant in the back of my spine that just plugs that platform directly into your nervous system, maybe over the optic nerve. Think about the opportunity and the level of connectedness and the amount that we'll be able to do when you even get rid of the computer as part of the interface and get all this input and output directly into your biological systems."

Dave Sifry

→ *Sifry is a software entrepreneur and blogosphere icon. He founded Technorati, a leading blog search engine.*

In 1989, while a fellow at CERN, the European Particle Physics Laboratory in Geneva, Switzerland, *Tim Berners-Lee* invented the World Wide Web. Today he is 3Com Founders Professor of Engineering at the Massachusetts Institute of Technology (MIT), where he serves as director of the World Wide Web Consortium (W3C), an international standards body dedicated to leading the Web to its full potential. Sir Tim is the author of *Weaving the Web*. Jason Rubin spoke with him at his office in Cambridge, Massachusetts.

FROM THE WEB OF DOCUMENTS TO THE WEB OF DATA:

TIM BERNERS-LEE on THE FUTURE OF HIS INVENTION

BERNERS-LEE

TWENTY YEARS ON, THE WORLD WIDE WEB HAS PROVEN ITSELF BOTH UBIQUITOUS AND INDISPENSIBLE. DID YOU ANTICIPATE IT WOULD REACH THIS STATUS, AND IN THIS TIME FRAME?

TIM BERNERS-LEE: I think while it's very tempting for us to look at the Web and say, "Well, here it is, and this is what it is," it has, of course, been constantly growing and changing—and it will continue to do so. So to think of this as a static "This is how the Web is" sort of thing is, I think, unwise. In fact, it's changed in the last few years faster than it changed before, and it's crazy for us to imagine this acceleration will suddenly stop. So yes, the 20-year point goes by in a flash, but we should realize that, and we are constantly changing it, and it's very important that we do so.

> "I believe that 20 years from now, people will look back at where we are today as being a time when the Web of documents was fairly well established. ... The Web of data, though, which we call the Semantic Web, would be seen as just starting to take off."

I believe that 20 years from now, people will look back at where we are today as being a time when the Web of documents was fairly well established, such that if someone wanted to find a document, there's a pretty good chance it could be found on the Web. The Web of data, though, which we call the Semantic Web, would be seen as just starting to take off. We have the standards but still just a small community of true believers who recognize the value of putting data on the Web for people to share and mash up and use at will. And there are other aspects of the online world that are still fairly "pre-Web." Social networking sites, for example, are still siloed; you can't share your information from one site with a contact on another site. Hopefully, in a few years' time, we'll see that quite large category of social information truly Web-ized, rather than being held in individual lockdown applications.

You mentioned a "small community" of people who see the value of the Semantic Web. Is that a repeat occurrence of the struggle 20 years ago to get people to understand the scope and potential impact of the World Wide Web?

It's remarkably similar. It's very

funny. You'd think that once people had seen the effect of Web-izing documents to produce the World Wide Web, doing likewise with their data would seem the next logical step. But for one thing, the Web was a paradigm shift. A paradigm shift is when you don't have in your vocabulary the concepts and the ideas with which to understand the new world. Today, the idea that a web link could connect to a document that originates anywhere on the planet is completely second nature, but back then it took a very strong imagination for somebody to understand it.

Now, with data, almost all the data you come across is locked in a database. The idea that you could access and combine data anywhere in the world and immediately make it part of your spreadsheet is another paradigm shift. It's difficult to get people to buy into it. But in the same way as before, those who do get it become tremendously fired up. Once somebody has realized what it would be like to have linked data across the world, then they become very enthusiastic, and so we now have this corps of people in many countries all working together to make it happen.

Do you see the Semantic Web as enabling greater collaboration between and among parties, as opposed to the point-to-point or point-to-many communication that seems more prevalent in the current Web?

The original web browser was a browser editor and it was supposed to be a collaborative tool, but it only ran on the NeXT workstation on which it was developed. However, the idea that the Web should be a collaborative place has always been a very important goal for me. I think harnessing the creative energy of people is really important. When you get people who are trying to solve big problems like cure AIDS, fight cancer, and understand Alzheimer's disease, there are a huge number of people involved, all of them with half-formed ideas in their minds. How do we get them communicating so that the half of an idea in one person's head will connect with half of an idea in somebody else's head, and they'll come up with the solution?

That's been a goal for the Web of documents, and it's certainly a goal for the Web of data, where different pieces of data can be used for all kinds of different things. For example, a genomist may suspect that a particular protein is connected to a certain syndrome in a cell line, search for and find data relating to each area, and then suddenly put together the different strains of data and discover something new. And this is something he can do with the owners of the respective pieces of data, who might never have found each

BERNERS-LEE

other or known that their data was connected. So the Web of data will absolutely lead to greater collaboration.

Is your vision of the Semantic Web one in which data is freely available, or are there access rights attached to it?

A lot of information is already public, so one of the simple things to do in building the new Web of data is to start with that information. And recently, I've been working

with both the U.K. government and the U.S. government in trying not only to get more information on the Web, but also to make it linked data. But it's also very important that systems are aware of the social aspects of data. And it's not just access control, because an authorized user can still use the right data for the wrong purpose. So we need to focus on what are the purposes for accessing different kinds of data, and for that we've been looking at accountable systems.

Accountable systems are aware of the appropriate use of data, and they allow you to make sure that certain kinds of information that you are comfortable sharing with people in a social context, for example, are not able to be accessed and considered by people looking to hire you. For example, I have a GPS trail that I took on vacation. Certainly, I want to give it to my friends and my family, but I don't necessarily wish to license people I don't know who are curious about me and my work and let them see where I've been. Companies may want to do the same thing. They might say, "We're going to give you access to certain product information because you're part of our supply chain and you can use it to fine-tune your manufacturing schedule to meet our demand. However, we do not license you to use it to give to our competition to modify their pricing."

You need to be able to ask the system to show you just the data that you can use for a given task, because how you wish to use it will be the difference in whether you can use it. So we need systems for recording what the appropriate use of data is, and we need systems for helping people use data in an appropriate way so they can meet an ethical standard.

Ultimately, what is one of the most significant things the Semantic Web will enable?

One thing I think we'll be able to do is to write intelligent programs that run across the Web of data looking for patterns when something went wrong—like when a company failed, or when a product turned out to be dangerous, or when an ecological catastrophe happened. We can then identify patterns in a broad range of data types that resulted in something serious happening, and that will allow us to identify when these patterns recur, and we'll be better able to prepare for or prevent the situation.

I think when we have a lot of data available on the Web about the world, including social data, ecological data, meteorological data, and financial data, we'll be able to make much better models. It's been quite evident over the last year, for example, that we have a really bad grasp of the financial system. Part of the reason for that might be that we have insufficient data from which

to draw conclusions, or that the experts are too selective in which data they use. The more data we have, the more accurate our models will be.

After 20 years, what about the Web—either its current or future capabilities—excites you the most?

One of the things that gets me the most excited are the mash-ups, where there's one market of people providing data and there's a second layer of people mashing up the data, picking from a rich variety of data sources to create a useful new application or service. A classic example of a mash-up is when I find a seminar I want to go to, and the web page has information about the sponsor, the presenter, the topic, and the logistics. I have to write all that down on the back of an envelope and then go and put it in my address book; I have to put it in my calendar; I have to enter the address in my GPS—basically, I have to copy this information into every device I use to manage my life, which is inefficient and time-consuming. This is because there is no common format for this data to become integrated into my devices.

Now, the vision of Semantic Web is that the seminar's web page has information pointed at data about the event. So I just tell my computer I'm going to be attending that seminar and then, automatically, there is a calendar that shows things that I'm attending. And automatically, an address book I define as having in it the people who have given seminars that I've attended within the last six months appears, with a link to the presenter's public profile. And automatically, my PDA starts pointing towards somewhere I need to be at an appropriate time to get me there. All I need to do is say, "I'm going to that seminar," and then the rest should follow.

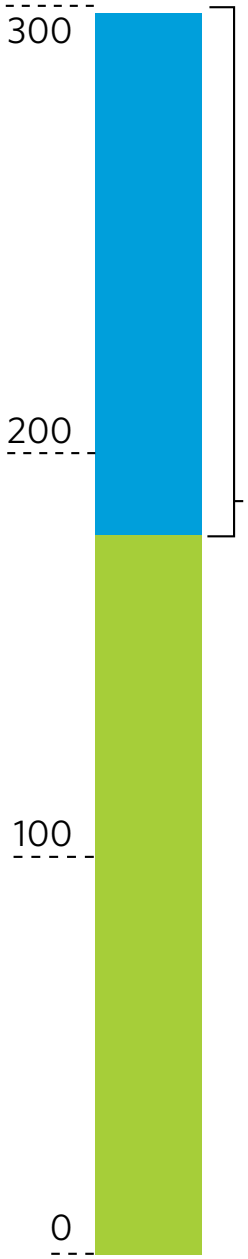
The Web is such a mélange of useful, noble content and stuff that runs the gamut from the mundane to the grotesque. Do you think humanity is using this incredible invention of yours appropriately?

Yes. The Web, after all, is just a tool. It's a powerful one, and it reconfigures what we can do, but it's just a tool, a piece of white paper, if you will. So what you see on it reflects humanity—or at least the 20 percent of humanity that currently has access to the Web.

As a standards body, the W3C is not interested in policing the Web or in censoring content, nor should we be. No one owns the World Wide Web, no one has a copyright for it, and no one collects royalties from it. It belongs to humanity, and when it comes to humanity, I'm tremendously optimistic. After 20 years, I'm still very excited and extremely hopeful. ▪

Number 1

Millions of users



The number of Internet users in China jumped nearly 42 percent to 298 million by the end of 2008 from the previous year, according to the China Internet Network Information Center (CNNIC), a state-affiliated research group, making China the country with the most Internet users in the world.

VIDEO VISION

"One of the things I would like to see in the future is large-scale, collaborative video projects. Imagine what the expense would be with traditional methods if you wanted to do a documentary film where you go to 90 different countries and in each one, you do a one-minute clip asking a person on the street what they think of a certain question like, 'What do you think of global warming?' or, 'What do you think about Obama being elected?'

"To get an interesting 90-minute film, you'd need 900 short videos because many of them won't be that great. Then you have to translate them because you're talking to people in 60 or 70 languages. That would be an enormous undertaking.

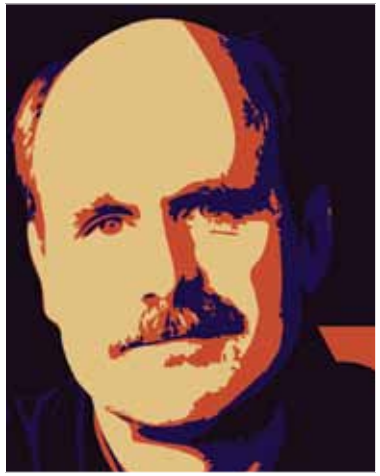
"But with the Web, a large community online could easily make that happen. They get 10 or 20 videos per country. They upload them all. The community starts working, finding the funny ones, the touching ones, the thoughtful and serious ones—because you want to have a mix. That's just one example of something you couldn't do in the traditional way but that you could do with a large community online."

