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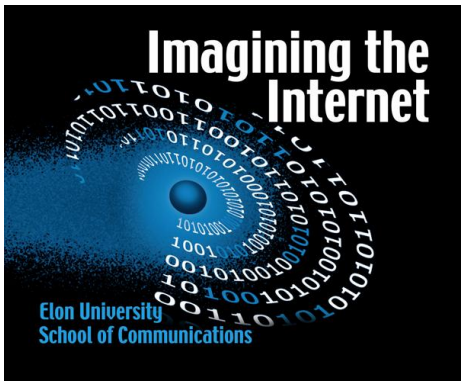

The Web Is Dead? No. Experts expect apps and the Web to converge in the cloud; but many worry that simplicity for users will come at a price

Tech experts generally believe the mobile revolution, the popularity of targeted apps, the monetization of online products and services, and innovations in cloud computing will drive Web evolution. Some survey respondents say while much may be gained, perhaps even more may be lost if the "appification" of the Web comes to pass.

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THE FUTURE OF THE INTERNET

This publication is part of a Pew Research Center series that captures people's expectations for the future of the Internet, in the process presenting a snapshot of current attitudes. Find out more at: http://www.pewInternet.org/topics/Future-of-the-Internet.aspx and http://www.imaginingtheInternet.org.

Overview

A high-impact cover story in *Wired* magazine in 2010 asserted in its title: "The Web Is Dead. Long Live the Internet."[1] Authors Chris Anderson and Michael Wolff argued that the World Wide Web was "in decline" and "apps" were in ascendance. This is not just a debate about technology use and which businesses will prevail. It involves different visions of the way that people will access information, learn, amuse themselves, and create material with others in the digital era.

Anderson and Wolff stated their case this way:

> As much as we love the open, unfettered Web, we're abandoning it for simpler, sleeker services that just work ….This is not a trivial distinction. Over the past few years, one of the most important shifts in the digital world has been the move from the wide-open Web to closed platforms that use the Internet for transport but not the browser for display….
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> Because the screens are smaller, such mobile traffic tends to be driven by specialty software, mostly apps, designed for a single purpose. For the sake of the optimized experience on mobile devices, users forgo the general-purpose browser. They use the Net, but not the Web. Fast beats flexible…
>
> This was all inevitable. It is the cycle of capitalism. The story of industrial revolutions, after all, is a story of battles over control. A technology is invented, it spreads, a thousand flowers bloom, and then someone finds a way to own it, locking out others. It happens every time….
>
> The wide-open Web of peer production, the so-called generative Web where everyone is free to create what they want, continues to thrive, driven by the nonmonetary incentives of expression, attention, reputation, and the like. But the notion of the Web as the ultimate marketplace for digital delivery is now in doubt.

They clearly forecast the rise of the mobile Web, but the debate they launched with the apps vs. Web formulation continues. It is in part a debate about the future of the personal computer vs. smaller, portable mobile devices. It is also central to the debate about the environment in which people gather and share information.

Others have shared concerns, including a warning in the December 2011 issue of *Scientific American* in which Web creator Tim Berners-Lee wrote, "The Web as we know it is being threatened," adding that it "could be broken into fragmented islands."[2]

The trends are quite clear. Mobile tools such as smartphones, tablets, netbooks, and laptop computers are now a primary source of Internet connectivity in highly developed nations, and the uptake of technology tools in less-developed regions of the world has also been dominated by small, wireless devices. The latest surveys of American adults by the Pew Research Center's Internet & American Life Project show that nearly two-thirds connect to the Web via a smartphone, tablet computer, or an on-the-go laptop computer.

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[1] See http://www.wired.com/magazine/2010/08/ff_webrip/all/1

[2] See http://www.scientificamerican.com/article.cfm?id=long-live-the-web

According to estimates by Cisco, by 2016 there will be 10 billion mobile Internet devices in use globally. The world population is expected to be 7.3 billion in 2016, so that's 1.4 devices per person on the planet. Smartphone traffic will grow to 50 times the size it is today by 2016. In fact, Cisco's "Visual Networking Index," released in February, reports there will be so much traffic generated between 2015 and 2016 by smartphones, tablets, and laptops that the amount of Internet data movement *added* for that year alone will be three times the estimated size of the entire mobile Internet in 2012.[3]

The boom in mobile connectivity has been accompanied by a boom in innovation and sales of targeted software applications (apps). Apple's iPhone and its App Store debuted in June 2007; the iPad debuted in April 2010. On March 3, Apple announced that 25 billion apps had been downloaded.[4] Similarly, Google's Android Market hit 10 billion downloads by December 2011, and users have been downloading apps at a rate of 1 billion a month.[5]

In June 2011, researchers reported that time spent on apps began to outpace time spent on the desktop or mobile Web.[6] The change reflected a 91% increase in time spent with apps between June 2010 and June 2011. In December 2011, the technology forecasting firm The Gartner Group predicted, "By 2015 mobile application development projects targeting smartphones and tablets will outnumber native PC projects by a ratio of 4-to-1. Smartphones and tablets represent more than 90% of the new net growth in device adoption for the coming four years."[7] Gartner predicts that 1 billion smartphones will be sold in 2014 – about double the number of PCs it expects will be sold that year.

Over the past year a number of prominent technology experts, including Apple CEO Tim Cook, have been proclaiming the focus of software innovation has nearly completely shifted from an emphasis on designing tools for use on full-size personal computers to designing for mobile devices – especially smartphones and tablets.[8]

The Pew Internet Project and Elon University's Imagining the Internet Center invited experts and Internet stakeholders to predict where things might be by the end of the decade. They were asked to take sides in the apps vs. Web debate by choosing among alternative visions of where things will stand in 2020. A number of survey participants who are most attuned to the nuances of this particular issue responded that the outcome will be a mix; they said apps and the Web are converging in the cloud. Some argued that the language framing the question did not frame the issue well. While most people agreed with the statement that the Web will generally be stronger than ever by 2020, many who chose that view noted that it is more their hope than their firm prediction. Some 35% disagreed that the Web would be in better shape, and a number of survey participants said the outcome will be a combination of both scenarios.

The survey questions are written to generate detailed written responses, not to derive a clear-cut statistical outcome, so respondent choices are not a representative measure. Some 59% agreed with the statement:

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[3] See http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.html
[4] See http://www.apple.com/pr/library/2012/03/05Apples-App-Store-Downloads-Top-25-Billion.html
[5] See http://googleblog.blogspot.com/2011/12/10-billion-android-market-downloads-and.html
[6] See http://www.mediapost.com/publications/article/152706/
[7] See http://www.gartner.com/it/page.jsp?id=1862714
[8] See http://blogs.computerworld.com/19736/apple_ceo_tim_cook_pc_app_innovation_is_dead_killed_by_the_ipad

> In 2020, the World Wide Web is stronger than ever in users' lives. The open Web continues to thrive and grow as a vibrant place where most people do most of their work, play, communication, and content creation. Apps accessed through iPads, Kindles, Nooks, smartphones, Droid devices, and their progeny—the online tools GigaOM referred to as "the anti-Internet"—will be useful as specialized options for a finite number of information and entertainment functions. There will be a widespread belief that, compared to apps, the Web is more important and useful and is the dominant factor in people's lives.

Some 35% agreed with the opposite statement, which posited:

> In 2020, most people will prefer to use specific applications (apps) accessible by Internet connection to accomplish most online work, play, communication, and content creation. The ease of use and perceived security and quality-assurance characteristics of apps will be seen as superior when compared with the open Web. Most industry innovation and activity will be devoted to apps development and updates, and use of apps will occupy the majority of technology users' time. There will be a widespread belief that the World Wide Web is less important and useful than in the past and apps are the dominant factor in people's lives.