Jimmy Wales
Founder of Wikipedia
→ *Wales is co-founder of Wikia, a consumer- publishing platform that enables communities to create their own wikis around shared interests such as food, politics, and entertainment.*

Think Big, Think Long

Paul Saffo
Technology Forecaster

→ *Saffo explores technological change and its impact on business and society. He teaches at Stanford University and is a visiting scholar in the Stanford Media X research network.*

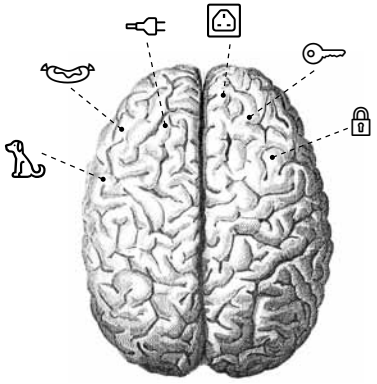


"The Internet indirectly came out of the space program, DARPA's research, and the whole climate of 'anything's possible,' the moon shot, Apollo, and all that. The Internet resulted from our going into space, and the Web came out of CERN, which of course is concerned with going in precisely the opposite direction: into the very small, into the inner space of atoms.

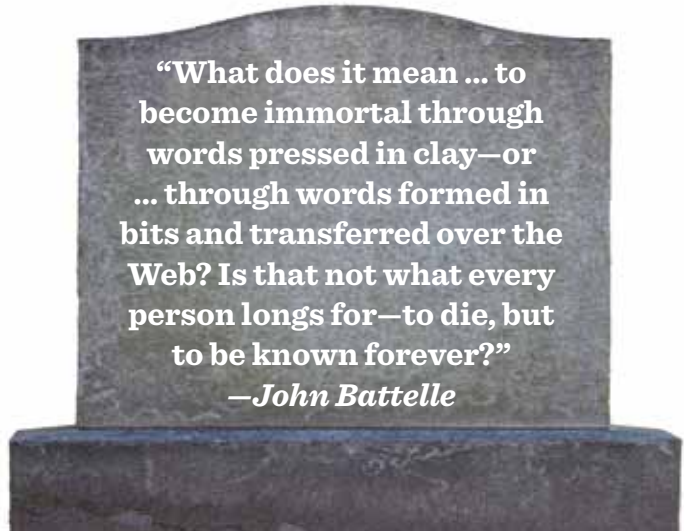
"The parallels for today are hugely important. ARPANET and then the Internet took off because we had an environment where people were allowed to think big and think long, and to build things that nobody was sure would actually take off. I love that story of when Tim [Berners-Lee] took his proposal to his boss, who scribbled on it, 'Sounds exciting, though a little vague.' But Tim was allowed to do it.

"I'm alarmed because at this moment in time, I don't think there are any institutions out there where people are still allowed to think so big. While we celebrate the arrival of this marvelous thing, the big question we should be asking ourselves is, 'Are we stifling the creation of the future Webs?'"

Headline TK



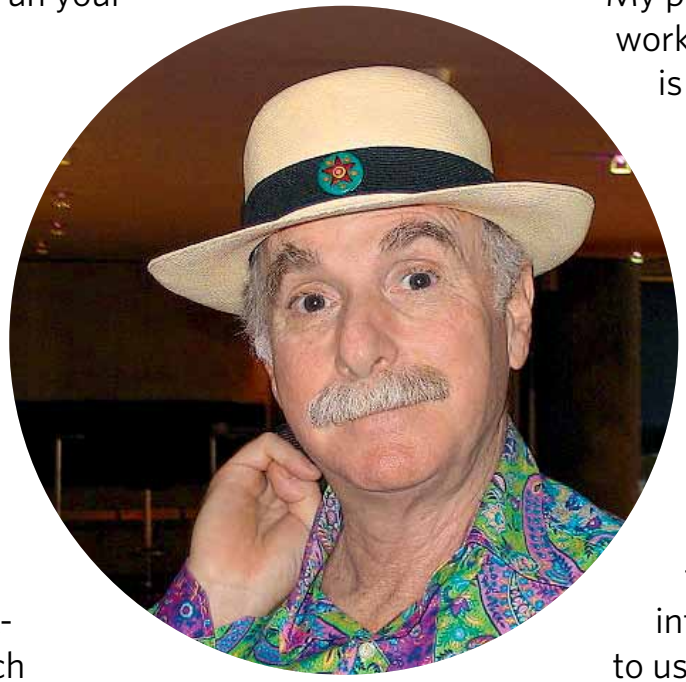
"When data of any sort are placed in storage, they are filed alphabetically or numerically, and information is found (when it is) by tracing it down from subclass to subclass. ... The human mind does not work that way. It operates by association. With one item in its grasp, it snaps instantly to the next that is suggested by the association of thoughts, in accordance with some intricate web of trails carried by the cells of the brain."
—Vannevar Bush, 1945



35 YEARS OF CONNECTING

"I first started getting excited about groups of people communicating socially in 1985, when I became involved in the WELL, which I called a virtual community. It was based on the computer that cost about three quarters of a million dollars, and you had to get an expensive software license to run your own BBS.

"Now, you probably carry 10,000 times that much computer power in your pocket, with your iPhone or BlackBerry. And you don't have to pay for any license. You can start a Google group. You can create a Meebo chat room and drag it to a Netvibes RSS aggregator. All are free. Who would have thought that all the knowledge in the world would be available at your fingertips by asking a question correctly to a search engine? We take these things for granted, but I'm still marveling at it.



"Economically, politically, socially, and culturally, the Web allows people to do things together that they weren't able to do before. I think in the long run, that's the most important thing. But I want to add one caveat. I think we are in danger of drowning in a sea of misinformation, disinformation, spam, porn, urban legends, and hoaxes. Scurrilous political rumors are believed, stupid things like 'pass this e-mail along, and Bill Gates will pay you $5.' And, more seriously, people with illnesses are getting great information but also bad information.

"My personal challenge, what I'm working on for the next few years, is literacy. I've written about 21st century literacy, about attention literacy, about Twitter literacy, and about crap detection 101. (And by the way, it's legit to use the term 'crap detection.' It's a quote from Hemingway.) People need to cultivate and understand how to deploy their attention, participation, collaboration, ability to determine the credibility of information, and awareness of how to use networks. It's both a personal necessity and a responsibility to society."

Howard Rheingold
Writer and educator
→ *The author of* Smart Mobs, The Virtual Community, *and other books, Rheingold writes, speaks, and blogs on the social media classroom, cooperative communities, and other topics.*

By Hugo A. Iavarone

The World Wide Web has been a life-changing experience for my company and for me personally.

GIRE is an Argentinean company specializing in solutions integration for commercial transactions that involve cash flow and information with high security standards. A typical example of one of our key solutions is the taxes and services payment system, called Rapipago. It offers a service that was provided in the past by financial institutions.

GIRE's customers span a wide range of major industries and include telecommunications providers, credit card companies, and banks.

Over the past decade, the Internet has revolutionized how we do business. Back when GIRE was founded in 1991, our files interchange consisted of 5 1/4 diskettes or tape reels. In 1994, we started to transmit our files using BBS software with 19200-baud modems. This process was slow and insecure.

When GIRE first started using the Internet in 1998, the transformation was really fantastic. We had no congestion in the telephone lines. We were able to buy network cards almost immediately as opposed to waiting for months. We shared experiences about configuration problems and other technical solutions with other users.

Later on, we added e-mail solutions, practically replacing the use of telephones and our paper memos. This provided us with the richest communication system in our history, including tracking capabilities.

After having worked in the IT business for 23 years, I can't imagine life without the Internet and the Web. I rely on it for the news, weather, social networks, business and pleasure trips, papers, forums, blogs, college finals, the Tampalaya's height, renting cars, buying food, checking my bank account, chatting with friends, finding the history of any civilization, checking the dollar and euro exchange rates, music, radio programs, checking calories ingested, video viewing, and many other things.

I am truly convinced that my life has undergone a 180-degree transition, in an amazing and extremely positive way. I am now able to understand why information is so vital for our lives, both at work and at home.

HUGO A. IAVARONE *is Chief Information Officer at GIRE, Buenos Aires, Argentina.*

SHIP ANYWHERE

"For businesses, that metaphor of the information superhighway, tired as it is, turned out to be exactly right. Inventing things like railroads, canals, and highways turned out to be good for people who make physical stuff because they could move that stuff around. Consumers don't just have to buy stuff from the local supplier. They can buy it from whoever is best in their whole catchment basin. The Internet has done that for information. You don't just have to use whatever information is local. You can ship information to anyone anywhere.

"The key is to have the right filter. That filter is often what startups make. So, a startup making a CRM tool will enable a business to filter the huge amount of interactions with customers and figure out: Are there patterns? Are a bunch of people complaining about the same thing so we should respond quickly? Imagine what it would be like to try to do that with index cards and physical mail."

Paul Graham

Co-founder of Y Combinator

→ *Graham's firm has funded more than 140 early stage startups, most of them Web-related.*

(Global) Village Boy

"I was born in a village in the South of France. Especially if you were in the countryside, you had few friends, maybe 10 or 20, whom you hung out with. Now I interact daily with hundreds and sometimes thousands of people. I have about 30,000 followers on Twitter, 6,000 on Facebook, and I get 1,000 pieces of feedback a day.

"It has become for me and so many other people the most important way to do anything. It ranges from twittering about a restaurant because you can't decide which sushi bar is better, to buying a product or finding a job.

"I organized a conference in Paris where we gathered 2,000 people from many countries. I needed to partner with an airline company, so I posted a tweet, 'Does anybody know anyone in Air France?' In two hours, I had a contact, and in two weeks, we had done a partnership.

"So, this is just magic. When you understand that, of course you share and you focus a lot on that because it's just much more powerful than anything else."

Loic Le Meur

CEO of Seesmic

→ *Seesmic helps users organize access to social networking apps. Le Meur has been named one of the 25 most influential people on the Web by BusinessWeek.*

ADAM MCCAULEY

CLOUD COMPUTING

Standing on the Shoulders of the Web

By Jeff Nick

The Web has given us new opportunities and tools for collaboration, information access and visualization, and IT service-based consumption, ushering in the new era of cloud computing.

Before the dawn of the Web, if you wanted to collaborate, you had to bring together everyone in the same room at the same time. The odds of having all the right players present were slim. This was not only due to the barriers created by travel time and cost, but because, in large global organizations, it was difficult to know where all your potential collaborators—those with the most relevant talents—existed within the company.

The Web has changed this landscape in truly powerful ways, allowing us to find relevant people, information, and resources in a global manner, limited only by the security boundaries that we set in place. At EMC, this new way to collaborate has facilitated a new model for innovation and product development. The EMC Innovation Network is based on the principle that innovation is an open process involving multiple players from different organizations, coming together in a global network to share ideas and their passion for a specific topic of research and to incubate these ideas to realization. It allows us to discover and leverage EMC talent anywhere in the world and to build a community of interest that can also be open to outside partners.

Making Content Consumer-Centric

The Web has also given us new tools and models for managing how information is assembled and presented. In the past, the display of information was constructed in a rigid, hierarchical way based on a vendor's best guess about what the average user wants or needs, or based on what the producer wants to deliver. Today, users can control and customize what information is delivered to them. With Web-inspired mash-up capabilities, users can assemble information from different sources and define how it is going to appear on the screen.