These findings come from an opt-in, online survey of a diverse but non-random sample of 1,021 technology stakeholders and critics. The study was fielded between August 28 and October 31, 2011.

Respondents were asked to select the one statement of the two scenarios above with which they mostly agreed. The question was framed this way in order to encourage a spirited and deeply considered written elaboration about the potential future of hyperconnected people. While 59% agreed with the statement that most people will trust and rely upon the open Web to access and share information over the Internet, a significant number of the survey participants said the true outcome will reflect parts of both scenarios, and some people said their choice of the Web as the winner was their “vote” for what they hope to be the 2020 outcome.

Here is a sampling of their predictions and arguments:

The case for the Web

- The robust nature of the Web’s architecture and the appeal of the diversity of the Web will not go away, even as economic imperatives push toward Apps. “The World Wide Web may evolve significantly, but the core design of open and scalable will make it the compelling solution,” wrote **Robert Cannon**, senior counsel for Internet law for the Federal Communications Commission. This is the way that **Allison Mankin**, a computer-networking expert formerly with the National Science Foundation, puts it: “Economic forces and our tendency to prefer smaller pictures lead to a view that there will be consolidation and apps will dominate, but in the big picture, I cannot see the highly diverse, millions to billions of destinations going away. The ability of the Net to accommodate unlimited diversity will continue and therefore there will be an open Web, never fully open because there are many competing forces, but diversified and fast-moving, as a reflection of human society’s restless character.”

- The more blunt version of that verdict comes from **Jeff Jarvis**, blogger and City University of New York professor: "The browser—or its future equivalent—will continue to have key advantages over apps. They are connected to the entire Net, they offer full interoperability, and they give the user more power than the developer or publisher. Yes, publishers have dreamed that apps would return to them the control of content, experience, business model, and pricing that the Net took from them, but they are merely deluding themselves. The value is not in their control of content but in the ability to become platforms for users to do what they want to do."

- "The gated bubble worlds formed by app markets, Facebook, and other private spaces will bloom and fade, while people will keep gathering in the open spaces." – **Jerry Michalski**, founder of Relationship Economy Expedition and consultant at the Institute for the Future

New information protocols will ease the Web-experience and also change it

- Web evolution to HTML5 protocols and beyond will build upon its relevancy and functionality. HTML5 is the latest version of the HyperText Markup Language used to create Web pages. The term is most often used to refer to what is actually a suite of approaches (including HTML5, CSS, SVG, WOFF, and others) that Web architects use to orchestrate interactive text, graphics, video, audio and other elements on Web pages. The evolution to HTML5 is allowing people to create more dynamic Web content, making it possible to write browser-accessible Web apps that are as appealing and interactive as the device-specific apps so popular now on smartphones and tablets. The newest versions of browsers, including Firefox, Internet Explorer, and Safari, can easily read HTML5 pages without using "plug ins" which can sometimes cause usability problems. While these improvements are still under development, they are being actively deployed and broad interoperability for the full suite is targeted for 2014. HTML5 is particularly helpful for rendering Web content that looks great on PCs *and* mobile devices. A number of key analysts pin their hopes on that. "HTML5 is going to make the Web very attractive," said **Hal Varian**, chief economist at Google. Adds **Rob Scott,** chief technology officer for Nokia: "Once HTML5 browsers and fully capable Web runtimes are in place on the common Kindle through iPhone, the Web app will begin replacing native apps."

- Consumer perceptions will shape the future. As **Alexandra Samuel**, director of the Social + Interactive Media Centre at Emily Carr University, framed it: "The real question is whether consumers will perceive those HTML5-based apps as part of the Web. What is worrying is a landscape in which so many people interact with the Web through these tiny little pinholes created by individual apps. If users' experience of the Web is largely through the lens of their apps, will they still perceive themselves as users of the Web? Will they feel like they have a stake in Web standards, access, interoperability, and Net neutrality? Given how hard it is to engage today's users in these issues, it's hard to see how people who have grown up or lived behind the app wall will really feel connected to the Web as a whole."

- The Web and apps are merging online in various forms as people come to depend upon remote access to information and tools in "the cloud"— that is, on remote servers. "The experience when you visit a webpage and the experience when using an app will converge, possibly to the point where there is little practical difference," argued **Mark Watson**, senior engineer for Netflix. **Jeffrey Alexander**, senior technology analyst at SRI International, said, "In general the Web will come to resemble a segment within the 'app economy' more than the reverse. The current incarnation of the Web will continue to be important for certain kinds of human-computer interaction, particularly those that require sustained attention and a richer media experience. However, the rise of cloud computing infrastructure means that apps will have comparable processing power and capability as traditional Web applications, and in many cases will be superior to our conception of today's Web."

- The Web is the best place to develop and offer applications and the "appification" of the Web is already under way. **Paul Gardner-Stephen**, telecommunications fellow at Flinders University, noted, "HTML5 and other technologies will continue to blur the line between Web and app, until the average end user would have difficulty assessing the meaning of this question." **William Schrader**, a consultant and founder of PSINet, said, "The Web and the apps will be *one* and the same. The app, if accessed by a large screen (formerly known as a computer) will automatically slide into a large-screen mode to allow more advertising and ease of reading, navigation, and additional information. The webpage will sense when the user leaves the computer and transfer the same information to the departing user's smartphone (or other device)."

- There is disagreement on whether the browser-based Web will survive. Technology consultant and author **Stowe Boyd** expects it will be replaced by the app-based model of Web access. "Platform companies—especially Apple and Google—are moving to new meta-architecture principles, such as tablets, touch, and gestural interfaces, ubiquitous connectivity, and social networking," he noted. "These are being baked into the core platforms."

The case for apps

- The convenience of using apps as a gateway to getting what you want meets human needs. Those who argued this were not necessarily rooting for it to happen. They tended to cite human preferences and market imperatives pushing towards apps-based solutions to people's information interests. "Ease of use always wins," wrote technology author and consultant **Fred Hapgood**. "People *never* cared about the Web vs. apps and devices," commented **Mark Walsh**, co-founder of geniusrocket.com. "They want free stuff, entertainment, and services when they want them, and on the device they have in front of them."

- Information mobility and accessibility is being monetized. "The corporate push is to close off the Web and rely upon apps, as they are easier to control and turn into commodities for sale," said **Jesse Drew**, an associate professor of technocultural studies at the University of California-Davis. Researcher **Brian Trammell** of the Swiss Federal Institute of Technology said, "The Web is already moving toward a delivery platform for AJAX/Javascript/Flash 'apps' masquerading as websites. Certainly, the world is moving away from open protocols where anyone can play to proprietary, more easily

monetizable services."

- "I have to admit the 'open' Web is certainly changing—just ask the 750 million people on the anti-Web, also known as Facebook," noted **David Ellis**, director of communication studies at York University.

- The apps approach to accessing information on the Internet is perceived as "closed," while the traditional Web paradigm is seen as "open." "I wish it weren't true, but the history of enclosure, centralization, and consolidation makes me very pessimistic about the open Web winning over the closed apps," observed Electronic Frontier Foundation Pioneer Award winner **Seth Finkelstein**. "There will always be a Web, but it may end up like the imagery of a person standing on a soapbox, referred to more for its romantic symbolism than mattering in reality."

- Apps' ability to meet specific needs becomes a double-edged sword; they simplify life and they create "walled gardens" and a lack of serendipity. "What apps do terribly is the thing that makes so many like John Perry Barlow afraid of this stage of evolution," observed venture capitalist **Richard Titus**. "The Web is about discovery and serendipity, it's about finding something you weren't looking for; to lose that would be to take a step back in our progress as intellectual humans, the equivalent of burning a digital book.