EMC and other leading IT vendors are embracing this shift from producer-centric to consumer-centric content. For example, EMC Data Center Insight allows IT administrators to mash up information from different sources to yield much deeper insights about the IT infrastructure. This is next-generation IT, and coming up behind it is the next-generation Semantic Web.

Up Ahead: the Semantic Web

Similar to how translators break down language barriers so that information is comprehensible to a diverse audience of listeners, so too will the Semantic Web unleash information that is now stored in silos—tied to specific schema and access methods—so it can be seamlessly discovered and accessed over the Internet by all the people and applications that need it. By unlocking data from many heterogeneous sources, then assembling and linking it into sets of information that are contextually meaningful to the user, the Semantic Web will allow us to gain deeper, richer insight into the vast quantities of data being accumulated in every industry and organization.

Take healthcare, for example. In the healthcare supply chain—which includes not only providers, but also insurers, regulators, and other parties—we have many different players. They are not only creators and custodians of data (which exists in many different formats), but they also must access data that is created and stored by others. It is neither desirable nor feasible to move all the data to one place. We need to leave the data where it is today but be able to find it, catalogue it, classify it, interact with it, translate it, and update it all along the supply chain.

Our ability to create an electronic healthcare record system will be predicated on our ability to build an information exchange where information can be extracted from these proprietary data sources, translated into the form fit for the next participant in the supply chain, and then updated and stored back into the original data sources in a secure and authoritative manner. This kind of semantic information exchange is the business corollary to the Semantic Web.

The Semantics of Cloud Computing

The Semantic Web also has a correlation to where we are going with cloud computing. The ability to find, allocate, and consume IT as a service has its roots in the Web's mechanisms for discovery and navigation. The Internet provides us with the semantics to interact with end points and exchange "information about information." In a similar way, we are now starting to exchange information about resources at Internet scale. The Web has been a stepping stone to our ability to actually interact with and federate to resources that are distributed globally.

Cloud computing is based on Web-facilitated collaboration, the Web-inspired idea of consumer-centric information mash-ups, and now Web-based discovery and access of IT resources as a service. Semantic Web-based information exchanges will follow. As such, cloud computing stands on the shoulders of the Web.

JEFF NICK *is Senior Vice President and Chief Technology Officer at EMC.*

Increasingly Interconnected INDIA

By Dr. Vidya Raj C

Over the years, the mode of expressing has changed significantly. I remember a few years back, the exercise of trying to get connected to the Web, when I had to pay more than a dollar an hour at a cyber café. With advancements in technology, the Internet has become highly affordable and accessible to all, spinning its web of interconnectivity around the globe—thereby making the world a small place.

It has gone from being a storehouse for information to an outlet for socialization and commerce. As the Internet grows—quite liter-

ally, by the hour—India is keeping pace. While the national rate of Internet penetration is only seven percent, its use is growing rapidly, and millions of young people in today's generation are transferring more of their day-to-day activities from the physical realm to one that exists beyond their computer screens. Some examples:

Self-Expression: The Web has certainly changed the way ordinary people express their feelings and beliefs. Earlier, there was no place where citizens could widely share their thoughts. But with the Web, anyone can simply start a blog and get the feedback of people.

Shopping: The Web has been the most wonderful discovery of all time, especially for people who love to shop! Now you don't even have to step out of your home. From groceries to clothes to gadgets, you can get all of it right at your doorstep with net shopping, purchasing your favorite items by making an online payment.

Communication: There is no doubt that the Web has revolutionized the way we communicate. Now instead of postal addresses, we have e-mail IDs, and instead of post offices being crowded, Internet cafés are. The Web has given us an enormous luxury in the way we communicate. Sitting right in our room, we can communicate with a person sitting seven seas away, via net chatting and e-mail.

Entertainment: With the Web by your side, you don't need a TV or radio for entertainment anymore. You can catch your favorite movies, serials, and music on the Internet. In fact, you can even play the latest games on the Web. And web surfing these days is probably the best entertainment available. You can read the latest gossip, catch the international news, or even date online.

Information: The Web is one huge well of information. Just go to any search engine and type whatever topic you want to search about. No longer do you have to spend hours in the library to complete that project. If you want directions to the hospital, the address of the nearest saloon, or information on the latest diet, it's all out there on the Web.

India's IT industry is one of the fastest- growing in the world. It is currently ranked third worldwide due to domestic and international market demand. Though 'IT' is a small word, it converts the entire world into a global village. Over the last decade, India became one of the most important offshoring centers in the Asia-Pacific region. The total revenue from IT is anticipated to be US $73 to 75 billion by 2010. Over a million professionals are part of this growing industry. This skilled workforce will help ensure India keeps pace with the latest trends as the Internet continues to grow in popularity.

DR. VIDYA RAJ C *is a professor and head of the Department of Computer Science & Engineering at The National Institute of Engineering in Mysore, India.*

KATHLEEN DOOHER

By Sanjay Mirchandani

I still remember when I first realized that the Web would be big. But I also sensed it would be "freedom with shackles." Freedom, in getting information with exhilarating speed. Shackles, in the form of unpredictable access, limited dial-up ports, and tied-up phone lines.

The inconvenience of being shackled by immature technology was overshadowed by a collective excitement: We certainly became hooked quickly. And of course, anyone working in IT saw the Web's potential. I was part of the team that helped create one of the Middle East's first online banking solutions and was particularly excited by the "e-opportunity." The convenience that e-business brought and the speed at which we were rolling out services for customers—it was mind-boggling and easy to feel passionate about.

The Shackles Evolve

But the shackles never disappeared. These days, they come not from undependable connectivity but from non-stop connectivity. We can be shackled to our workplaces every waking moment if we wish. On a personal level, though, I'm not sure it's wise to be online 24x7. Everyone needs downtime, family time, balance. Our job in IT is to enable that balance.

My dad was in the shipping business. His two communication choices were the telephone and the Telex machine. He didn't take that Telex home with him, however. Dad had downtime, knowing that in his office, in the morning, he'd find the previous night's Telexed shipping assignments waiting.

Even just a few years ago, it was still perfectly acceptable to have your e-mailed question to someone answered 24 or 48 hours later. Today, the mindset is different. When people initiate contact, they expect a response right away and don't care if you're in Timbuktu at the time. If you don't reply, they may throw a "Where are you?" message on your Facebook wall. Web 2.0 technology has blurred our consumer and business lives. ➜

THE WEB I KNOW

Merging our Personas

Productivity and personal connectivity exemplify Web 2.0. Now, it's the etiquette of business that needs to fold itself into the Web 2.0 product. That brings me to the non-productivity dangers of the Web. We don't want to tell employees how to spend their day; they understand which tasks they must complete. Again, it's a balance. If I'm having lunch in my office, I do go online to read what people are saying about EMC. That kind of web surfing enhances my productivity. It makes my day more relevant.

Similarly, if I'm prepping for a customer visit, I like to learn what the customer's business priorities are. Online, it takes me five minutes to do that. And afterward, I am more attuned to what's important to that customer. But checking tech blogs or corporate sites at lunch is not the same thing as spending half the day monitoring a ballgame online and chatting about it. Our job in IT is to give people the opportunity for productivity. The rest is left to the individual. With the social Web comes a responsibility to be sensible.

I think the next wave will center, in large part, on a balancing of our work and our personal personas. For example, a lot of us carry two mobile phones to keep our business and personal contacts and e-mail messages separated. At some point, technology will allow us to carry one device while maintaining our two personas.

Businesses will eventually bring the experiences that we have as consumers fully into our workplaces. It almost happened with Web 1.0, when we learned how to obtain information and transact commerce. Now, with Web 2.0, everyone is trying to figure out how to make social media work in a business environment. A lot of that script remains unwritten. I can't wait to see what happens.

SANJAY MIRCHANDANI *is Senior Vice President and Chief Information Officer at EMC.*

Seeing Patterns in The Cloud

There is a massive parallel in my mind between what happened in the early, potential-rich days of the World Wide Web and what cloud computing could offer us. We know we can take this very ambitious next step into the cloud—into the future of information technology—and not trip. We know it because we remember how our embracing of the Web changed *everything*. The Web's early days centered on reading information. Then e-commerce made companies reachable worldwide. With cloud computing, businesses can achieve even more massive, secure scalability.

I sensed that the Web was going to be a big deal 20 years ago, but now, I realize, I had no idea just how big it could be. Inside the cloud, another next-generation experience awaits us. The technology parallels are there.

NAMIBIA Goes Online

By Rainer Rusch

The evolution of the World Wide Web has had a huge effect on Namibia, providing a vital link for businesses, organizations, and individuals. But perhaps its biggest impact has been in helping to make eco-tourism a main industry for the country.

In the past, tourism relied on word-of-mouth advertising, flyers, pamphlets, and expos to promote Namibia's unique natural environment and diverse wildlife. But with little visibility internationally, tourism was largely limited to people who either had friends or relatives living here or knew people who had visited previously. In turn, without enough business to support a vibrant industry, there were few lodges and game ranches.

A Worldwide Window on Namibia

Today, that situation has changed, due in part to a modernization of the country's backbone and related infrastructure. An array of websites provides a window on popular eco-tourism destinations, including Internet-based booking services and sites where lodges and game ranches can provide information.

Beyond tourism, many other businesses make extensive use of the Web to provide services and operate online marketplaces, selling anything from property and cars to prepaid electricity. Every major organization has a web presence to promote its products and

NAMIBIA

services, and the government uses the Internet to provide the latest public communications, including details about upcoming elections.

Connecting Across Distances

After Mongolia, Namibia is the least densely populated country in the world, with its two million people scattered across 320,000 square miles. This poses challenges for the telecommunications infrastructure. Access to the Web is not an issue in larger cities, but it can be more difficult in smaller towns. Nevertheless, the local telecoms are striving to improve connectivity. Most parts of Namibia have cell phone coverage, and Internet-capable cell phones and wireless service providers have made the Web more accessible in remote areas.

For my employer, which is an IT service provider, the Web is a crucial tool, not only to get the latest software and patches, but also for technical or product information. Most of our communication with partners or vendors is done by e-mail, which helps drive down costs.

Internet and e-mail are critical communication tools for customers. A few years ago, e-mail and Internet access were seen as luxuries reserved for management, and if the system was down, it was not a big issue.

Today, this is not the case. The Internet is also crucial for system interfaces to external partners. Interfaces to external systems tripled over the past five years for some of our customers.

As an information technology specialist, I realize that the Internet is crucial to my career, and it has a high impact on my life. First thing upon arriving in the office, I usually check my e-mails and read the latest technology information. Getting the latest news on technology and doing research about various areas would be very difficult without the Web, since Namibia does not have a broad range of technology publications.

Being without the Web for a few days when on vacation is not an issue; nevertheless, I don't want to live without it anymore.