The case against apps domination

- The rapid global adoption of narrowly targeted software applications—increasingly popular because of their ease of use on mobile devices—is negatively impacting creativity, innovation, and individuality on the World Wide Web. Former White House technology advisor **Susan Crawford**, a professor at Harvard University and founder of OneWebDay, responded, "Apps are like cable channels—closed, proprietary, and cleaned-up experiences…I don't want the world of the Web to end like this. But it will, because people's expectations have been shaped by companies that view them as consumers. Those giant interests will push every button they can: fear, inexperience, passivity, and willingness to be entertained. And we'll get a cleaned-up world that we can be perfectly billed for. It's not good."

- "Instead of couch potatoes you'll have app-potatoes," predicted **Giacomo Mazzone**, head of institutional relations for the European Broadcasting Union

The apps vs. Web framing of this issue is a false dichotomy

- **Tony Smith** of the Open Source Developers Club in Melbourne, Australia said as much: "Both will continue to grow in ways that are impossible for most to imagine…. Apps are generally better for narrowly defined repetitive tasks, especially where your needs can be narrowed by your location, time, etc. The Web will remain better for asynchronous exploring and continue its gateway role."

- Many anonymous responders challenged the structure of the apps-Web question. Among their arguments: The world ahead is not either apps or the Web. A more hybrid world is likely. Moreover, the tussle between controlled content and user experiences on the one hand and openness on the other hand will play out in other ways. As one anonymous writer put it: "Apps will continue, as will app stores, but they'll continue to

be mass-market outlets for lightweight products on the one hand, and very narrow vertical outlets for very specific platform-dependent professional tools on the other, while the entire middle-ground will continue to belong to the Web."

A summation

Futurist **John Smart**, founder of the Acceleration Studies Foundation, looks beyond 2020 and sees apps as merely a passing phase in Internet evolution. "Apps are a great intermediate play, a way to scale up functionality of a primitive Web," he said, "but over time they get outcompeted for all but the most complex platforms by simpler and more standardized alternatives. What will get complex will be the 'artificial immune systems' on local machines. What will get increasingly transparent and standardized will be the limited number of open Web platforms and protocols that all the leading desktop and mobile hardware and their immune systems will agree to use. The rest of the apps and their code will reside in the long tail of vertical and niche uses."

Survey Methodology: 'Tension pairs' were designed to provoke detailed elaborations

This material was gathered in the fifth "Future of the Internet" survey conducted by the Pew Research Center's Internet & American Life Project and Elon University's Imagining the Internet Center. The surveys are conducted through an online questionnaire sent to selected experts who are encouraged to share the link with informed friends, thus also involving the highly engaged Internet public. The surveys present potential-future scenarios to which respondents react with their expectations based on current knowledge and attitudes. You can view detailed results from the 2004, 2006, 2008, and 2010 surveys here: http://www.pewInternet.org/topics/Future-of-the-Internet.aspx and http://www.elon.edu/e-web/predictions/expertsurveys/default.xhtml. Expanded results are also published in the "Future of the Internet" book series published by Cambria Press.

The surveys are conducted to help accurately identify current attitudes about the potential future for networked communications and are not meant to imply any type of futures forecast.

Respondents to the Future of the Internet V survey, fielded from August 28 to Oct. 31, 2011, were asked to consider the future of the Internet-connected world between now and 2020. They were asked to assess eight different "tension pairs" – each pair offering two different 2020 scenarios with the same overall theme and opposite outcomes – and they were asked to select the one most likely choice of two statements. The tension pairs and their alternative outcomes were constructed to reflect previous statements about the likely evolution of the Internet. They were reviewed and edited by the Pew Internet Advisory Board. Results are being released in eight separate reports over the course of 2012.

About the survey and the participants

Please note that this survey is primarily aimed at eliciting focused observations on the likely impact and influence of the Internet – not on the respondents' choices from the pairs of predictive statements. Many times when respondents "voted" for one scenario over another, they responded in their elaboration that both outcomes are likely to a degree or that an outcome not offered would be their true choice. Survey participants were informed that "it is likely you will struggle with most or all of the choices and some may be impossible to decide; we hope that will inspire you to write responses that will explain your answer and illuminate important issues."