RAINER RUSCH *is manager of Data Center and Microsoft Solutions for Dimension Data Namibia, which is an important contributor to building and maintaining Namibia's IT infrastructure backbone. Dimension Data is an EMC partner.*

According to the website Internet World Stats, only 6.9 percent of Africa's population uses the Internet, compared with 74 percent in North America and 51 percent in Europe. This leaves tremendous room for growth. In fact, between 2000 and 2009, Internet usage in Africa grew by more than 1,300 percent. Three articles in this issue describe how the Web has affected Namibia ➲ PAGE 38*, Angola* ➲ PAGE 41*, and Mauritius* ➲ PAGE 46.

DON'T I KNOW YOU?

"The notion of having people find you on the Web and be able to get a complete picture of who you are—what you've done, how you behave, what your personality is—is quite amazing. Recently, I got 161 submissions for updating my logo. The person I chose had done an amazing amount of research in terms of what I had posted on my blog, what I had tweeted, and some of my companies. She came up with a design that is just unbelievable because it really characterizes what I do. The amount of information she extracted from what is on the Web was very profound.

"[In the past], she would have had to spend hours with me, meeting face to face, trying to understand what I do and what I think, and trying to derive a design out of that. It would have taken a lot of time for her and me. Here, the designer just nailed it. I was like, 'Wow!'"

Jeff Clavier

Venture Investor

→ *Clavier is founder of SoftTech VC, an early-stage fund that has invested in dozens of start-ups, mostly related to Web 2.0 and the Internet.*

Going Granular

"The Web is certainly changing business models. Take the media segment, for example. Media was, for the last 80 or 90 years, about mass media and one-to-many. It was about having very big, singular advertising buys, and that supported the rise of giant international brands that could afford those ad buys.

"Some really interesting fragmentation is going on because of the Web. People are connected in more person-to-person ways. With each new evolution of web technology, those person-to-person connections become arguably more granular, and we're starting to see really small hyper-local businesses take off by using that shift. Does it bring back the small-town boutique, the person who makes a business successful because he or she knows a lot about the product and shares that information? I think that would be a very naïve read. But it certainly shakes up the dynamics, from these giant monolithic multinational brands to a little bit more of a grassroots economy."

Laura Fitton

Principal, Pistachio Consulting

→ *Fitton is co-author of* Twitter for Dummies *and the founder and CEO of oneforty, an app store for Twitter. Her focus is on productive business uses of emergent technologies.*

ANGOLA Is Rebuilding Connections

By Hugo Recchimuzzi

Up until five years ago, Angola had little access to the World Wide Web. Our country was torn by 27 years of civil war that destroyed most of our infrastructure, including telecommunications. But since the peace agreement in 2002, we have gradually been rebuilding, and Internet access has improved by 300 percent.

We now have five Internet service providers—one public and four private—and WiMax is available in 40 percent of the country. Angola is also about to launch its first online university, where students can take classes on the Internet.

Still, there are issues to be resolved. Only 30 percent of the population of 13 million has access to the Internet because it is too expensive for many. The government has resolved to improve Internet infrastructure by 50 percent in 2010, making it more affordable. Currently, I pay $100 a month for Internet service, which is way too expensive.

Most web pages and portals are still hosted outside the country. The ability to download large files is still evolving. Currently, the maximum file that can be downloaded is one megabyte.

While the government here is making progress in providing information over the Web to citizens, it faces a larger challenge in communicating with its population: More than 50 percent of the people in Angola are illiterate. Hopefully, the Internet will help improve that situation.

Meanwhile, the Web is connecting and informing people across the country. News now reaches areas that were previously isolated, and people are able to stay current on the political situation.

For my employer, the Internet has been central to increasing sales by 50 percent over the past three years. It allows us to keep in touch with our enterprise customers, including the country's substantial oil and gas industry, and to avoid the previous difficulties and delays of relying on the troubled telephone system. We have also launched a new website that improves our communications with customers.

In my career, no Internet means lost business. I rely on it at my company, where I have worked since 2002.

As for my personal life, our family has had Internet access at home for three years and can't imagine not having it. My two children, ages 5 and 6, use it to learn, play games, and entertain them like TV.

It's like oxygen. We can't live without it.

HUGO RECCHIMUZZI *is a sales manager in Luanda for MEDTECH Technology and Services, an EMC partner.*

REFLECTIONS FROM "The Coolest Guy in Town"

KATHLEEN DOOHER

By Steve Duplessie

In 1986, I thought I was the coolest guy in town—I had a cellular bag phone! It had awful service, a huge fee structure, and stretched the limits of the term "mobile"—but it didn't matter. For me, it was the beginning of the "information anywhere, anytime" era. Soon after, the World Wide Web took that concept and exploded it to every nook and cranny of the planet.

Just like the cell phone, the Web has had its share of growing pains, created information revolutions and revelations, and caused its share of problems. Technology is an imperfect enabler of things previously unconsidered. Who foretold that 20 years after I got my bag phone, everyone on the planet would be using their mobile phones for everything but talking? They text, they shoot video, they surf the Net. Talk? That's old school.

Access to information is available almost anywhere, anytime, to anyone. Is it all good? Of course not. There are always problems when the world adopts a new way of doing things. The key is that we keep moving forward.

New technologies also highlight the flaws in our society, businesses, systems, and processes. Problems don't get fixed until they are exposed, and the WWW is the best thing ever created for exposing! Whether social, political, human, or machine, issues are exposed at the speed of light. There are no secrets and no limits—which can be good, and, as we all know, bad.

Competing with the Big Boys

In the business arena, the Internet enabled small business owners such as myself the capability to communicate globally, just like the big boys. It allowed me to enter markets at light speed and almost no cost. It put me at parity with corporate giants who previously were able to keep me out of markets because of cost and reach. It enabled my big mouth to reach eyes and ears everywhere. In the Internet era, truly the whole

REFLECTIONS FROM "THE COOLEST GUY IN TOWN"

world is a stage.

The Internet has revolutionized my business. Want relevant data on spending trends in China or Bolivia? From my office in Milford, Massachusetts, I can get you up-to-the-minute results. Why use six-month-old data that was questionable anyway? No need to any longer—the Internet changed the way primary research can be conducted. While the old guard puts out "data" based on 25 interviews, we can poll hundreds or thousands—and can do it in less time, in more places, with far more granularity. We couldn't do it without the Net.

Knowing is Better than Not Knowing

In my personal life, I've also seen the good and the bad. Six years ago, I was diagnosed with Hodgkin's lymphoma. Knowing nothing of cancer, my wife and I immediately went to the Web to educate ourselves. The bad news is there were millions of results, and I only needed a few proper ones. The good news is after manually sifting through those results for a few days, I was able to get smart on my disease. I learned that I had the odds with me, and I learned what the journey was going to be like for the next year. And knowing is far, far better than not knowing.

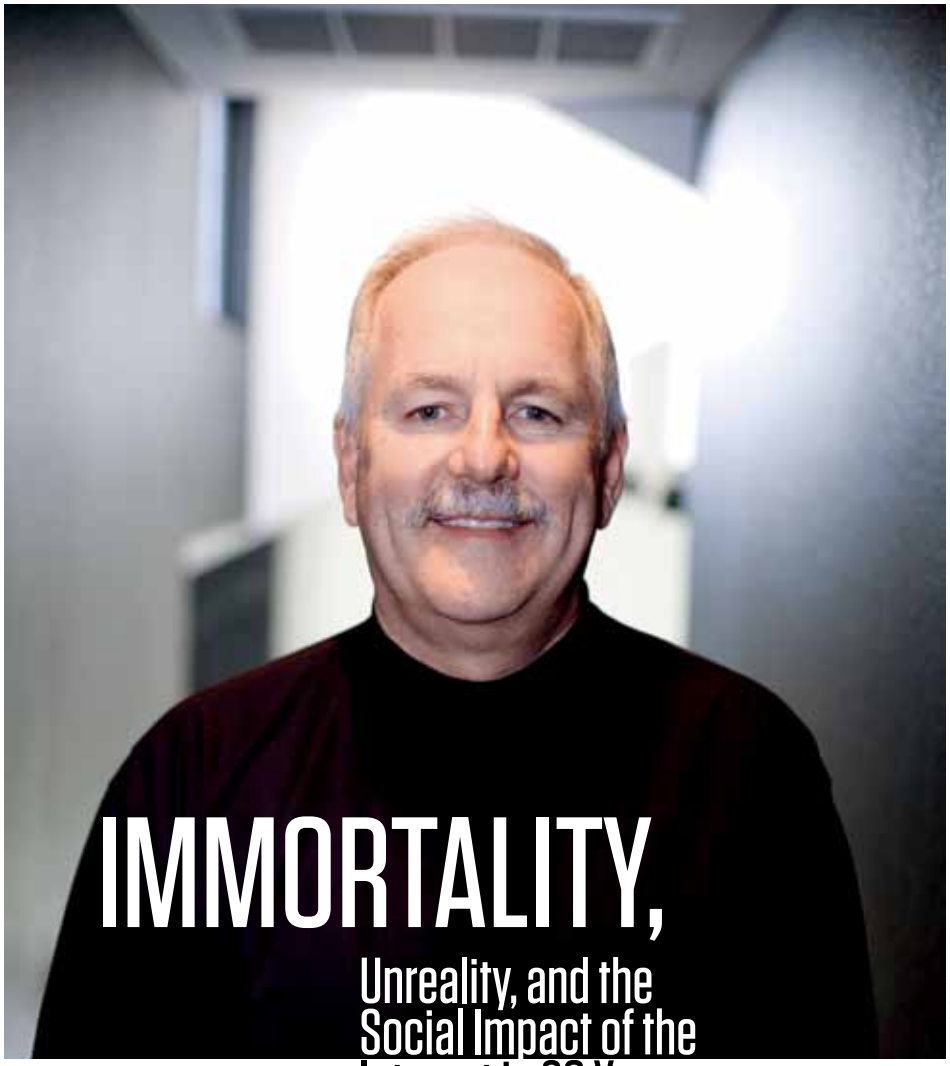
The downside of web capabilities manifested itself a month later. I was receiving treatment both in Boston and in a suburb closer to home. I had high-resolution nuclear scanning done in Framingham using the highest-tech gear available—it was able to sense cancerous tumors no bigger than just a few cells. Those images took up a half-terabyte of capacity. But when I needed to send that data to my doctor in Boston, the files were too large to transmit between the hospitals. So I was forced to take a million dollars worth of digital technological brilliance and reduce it to analog films—circa 1952—and then drive them to Boston.

Reaching Across Continents

More recently, I saw firsthand how a young man desperately in need of a bone marrow transplant was able, through the use of Twitter, to reach across every continent to find a donor within 72 hours. There were responses from Brazil, China, Japan, and other countries. This simply was not feasible in the pre-Web world. Unfortunately, the disease was too far advanced, and the transplant failed, but not for the lack of a donor.

There is always a price to progress, intended and otherwise. The Web has exposed commercial and personal issues, enabled massive societal change, and, in the end, made a big world smaller, and that has proven to be a really good thing.

STEVE DUPLESSIE *is the founder of and senior analyst at the Enterprise Strategy Group. He is recognized worldwide as a leading independent authority on enterprise storage.*



IMMORTALITY,

Unreality, and the Social Impact of the Internet in 20 Years

JEN SISKA

By Rob Enderle

Predicting social change is a crap shoot. There are so many variables to consider. And, as powerful as the Internet may be, the real world that exists outside the virtual one is so far beyond our control that its impact is virtually unpredictable.