Experts were located in three ways. First, several thousand were identified in an extensive canvassing of scholarly, government, and business documents from the period 1990-1995 to see who had ventured predictions about the future impact of the Internet. Second, several hundred of them have participated in the first four surveys conducted by Pew Internet and Elon University, and they were recontacted for this survey. Third, expert participants were selected due to their positions as stakeholders in the development of the Internet. The experts were invited to encourage people they know to also participate. Participants were allowed to remain anonymous; 57% shared their name in response to at least one question.

Here are some of the respondents: danah boyd, Clay Shirky, Bob Frankston, Glenn Edens, Charlie Firestone, Amber Case, Paul Jones, Dave Crocker, Susan Crawford, Jonathan Grudin, Danny Sullivan, Amber Case, Patrick Tucker, Rob Atkinson, Raimundo Beca, Hal Varian, Richard Forno, Jeff Jarvis, David Weinberger, Geoff Livingstone, Stowe Boyd, Link Hoewing, Christian Huitema, Steve Jones,

Rebecca MacKinnon, Mike Liebhold, Sandra Braman, Ian Peter, Mack Reed, Seth Finkelstein, Jim Warren, Tiffany Shlain, Robert Cannon, and Bill Woodcock.

The respondents' remarks reflect their personal positions on the issues and are not the positions of their employers', however their leadership roles in key organizations help identify them as experts. Following is a representative list of some of the institutions at which respondents work or have affiliations or previous work experience: Google, the World Bank, Microsoft. Cisco Systems, Yahoo, Intel, IBM, Hewlett-Packard, Ericsson Research, Nokia, O'Reilly Media, Verizon Communications, Institute for the Future, Federal Communications Commission, World Wide Web Consortium, National Geographic Society, Association of Internet Researchers, Internet2, Internet Society, Institute for the Future, Santa Fe Institute, Harvard University, MIT, Yale University, Georgetown University, Oxford Internet Institute, Princeton University, Carnegie-Mellon University, University of Pennsylvania, University of California-Berkeley, Columbia University, University of Southern California, Cornell University, University of North Carolina, Purdue University, Duke University, Syracuse University, New York University, Ohio University, Georgia Institute of Technology, Florida State University, University of Kentucky, University of Texas, University of Maryland, University of Kansas, University of Illinois, Boston College.

While many respondents are at the pinnacle of Internet leadership, some of the survey respondents are "working in the trenches" of building the web. Most of the people in this latter segment of responders came to the survey by invitation because they are on the email list of the Pew Internet & American Life Project, they responded to notices about the survey on social media sites, or they were invited by the expert invitees. They are not necessarily opinion leaders for their industries or well-known futurists, but it is striking how much their views are distributed in ways that parallel those who are celebrated in the technology field.

While a wide range of opinion from experts, organizations, and interested institutions was sought, this survey should not be taken as a representative canvassing of Internet experts. By design, this survey was an "opt in," self-selecting effort. That process does not yield a random, representative sample. The quantitative results are based on a non-random online sample of 1,021 Internet experts and other Internet users, recruited by email invitation, Twitter, Google+, or Facebook. Since the data are based on a non-random sample, a margin of error cannot be computed, and results are not projectable to any population other than the respondents in this sample.

When asked about their primary workplace, 40% of the survey participants identified themselves as a research scientist or as employed by a college or university; 12% said they were employed by a company whose focus is on information technology; 11% said they work at a non-profit organization; 8% said they work at a consulting business, 10% said they work at a company that uses information technology extensively; 5% noted they work for a government agency; 2% said they work for a publication or media company.

When asked about their "primary area of Internet interest," 15% identified themselves as research scientists; 11% said they were futurists or consultants; 11% said they were entrepreneurs or business leaders; 11% as authors, editors or journalists; 10% as technology developers or administrators; 6% as advocates or activist users; 5% as legislators, politicians or lawyers; 3% as pioneers or originators; and 28% specified their primary area of interest as "other."