Nonetheless, there are some clear trends that will affect society greatly, and by focusing on them, we can glimpse where we are going—and hopefully control the technology rather than allowing it to control us.

It's Time for Your Close-Up

We are still at the early stages of digitizing, imaging, and monitoring the real world. But by 2030, video scrutiny will be far more pervasive than today, and more heavily populated areas will be under constant video surveillance. Being on camera virtually all the time, and being able to access images of most locations and activities, will not only change how we feel about personal security and privacy, but will also cause us to censor how we behave in public places.

It isn't yet clear if we will feel less or more secure, but the reaction to Google Earth in Europe reminds us that technology is a two-edged sword: Many people see the application as a tool that helps burglars case a location before striking. Others point out that live feeds could, in theory, make it easier to catch thieves and other criminals.

In the future, more people will be able to monitor what you do, and there will be a more detailed and permanent record of it, creating profound privacy concerns. One can imagine

THE SOCIAL IMPACT OF THE INTERNET IN 20 YEARS

creating a video diary of a specific time interval in one's life or perusing a video database to see where a prospective employee, a suspected criminal, or a rebellious teenager goes and what they do during the day.

A "Virtual You" That Could Live Forever

The concept of creating a virtual representation of oneself has already begun at sites, like Lifenaut, that let users create a realistic, 3D avatar: a "virtual you" that you can teach to talk and behave like you, using online tools. In 20 years, this technology may make it possible to "be in two places (or more) at once." For example, an avatar might handle routine e-mail, monitor news and social networking feeds, and even chat with people when you're unavailable. And, of course, a virtual person could outlive the real one, perhaps offering some comfort, or affliction, to those still alive.

Advancements in data mining are creating tools like MIT's Persona, which can quickly compile how you are viewed and spoken about on the Web. Down the road, one can imagine a job interview that is conducted with your virtual self—not one that you create, but one that is based on the information, accurate or not, that is available about you. The Web could become a highly accurate lie detector or a totalitarian nightmare. It's easy to imagine your avatar testifying against you based on what past behavior suggests you would likely do.

You Ain't Seen Nothin' Yet

In 20 years, the ability to separate what is real from what is imagined will be increasingly difficult, but the difference may become irrelevant as the real and virtual worlds blend—most likely to our benefit and our detriment. And that's only the beginning of the impact of the Internet. The next hundred years? Now that's where the really big changes will occur!

ROB ENDERLE *is president and principal analyst of the Enderle Group, a forward-looking emerging technology advisory firm. He is one of the most recognized commentators on technology.*

We're the Same, Only More So

"The Internet is like alcohol in some sense. It accentuates what you would do anyway. If you want to be a loner, you can be more alone. If you want to connect, it makes it easier to connect." *—Esther Dyson*

JAMES DUNCAN DAVIDSON

By Frederic Ng

The arrival of the World Wide Web helped put Mauritius on the map, though we still have a way to go to reach global recognition. We are a small island nation off the coast of Madagascar that relies on the sugar, textile, and tourist industries. Many people have never heard of us.

The Web has brought some amazing capabilities to our remote world. About 30 percent of our population of 1.2 million has Internet access, which first became available here in 1995. We mainly use it for communications, e-mail, social networking, browsing, and downloads. But shopping and banking on the Web are still limited.

The High Cost of a Monopoly

A single telecommunications company has a monopoly on Internet service, making it quite expensive. A business package with two-megabyte-per-second ADSL costs $270 a month. Some companies don't think it's worth it. While there are other providers emerging these days to try and bring prices down, they are limited by the high cost of using the existing telecom infrastructure. The most promising solution, in my view, is to make services available via mobile phone. While a lot of people still cannot afford to have a PC here, 80 percent of the population has mobile phones.

The government does have a website for some services, which our company helped implement five years ago. But it has not improved the site since it was established. The interface is not very user-friendly, and navigation is not straightforward. So it's a nightmare, and people don't use it.

Bridging the Distance Between Businesses

The Internet is crucial for my employer. It lets us stay connected with customers and vendors and have immediate access to price information. That's particularly important, since we are so far away from everything. For instance, the nearest EMC office is in South Africa, four hours away by plane.

I can't imagine how I would work if I didn't have the Internet. Everything would be so slow. It would take two months to send an order to a customer. Now we can get orders out in a matter of days. I still

MAURITIUS

have to track them by e-mail, however, since I do not have a website to let me have continuous visibility. I can also get career training, including EMC certifications, online without having to travel to South Africa.

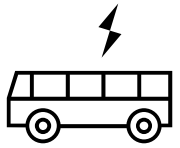
Bridging the Distance Between People

The Web has played a vital role in my personal life as well. It has allowed me to get back in touch with friends that I have lost contact with. Just about every week, I hear from another old-time friend on Facebook. Some of them I haven't talked to for more than 10 years.

On this, the 20th anniversary of the Web, it's still a big mess with all the interconnections and complexities, and yet it works. It's amazing.

FREDERIC NG *is a sales executive with Blanche, Birger Co. Ltd., provider of information and communications technology services, and an EMC partner.*

Leave the Driving to Us

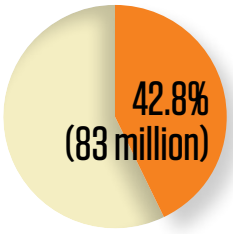


"When I think about what we will be able to do on the Web in 20 years that we can't do today, I think about things like people moving out of big cities and living where they please. In our company, one of my colleagues lives on a bus. He actually has a house, but he only lives in it half of the year. For the other half, he drives around to anyplace where there's good weather or nice things to see. He has a satellite dish on the roof and the equivalent of a broadband connection.

"If you take this to the next step, you ask, 'Why should people pay incredibly inflated real estate prices to live in certain small areas? Why should you pay a fortune to live in a so-called good school district when you could have the best teachers in the world while you're on your bus, actually, because it's all done over the Net?'

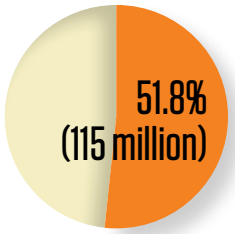
"That kind of change is completely credible, but it will happen very slowly. Sociological changes or even changes to the way business is done are not something that happens overnight. I think it is going to take another 20 to 30 years to play out."

JAKOB NIELSEN *is one of the world's foremost experts in Web usability.*



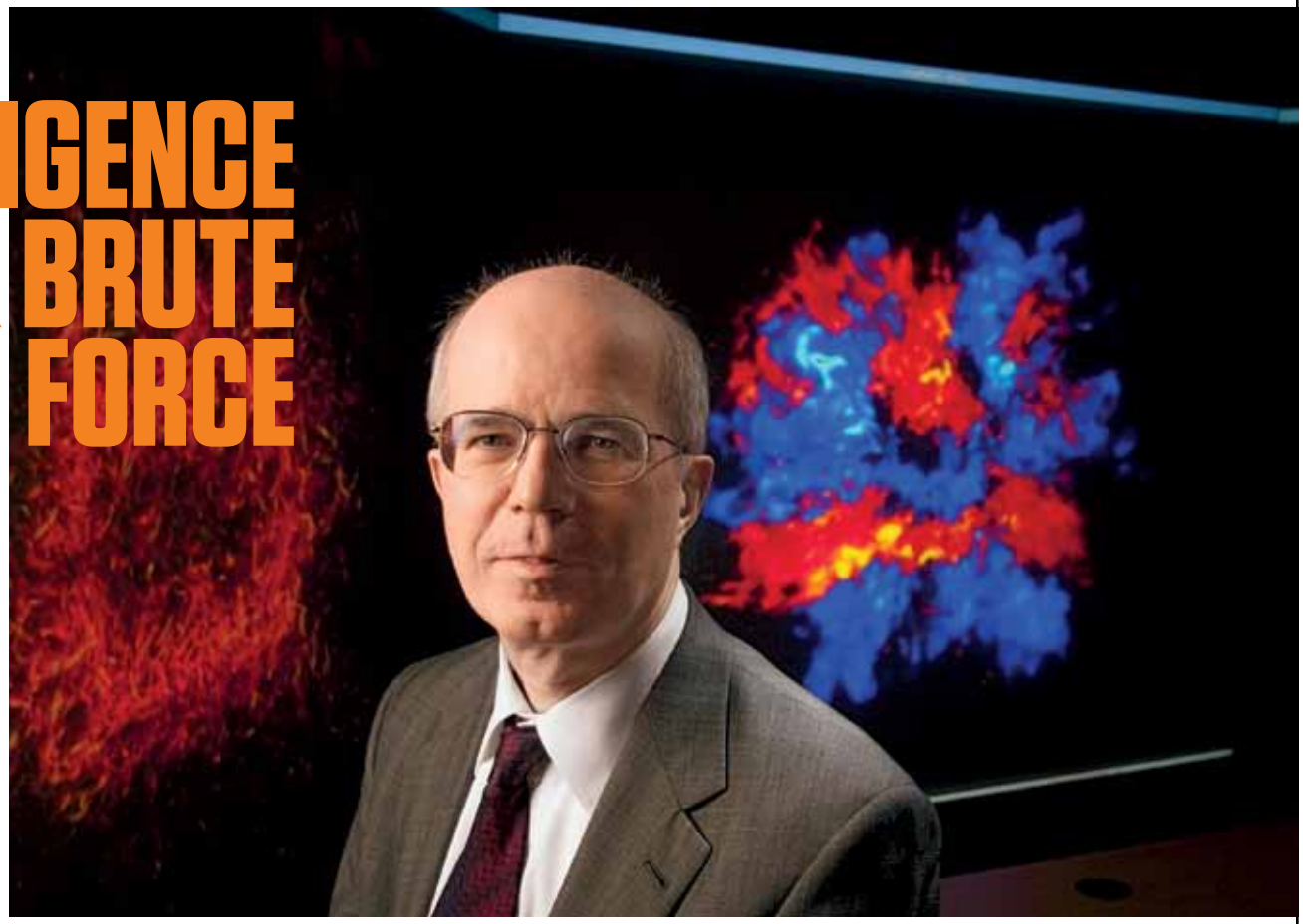
User-Generated Content Creators **2008**

By 2013, according to eMarketer, 155 million U.S. Internet users will consume some form of user-created content, up from 116 million in 2008. The number of user-generated content creators will grow by similar proportions, reaching 115 million (or 51.8 percent of U.S. Internet users) in 2013, up from 83 million (42.8 percent) in 2008.



User-Generated Content Creators **2013**

TECHNOLOGY PREDICTIONS: INTELLIGENCE & BRUTE FORCE



DOUG KNUTSON

Technology prediction is inherently hard. And it is even harder to predict how society will react to a new product or service.

By Andrew Odlyzko

Potential customers may sneer at a new technology, as happened a decade ago with application service providers (ASPs). Or they may embrace it, as seems to be happening with today's incarnation of ASPs, cloud computing. (Of course, it is still too early to tell if what we see is truly an enthusiastic embrace, or simply hype generated to stimulate an enthusiastic embrace.) The presence of complicated feedback loops—hype can inspire creation of new applications, which will make a service more attractive and persuade people to try it—makes the task of prediction even harder. So it is no wonder that "progress by mistake" is not just frequent, but almost a rule.

An Unexpected Killer App

Technology can surprise on the upside as well as the downside. E-mail, which was specifically excluded from the design crite-

ria for the ARPANET, became the "killer app" of that network as well as its descendant, the Internet. Who could have known at the time that the computer mouse, demonstrated by Doug Engelbart more than 40 years ago, would today still be the key device for human-computer interaction? And the World Wide Web, now 20 years old, spread slowly for several years, until the release of the Mosaic browser made it widely accessible—and then it caught fire. But even then, in the first few years, there was considerable speculation that even better tools for accessing information over the Internet might emerge.

What can we conclude from the long history of failed technology predictions? Wide experimentation is certainly called for, as well as maximizing the flexibility of new technologies, in order to accommodate demands that one did not foresee initially. One should not count on serendipity, but be prepared for it. And, of course, we should ride the technology curve, taking advantage of Moore's law and similar laws that provide predictable progress in information technologies, at rates that vary from field to field.

> "A fairly persistent pattern [in technology forecasting] is the underestimation of the continuing increases in processing power, storage capacities, and communication bandwidth, and overestimation of the extent to which computers can be made to reason like people."

Under- and Overestimating

Aside from the widely accepted principles above, there are a few other patterns that one can discern in the history of predictions about technology. Thus, although general technology forecasting is unreliable, some predictions have proven correct over an extended period of time. A fairly persistent pattern is the underestimation of the continuing increases in processing power, storage capacities, and communication bandwidth, and overestimation of the extent to which computers can be made to reason like people.

A striking example of this dichotomy is provided by J. C. R. Licklider's book *Libraries of the Future*, published in 1965. Licklider has the best claim of anybody to be called the "grandfather of the Internet," as he was the first one to point to computers as being primarily communication devices, not just computing ones, and he set up the program that led to the creation of the Arpanet. In his book, he made many predictions. Some, about development of computer networks, and about digital libraries becoming feasible around the year 2000, are among the finest examples of futurology. But those were based primarily on extrapolations from basic technology trends.

Many of his forecasts were wrong, in particular those based on expectations that computers would acquire intelligence.

A similar pattern appears in other areas: Speech recognition has made great strides, primarily by exploiting more powerful technology to do massive pattern matching, rather than by the methods pursued in the 1960s of trying to get computers to understand human speech. Language translation followed the same pattern. And so did chess. The best computer chess programs can handily beat the best human players today, but not by imitating human thought processes. (That presents us with a mystery: Why are there no contests involving pairings of people and computers on each side?)

Human, Not Artificial, Intelligence

With the Web, too, brute force has triumphed, although that brute force is directed by human intelligence, in the form of clever algorithms. (Clever algorithms were also needed for the advances in speech recognition, language translation, and chess.) The popularity of the Web obtained a substantial boost from the appearance of AltaVista, the first popular search engine. AltaVista's breakthrough, later improved on by Google, was to demonstrate that with sufficient computing, storage, and communications resources, one could do effective, automated crawling and indexing. But AltaVista's managers, for what seemed to be good business reasons at the time, made the misstep of switching their focus to making AltaVista a portal, and thus facilitated Google's rise to dominance. Google succeeds largely through use of massive resources, with direction from clever methods, but not ones drawn from conventional AI.

The Web is evolving rapidly. And there are hopes for major breakthroughs based on computer understanding of the growing volume of digitized data. Yet, if we go by historical precedents, such hopes will be disappointed. Computing, storage, and communications are all progressing rapidly, even if somewhat less rapidly than they did a decade ago. Hence, it is most reasonable to expect the incremental improvements they will provide (together with improvements in standard data mining, visualization, databases, and related algorithms) will be the main contributors to the Web's evolution.

ANDREW ODLYZKO *is professor of Mathematics at the University of Minnesota. Before founding the Digital Technology Center at the University of Minnesota, he had a long career in research and research management at Bell Labs and AT&T Labs. He is widely known for an early debunking of the myth of Internet traffic doubling every three or four months and for demonstrating that connectivity has traditionally mattered much more to society than content has.*

Learning to Be Alone and ANALOG AGAIN

ADAM MCCAULEY

By Jim Champy

When I see the penchant for people to be constantly connected—including myself—I wonder whether we will forget how to be alone. Communications devices are stuck in our ears, clipped to our belts, carried in our hands. The Internet is, of course, the great enabler of connectivity. But I must admit to getting tired of being asked to be linked, share a chat room, twitter, or blog.

I very much believe in the power of teams and the value of collaboration, which the Internet makes all the more possible. Teamwork and collaboration are required for a company to operate. But there are times when I want to be alone—maybe learn on my own from the knowledge available over the Internet—and then just think.

Any experienced manager knows that we are alone when making hard business decisions. At the same time, we cannot make good decisions based on data collected exclusively through digital channels. When I look at the generation of managers we are training, I wonder how they will perform if they are disconnected from their digital environment. It's a critical issue, because the quality of decision-making often defines the quality of leadership.

Develop and Nurture Direct Connections

Peter Drucker always advised his students to "walk in the marketplace." Drucker meant it physically. Go see a customer and ask what she thinks of your products. We now do that digitally. Our customers tell us what they think, whether or not we want it or like it—and smart companies make it easy for customers to form communities, exchanging their views and experiences.

But there is nothing like direct conversation with customers to understand the subtleties of what they really want. In my own business, IT services, customers are always gratefully acknowledging what we do and then asking for "more." It can take a lot of conversation to understand what that "more" is and how to deliver it.

Trust Your Intuition, Sharpen Your Sensibilities

In my research of high-performing companies over many years, I have been struck by how

LEARNING TO BE ALONE AND ANALOG AGAIN

many managers and executives are intuitive decision-makers. The Internet provides access to volumes of data and information to use in support of decision making. But, in the end, someone has to make a decision, and often the answer is not in the data. Today, it would be easy to decide that sales are off because of broad market conditions, but could sales also be off because of the quality of your product or because a competitor is doing a better job than you?

Great managers have a strong intuitive sense about their markets and customers, and they develop that sense by sharpening their sensibilities. They balance walking inside and outside their companies to learn what's going on.

Seek Alignment, Not Compromise

I have already acknowledged that teamwork and collaboration are important, but I must admit that I have never trusted committees to make decisions. Committees often make compromises, not the decision that's best for a company or its customers. For example, committees can make bad compromises when considering cost-cutting initiatives. They defer from making hard decisions, particularly if it requires a company to stop doing something. Committees can advise; managers and executives must make the hard decisions.

In the end, of course, a manager must be sure that people are aligned behind a decision. That is one of the great benefits of collaborative efforts. You can find games and exercises over the Internet to improve your people-alignment skills, but there is nothing like a steely argument to understand the passion that can be involved, even over a business issue.

You can see that I am of two minds: You cannot make good decisions by just being alone. Collaboration, listening, and learning all contribute to good business decisions. But in the end, you are alone in making the most momentous decisions. So get comfortable in doing that. Unplug yourself from time to time, and just think.

JIM CHAMPY *is the chairman of consulting for Perot Systems, a business unit of Dell. His most recent book is* INSPIRE!, Why Customers Come Back.

Socks.com

"When I took office, only high-energy physicists had ever heard of what is called the World Wide Web. ... Now even my cat has his own page."

—Bill Clinton, announcing the Next Generation Internet Initiative, 1996

INTIMACY, WEB STYLE

"With the Web, we've created these gradations of intimacy that both lubricate transactions and create the grounds for transactions that are, frankly, a little bit scary. I do some venture investing, so I see a continuous flow of business plans from people around the world who I actually think I know. You have what we call 'air friends,' these people I see all the time on Twitter, or they e-mail me now and then. So if I see them at a conference, I feel like I know them really well even though we've never actually inhabited the same physical state.

"So, I have all these attenuated relationships. I won't say it's a false intimacy, but it's an attenuated intimacy. And that's hugely productive as long as you remember that it is a different sort of intimacy than the one where we can get physical cues from people and say, 'You seem trustworthy. I'll write you a check for this much money because I feel comfortable with the way you support yourself.'"

Paul Kedrosky
Venture investor and entrepreneur
→ *Kedrosky is an analyst for CNBC, contributes regularly to The Wall Street Journal, and is frequently quoted in major media outlets.*

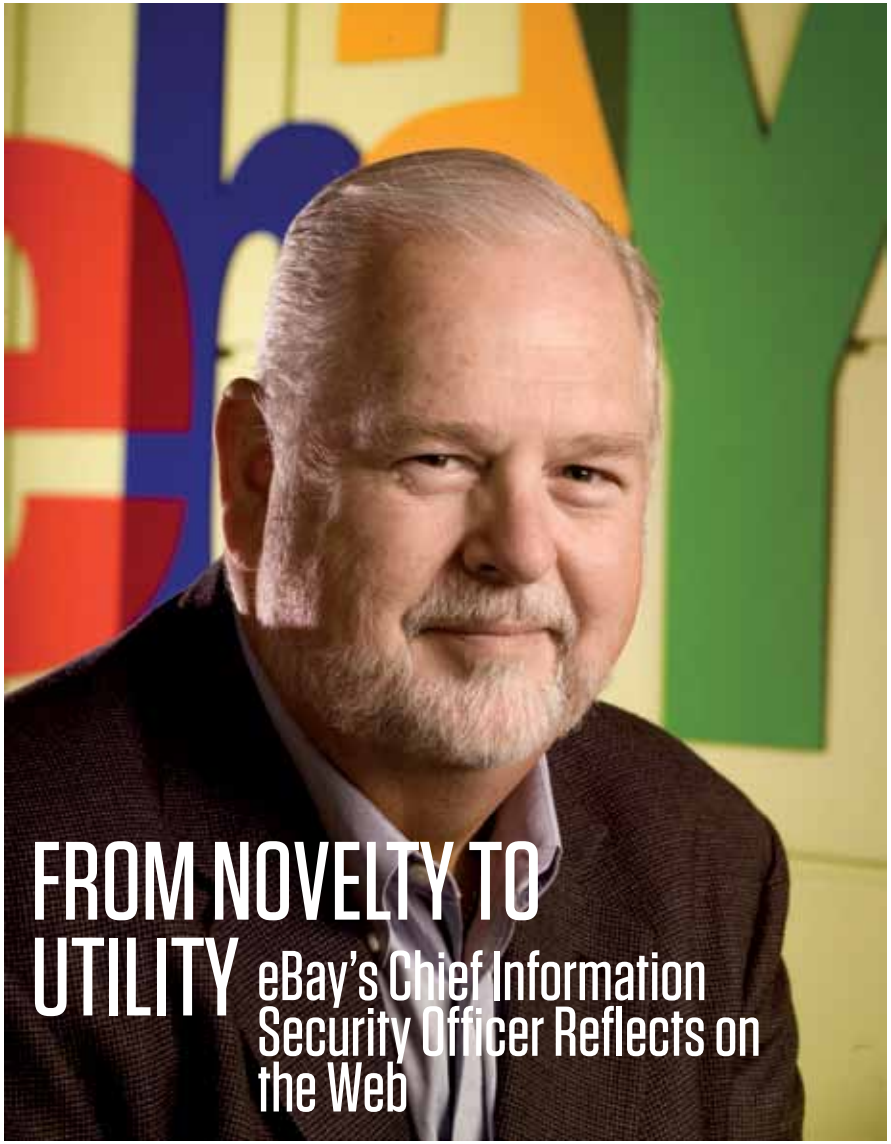
Web Workout

Jeremiah Owyang
Altimeter Group
→ *Described as a "social media superstar," Owyang is a web strategist whose expertise includes building personal brands and helping companies connect with customers.*

"In 20 years, the Web will fade into the background. It won't look like anything. People will just connect with other people and focus on the relationships. You won't visit websites the way you do now. The content will come to you in real time and assemble in front of you, on the fly, based on your needs. And it will anticipate your needs. URLs will fade away. People won't use them at all. That's a very antiquated way of finding things; it's machine language actually.