Main Findings: Apps vs. Web: Winner?

	TOTAL RESPONSES	Tension pair on future of apps and the Web
%	35	In 2020, most people will prefer to use specific applications (apps) accessible by Internet connection to accomplish most online work, play, communication, and content creation. The ease of use and perceived security and quality-assurance characteristics of apps will be seen as superior when compared with the open Web. Most industry innovation and activity will be devoted to apps development and updates, and use of apps will occupy the majority of technology users' time. There will be a widespread belief that the World Wide Web is less important and useful than in the past and apps are the dominant factor in people's lives.
	59	In 2020, the World Wide Web is stronger than ever in users' lives. The open Web continues to thrive and grow as a vibrant place where most people do most of their work, play, communication, and content creation. Apps accessed through iPads, Kindles, Nooks, smartphones, Droid devices, and their progeny—the online tools GigaOM referred to as "the anti-Internet"—will be useful as specialized options for a finite number of information and entertainment functions. There will be a widespread belief that, compared to apps, the Web is more important and useful and is the dominant factor in people's lives.
	6	Did not respond

PLEASE ELABORATE: Will the Amazon, Apple, Google model of apps, app stores, and controlled devices dominate to the point of diminishing the importance and utility of the open Web by 2020? What are the positives, negatives, and shades of grey in the likely future you anticipate? *(If you want your answer cited to you, please begin your elaboration by typing your name and professional identity. Otherwise your comment will be anonymous.)*

Note: The survey results are based on a non-random online sample of 1,021 Internet experts and other Internet users, recruited via email invitation, conference invitation, or link shared on Twitter, Google Plus or Facebook from the Pew Research Center's Internet & American Life Project and Elon University. Since the data are based on a non-random sample, a margin of error cannot be computed, and the results are not projectable to any population other than the people participating in this sample. The "predictive" scenarios used in this tension pair were composed based on current popular speculation. They were created to elicit thoughtful responses to commonly found speculative futures thinking on this topic in 2011; this is not a formal forecast.

Respondents' thoughts

Most people surveyed said the functionality and popularity of the Web will continue to get stronger. Many top experts said the future will be a blend of the wide-open Web and customized apps, with people using apps/Web accessed through cloud computing. More than a third of survey participants said the Web will be replaced as the primary gateway to information for most people, as humans' craving for convenient access to information everywhere magnifies the prevalence of and dependence upon mobile devices and the targeted software applications known as "apps."

Overall, the tech experts participating in this survey generally believe the mobile revolution, the popularity of targeted apps, the monetization of online products and services, and cloud computing innovations will drive Web evolution. Some survey respondents say while much will be gained, perhaps even more may be lost if the "appification" of the Web comes to pass.

After being asked to choose one of the two 2020 scenarios presented in this survey question, respondents were also asked, "Will the Amazon, Apple, Google model of apps, app stores, and controlled devices dominate to the point of diminishing the importance and utility of the open Web by 2020? What are the positives, negatives, and shades of grey in the likely future you anticipate?"

Following is a selection from the hundreds of written responses survey participants shared when answering this question. About half of the expert survey respondents elected to remain anonymous, not taking credit for their remarks. Because people's expertise is an important element of their participation in the conversation, this report primarily includes the comments of those who took credit for what they said. The full set of expert responses to the Future of the Internet V survey, anonymous and not, can be found online at http://www.elon.edu/predictions. The selected statements that follow here are grouped under headings that indicate some of the major themes emerging from the overall responses. The varied and conflicting headings indicate the wide range of opinions found in respondents' reflective replies.

Some expect a bright future for the 'open' World Wide Web

Many respondents said people will carry on with creating and communicating on the Web and not cede all power to apps-based activities, one prominent blogger noting that old-world publishers are "merely deluding themselves," and a research scientist saying the Web's diversity is a "reflection of human society's restless character."