"The system will look at your previous behaviors and your location and draw context from it. We're already seeing that happen. Whether you realize it or not, you're training your e-mail inbox to show certain things and not show certain things. Facebook is learning to show you information from people who are relevant to you. Following and un-following people in Twitter is another example.

"We're training the system to serve up the information that we like."



FROM NOVELTY TO UTILITY

eBay's Chief Information Security Officer Reflects on the Web

By Dave Cullinane

By connecting people around the world, allowing them to share more and more information, the Web has created a strong need for sophisticated, proven security that could keep information safe in a rapidly changing environment.

"The Web is Gonna Be Big"

When the Web began, I was working at Digital Equipment Corp., which became a pioneer in turning this new capability into something businesses could use. From the outset, it was clear to me that, with the capabilities it offered to communicate around the world effectively and inexpensively, the Web was going to have a pretty radical impact on the way we used computers and information. I remember giving a presentation on e-commerce security in the early days of the Web. Someone in the class asked, "Do you really think this is going to grow into something big?" He was drinking a bottle of water at the time. I said, "If I told you a year ago you'd be paying a dollar for a bottle of water, would you have believed me?"

Two decades later, the Web has become a utility that people expect to be there. It's very dramatic how much people are used to communicating via their BlackBerries and iPhones and keeping track of all the things that are going on around the world with a hand-held device. The trick is keeping it working the way they expect it to without imposing a whole set of requirements.

Outside the IT industry, companies didn't necessarily embrace the Web right away. When I ran the security program for U.S. operations of Sun Life of Canada, we held long discussions about

FROM NOVELTY TO UTILITY

whether to allow employees to access the Web at work. The concern was that they would fritter away their time browsing the Web. We decided to let them, but a lot of companies didn't.

> "Over the past 20 years, the World Wide Web has not only shaped the success of the companies I've worked for, but the career I work in. It was the development and growth of the Internet that turned IT security into a profession."

Two Hours and a Quarter of a Million Calls

The Web brought important changes to banking. Online banking became a strength of Washington Mutual, Inc., where I served as chief information security officer before joining eBay three years ago. The bank became aware of how vital online banking was when it was hit with a 24-hour system outage in 2003. I had been urging them to do a disaster and recovery plan. Within two hours of the system outage, their help desk got 250,000 phone calls from people upset that they couldn't bank online.

eBay, of course, couldn't exist without the Web—or without effective security. Trust and security are essential to both buyers and sellers.

For IT management, the Web has caused the pendulum to swing back to a more centralized infrastructure. Over my long career, we started out with mainframes, then terminals accessing mainframes, and then PCs. Now, it's moving back the other way, where companies are actually using VMware to basically provide a terminal server version on your PC, so they can limit what the employees can do and are exposed to. Security needs are much more complex because we are connecting to systems all over the world—some of which we own, some of which others run for us, and some of which are run by companies we know nothing about.

As with most people, the impact of the Web on my life has been huge. I Skype with my grandchildren all the time, so we can see each other even though I'm in California and they're in Massachusetts. I also find being able to hold business meetings with people face-to-face over the Web is a major innovation with tremendous potential.

One of the biggest challenges I see ahead is safeguarding information in the cloud computing environment. But I also think the cloud offers potential for new and innovative security tools.

DAVE CULLINANE *is chief information security officer at eBay Marketplaces and a member of RSA's Security for Business Innovation Council.*

VENEZUELA Shares its Story

By Fran Grillet

Since the World Wide Web arrived in Venezuela in the mid-1990s, it has been a positive force for important economic and social development here. The Web has opened new doors for our country, letting us share with the world that we are a major producer of oil and are home to some of the world's most beautiful people.

It has also helped us highlight the many attractions Venezuela has to offer travelers, from its tropical beaches and little-explored jungles, to its majestic mountains and idyllic colonial towns. Venezuela is home to the world's highest waterfall, Angel Falls, and the second longest river in South America, the Orinoco. It also has the longest coastline to the Caribbean Sea.

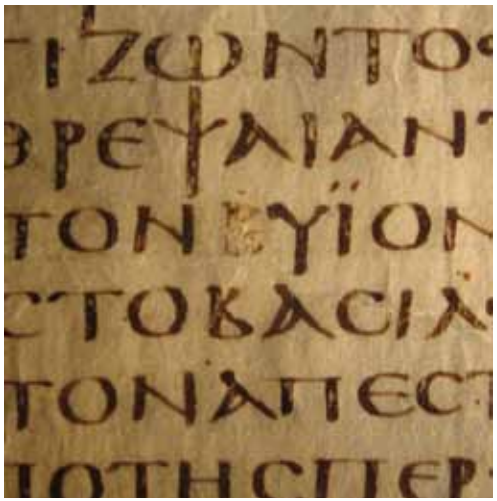
Currently, only about 28 percent of Venezuela's 26 million people have access to the Internet. However, that number is continuing to rise at a strong pace. In fact, between 2000 and 2009, the number of Internet users countrywide has grown by 695 percent. As more citizens connect to the Web, the government is now working to provide services over the Internet.

For my company, Toyota Services Venezuela, the Web is a vital tool for communicating with customers and vendors. It also lets us stay informed about industry developments around the world. This is a young company, and since its beginning in 2002, the strategy has been to focus on using the Internet to operate the business and reach every inch of the Venezuelan territory; this could only be possible because of the Internet. Our main office is located in Caracas, but we need to keep day-to-day contact with all our vendors who are located in cities all over Venezuela. The Internet is the key channel that lets communication flow in real time, easily, and fast.

The invention of the Web has certainly made my personal life and career easier. It has helped me to understand just how vital information is to our lives and businesses and how important it is to have the information that I need with just a click.

FRAN GRILLET *is IT Manager for Toyota Services Venezuela.*

"It's been my policy to view the Internet not as an 'information highway,' but as an electronic asylum filled with babbling loonies." —*Mike Royko*



OLDEST NEW TESTAMENT

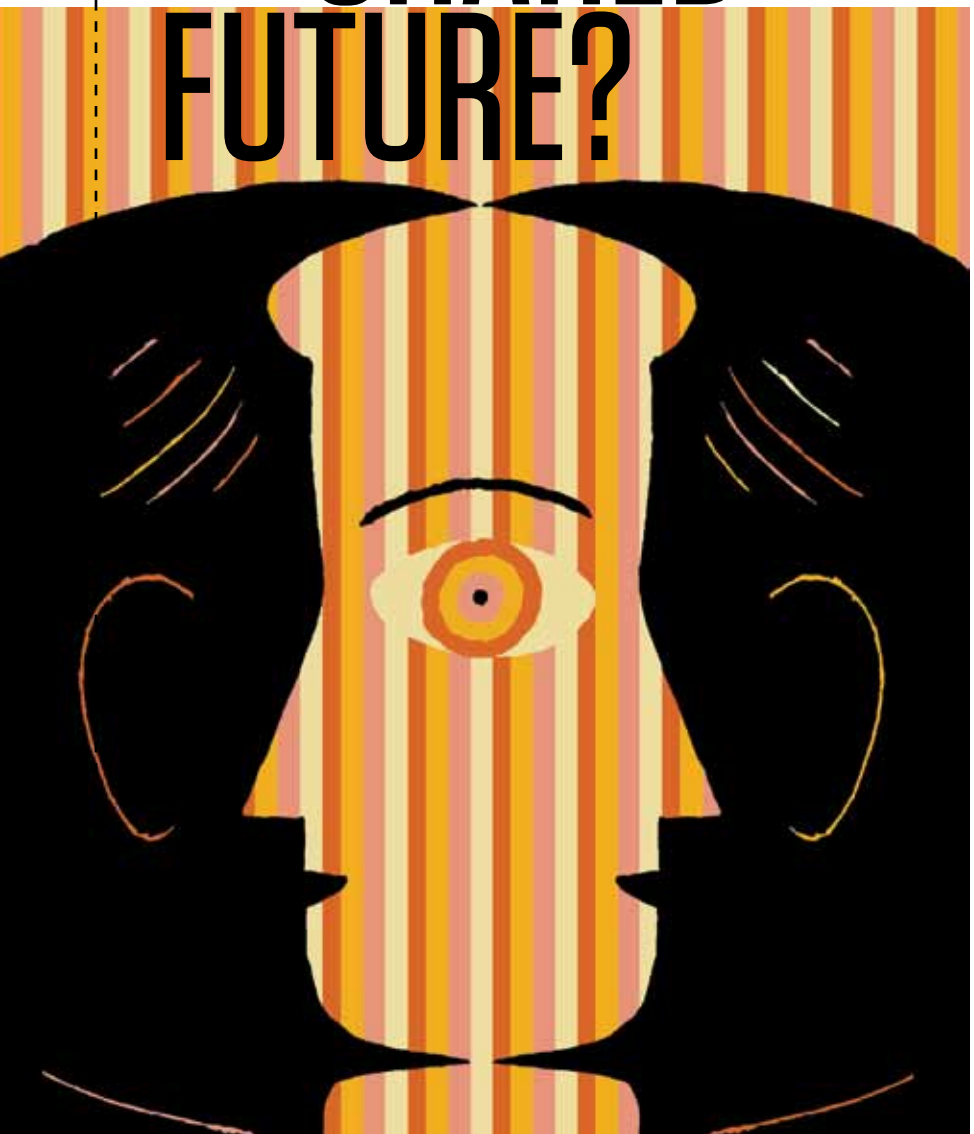
Scholars, conservators, and curators are collaborating via the Web to preserve and make accessible the *Codex Sinaiticus*, one of the most important books in history. Handwritten over 1,600 years ago, the manuscript contains the Christian Bible in Greek, including the oldest complete New Testament.

Digital Double Vision

"Forget everybody being famous for 15 minutes—on the Internet, anybody can become famous in 15 seconds. But in waiting around for our close-up, we may find ourselves stuck with digital double vision, with watching ourselves live life instead of just living it."
—Jason Fry

need something to go here

Technologies of Information: A SHARED FUTURE?



ADAM MCCAULEY

By Gil Press

This special issue of ON Magazine celebrates 20 years of the Web and centuries of overcoming barriers to sharing information. Throughout the remarkable evolution in the way mankind has created and used information, the urge to share—to collect, preserve, disseminate—has driven the invention and proliferation of numerous technologies for recording, duplicating, storing, distributing, and accessing information.

But time and again, these technologies have created islands of information, rather than the desired collective pool, always approaching but never achieving the goal of total recall of the most relevant information to the question of the moment.

Bridging the Islands that Span the Enterprise

Nowhere has this conundrum been more pronounced than in the management of IT by enterprises. First the mainframe and the minicomputer, followed by the PC, all developed and sold by vertically integrated IT vendors, have created isolated islands of computing and storage resources, walled by incompatible hardware, operating systems, and applications.

Two connectivity breakthroughs, the Internet and Ethernet, sought to bridge these islands. But initially, only Ethernet made an impact on enterprise IT. In the 1980s, it became clear to business executives

(if not to economists) that connecting PCs created opportunities to change the way work was done by workgroups, leading to gains in workers' productivity.

Bob Metcalfe's sales pitch about how increasing the number of connected PCs increased the value of the network masked the true impact of the local area network (LAN). It was the value of information that increased the more you connected PCs and the people working with them. With the right discipline and tools, you could start growing your organizational memory, retain expertise when people left or switched jobs, and effectively share pertinent information across the enterprise. In short, you could finally start harnessing information technology to capitalize on what Andrew Carnegie already knew to be "the only irreplaceable capital an organization possesses ... the knowledge and ability of its people."

Organizational Structure: The Next Barrier to Fall

Between 1989 and 1993, the percentage of U.S. computers on LANs rose from less than 10 to more than 60. But the promise was not fulfilled. Around the same time, a number of consultants (including *ON* columnist Jim Champy) pointed to the structure of the corporation—its division into business units, functions, and departments, a structure that hasn't changed since the Andrew Carnegie days—as the key barrier to adequately managing enterprise information. To overcome these structural islands of information, they advocated focusing on enterprise-wide processes.

This advice was great, but the implementations that were promoted and executed by IT vendors created new islands of applications. This fragmentation was reinforced by IT managers, who, eager to satisfy the rapidly-growing number of new internal clients, allocated ever-cheaper computing and storage resources to each application, thus building new barriers to retaining and sharing information across the enterprise. IT managers were responsible in the 1990s for remarkable advances in the use of IT to automate and augment economic transactions of all kinds. But as far as information was concerned, the 1990s were another lost decade for enterprise IT.

"A Universal Machine for Sharing Information"

Outside the enterprise, however, something very exciting was happening in the early 1990s. The great wide-area connectivity breakthrough, the Internet, finally came to life and achieved a critical mass with millions of individual users around the world. All because of Tim Berners-Lee's obsession with creating an "information space," giving information "a place to persist," and developing "a universal machine for sharing information."

Berners-Lee also had an undaunted conviction that his invention could be used not only by CERN to

A SHARED FUTURE?

retain and share internally its organizational memory, but also by the entire world to preserve, share, and mine … just about everything.

The "Web," the linking of information (and of people), is what made the "Net," the linking of incompatible computers, a household word.

Inevitably Perhaps, New Islands Arise

Not surprisingly, the Web is subject to the same forces of innovation that have given rise to succeeding generations of technology islands. To borrow ON editor Chris Kane's apt phrase, the "beautiful minds" that create innovative new technologies are not immune to the pursuit of glory and, occasionally, profit—impulses that tend to impede progress toward the linking of all information and the vision of total recall and relevance. As Tim Berners-Lee (who resisted the temptation to create yet another island with the Web) points out in this issue, we now face, for example, new islands in the form of social media sites that are not "compatible" with others.

However imperfect the Web is, does enterprise IT today come even close to providing us "information at your fingertips" like the Web does? Does it give us the flexibility and ease of use of setting up a new information hub or linking our information to others' or finding relevant information without knowing exactly what we are looking for—the way we are now accustomed to with the Web?

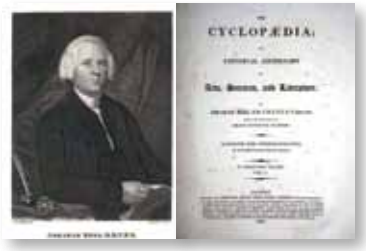
The glass-half-empty answer is "no." The glass-half-full answer is that we are poised to experience a remarkable progress in enterprise IT in the decade ahead. Virtualization has already started to topple the tyranny of applications. Marry this trend to the philosophy of the Web—that the container is less important than the information it contains—and add advanced tools for mining information, and what you get is the much-talked-about cloud computing. A lot of attention is paid today to consumer-driven cloud computing simply because consumer information is where the Web has largely made its impact. But the biggest promise lies in the transformation of enterprise IT into internal or private clouds. Enterprise IT may finally fully deliver, just like the Web, on the promise of linked and shared information.

Looking Backward From the Year 2020

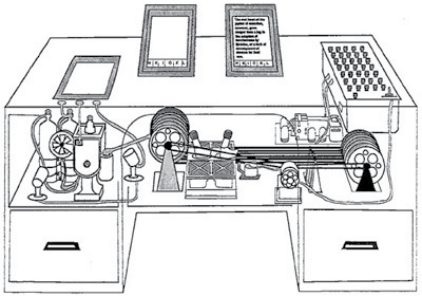
No more islands of information in the enterprise? Writing 20 years ago about "Enterprise Integration," the buzzword du jour, I stated its essence (not very originally) as "getting the right information to the right person at the right time." In the enterprise, it's still a reality-challenged proposition. But at the end of this new decade, we may succeed in bringing the Web concept of "information space" inside the enterprise and replace "IT" with a cloud that retains, shares, and mines the only irreplaceable capital of the organization. ▪

WEB TIME LINE

1728 Efraim Chambers, a London globe-maker, publishes the *Cyclopaedia,* or, *An Universal Dictionary of Arts and Sciences*. It is the first encyclopedia to include a system of cross-references.



1937 H.G. Wells: "The whole human memory can be, and probably in short time will be, made accessible to every individual."



JULY 1945 Vannevar Bush publishes "As We May Think," in which he envisions the "Memex," a memory extension device serving as a large repository of data that could be instantly retrieved through associative links: "The human mind ... operates by association. With one item in its grasp, it snaps instantly to the next that is suggested by the association of thoughts, in accordance with some intricate web of trails carried by the cells of the brain."

FEB. 1951 Mary Lee Berners-Lee, "the first commercial computer programmer," sets up the Ferranti Mark I, the world's first commercially available general-purpose computer, at Manchester University.

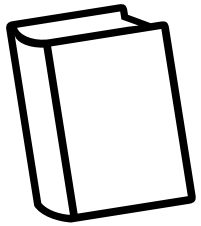
1957 In the movie *Desk Set*, when a "methods engineer" (Spencer Tracy) installs the fictional computer EMERAC, the head librarian (Katharine Hepburn) tells her anxious colleagues in the research department: "They can't build a machine to do our job; there are too many cross-references in this place."

1960 J.C.R. Licklider: "It seems reasonable to envision, for a time 10 or 15 years hence, a 'thinking center' that will incorporate the functions of present-day libraries together with anticipated advances in information storage and retrieval."

1965 Ted Nelson coins the terms Hypertext and Hypermedia.

1967 Andries van Dam and Ted Nelson develop the Hypertext Editing System (HES); it was used by NASA to produce documentation for the Apollo space program.

WEB TIME LINE



1967 "The great digital machines of today have had their existing proliferation because they could vitally aid business, because they could increase profits. The libraries still operate by horse-and-buggy methods, for there is no profit in libraries. ... The public does not understand that the welfare of their children depends far more upon effective libraries than it does on the collecting of a bucket of talcum powder from the moon. So it will not be done soon. But eventually it will." —***Vannevar Bush***

DECEMBER 9, 1968 Doug Engelbart demonstrates oN Line System, a working prototype of the first fully functional, multi-user hypertext system; users of NLS could share and annotate documents and use hyperlinks to jump from place to place within a document or between documents.

1971 Michael Hart launches Project Gutenberg with the aim of making copyright-free works electronically available. The first text is the U.S. Declaration of Independence.

1978 The Aspen Movie Map, one of the first hypermedia systems, developed by MIT's Andrew Lippman and others, provides a virtual tour the city of Aspen, Colorado.

1980 Tim Berners-Lee writes ENQUIRE, a program documenting links between people, computers, and projects at CERN: "ENQUIRE is a method of documenting a system. It concentrates on the way the system is composed of parts, and how these parts are interrelated."

1985 Whole Earth's 'Lectronic Link (WELL) is established. The WELL presented its first users with the disclaimer "You Own Your Own Words." YOYOW strived to achieve the goal of attracting interesting people into online conversations with each other, while giving them responsibility for their own words and ideas.

1987 First hypertext conference, Chapel Hill, North Carolina. Among the challenges Andy van Dam highlights in his keynote address are a lack of standards and scalability and the need for better navigation tools and new ways to design and display information.

WEB TIME LINE

1987 Apple releases Hypercard, a hypertext application distributed with Apple Macintosh computers.

MARCH 1989 Tim Berners-Lee writes "Information Management: A Proposal," and circulates it at CERN.

NOVEMBER 1989 "The real questions we have to ask ourselves today are, 'How do we build the infrastructure for hypertext?' 'Where is this information environment going to come from?' ... My contention is that if hypermedia is to catch on ... we have to integrate hypermedia features into the standard desktop environment. ... The infrastructure has to be integrated into the standard computing environments and standard networks of today and tomorrow." *–Norman Meyrowitz, keynote address at the Hypertext '89 conference*

OCTOBER 1990 Tim Berners-Lee begins writing code for a client program, a browser/editor he calls WorldWideWeb, on his new NeXT computer.

NOVEMBER 1990 First Web server nxoc01.cern.ch (later renamed info.cern.ch) launched.

MARCH 1991 Tim Berners-Lee releases the WorldWideWeb program to users of NeXT computers at CERN.

AUGUST 1991 Tim Berners-Lee publishes the code for the World Wide Web on the Internet: "From then on, interested people on the Internet provided the feedback, stimulation, ideas, source-code contributions, and moral support. ... The people of the Internet built the Web, in true grassroots fashion." *–Tim Berners-Lee*

FEBRUARY 1993 The National Center for Supercomputing Applications at the University of Illinois at Urbana-Champaign makes the first version of the Mosaic browser available over the Web.

WEB TIME LINE

DECEMBER 1993 "Think of [Mosaic] as a map to the buried treasures of the Information Age." —*John Markoff in* The New York Times.

DECEMBER 14, 1994 The Advisory Committee of the World Wide Web Consortium holds its first meeting

DECEMBER 15, 1994 Netscape releases the commerical version of its browser, Navigator 1.0.

1996 Brewster Kahle establishes the Internet Archives to preserve and provide access to nearly every site on the Internet, later evolving to become a comprehensive digital library. Kahle tells Newsweek at the time: "The Web is the people's medium. It is the publisher who won't turn you down. We have five million to 15 million people's individual voices."

26,000,000	**1998** The first Google index has 26 million Web pages.
1,000,000,000	**2000** Google's index of the Web reaches the one-billion mark.
1,000,000,000,000	**JUNE 2009** Google's index of the web consists of one-trillion unique URLs.

NOVEMBER 15, 2009 Tim Berners-Lee announces that the World Wide Web Foundation is open for business. It focuses on advancing the Web as a medium that empowers people to make positive social and economic change. The Web Foundation's first two projects will help people to better leverage the Web to support agriculture in near-desert environments in Africa and empower youth in inner-city centers by teaching them how to create Web content.

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