Jerry Michalski, founder of Relationship Economy Expedition and consultant for the Institute for the Future, wrote in response to this question: "The gated bubble worlds formed by app markets, Facebook, and other private spaces will bloom and fade, while people will keep gathering in the open spaces." But he tempered his remark by saying, "On this one, I may be too optimistic."

Jeff Jarvis, director of the Center for Entrepreneurial Journalism at the City University of New York Graduate School of Journalism, author of *What Would Google Do?* said*, "*The browser—or its future equivalent—will continue to have key advantages over apps: They are connected to the entire Net, they offer full interoperability, and they give the user more power than the developer or publisher. Yes, publishers have dreamed that apps would return to them the control of content, experience, business model, and pricing that the Net took from them, but they are merely deluding themselves. The value is not in their control of content but in the ability to become platforms for users to do what they want to do."

David Cohn, founder and director of the online journalism organization Spot.US, wrote, "I sincerely hope and believe that the open Web prevails. Until there is a 'Wordpress'-like app builder, the open Web has less barriers and more voices."

Bryan Alexander, a senior fellow at the National Institute for Technology in Liberal Education, listed three reasons he expects the Web to continue to be the go-to source for material: "One: The Web remains the source of many apps' materials. Example—news portal apps, which

duplicate website content. Two: Few producers can afford to build additional content and/or content production streams, alongside their Web work. Three: Consumers' hunger to move content around their owned devices will trump walled gardens (i.e., Apple's)."

Allison Mankin, a computer-networking expert formerly with the National Science Foundation and active in the Internet Engineering Task Force, wrote, "Collections of traffic data show that there are dominant, common destinations, but beyond those, the usage of the Net is highly diverse. Economic forces and our tendency to prefer smaller pictures lead to a view that there will be consolidation and apps will dominate, but in the big picture, I cannot see the highly diverse, millions to billions of destinations going away. The ability of the Net to accommodate unlimited diversity will continue and therefore there will be an open Web, never fully open because there are many competing forces, but diversified and fast-moving, as a reflection of human society's restless character."

Robert Cannon, senior counsel for Internet law in the Federal Communication Commission's Office of Strategic Planning and Policy Analysis, responded, "The World Wide Web model of an open platform available to all innovators and accessible to all consumers and creators—that has a low barrier to entry, low costs of development, and does not require permission from the core network (or firm) to add a new innovation—this will continue to be the compelling model. The World Wide Web may evolve significantly, but the core design of open and scalable will make it the compelling solution."

An anonymous respondent confidently proclaimed, "The open Web will continue to be where the action is long after my iPad has become a coaster." Another wrote, "Perhaps unfounded, I believe people will not side with a full cable-ization of the Internet."

A trend toward individuality was predicted by one anonymous respondent, who wrote: "Change will be driven by growing disgust with the functionality of desktop software, which will also help to system-design what you are calling the 'open Web.' It will be a very long time before consumers fully entrust their digital lives to closed systems, though tablets are certainly pushing in this direction. Apps are here to stay, but I do not think they will dramatically change the role of more open systems over the next decade. Also, there will also be a growth in content providers, and many of the trends driving the app world are focused on consumption. Trends towards natural foods, community gardens, live concerts, and the like will grow in importance. There will be powerful trends towards individuality as people embrace the importance of human experience in a world more dominated by tech knowledge."

Those who see apps dominating say they play into human needs and human nature. Are we entering an age of "apps potatoes"?

A number of respondents said that humans today have adopted a consumer-culture approach to negotiating their lives, and the convenience of using apps as a gateway to getting what you want fits in that paradigm. "Ease of use always wins," wrote technology author and consultant **Fred Hapgood**.

Giacomo Mazzone, head of institutional relations for the European Broadcasting Union, predicted some people will become "app potatoes," writing, "The Amazon, Apple, and Google model of apps will diminish the importance and utility of the open Web by 2020. There will be again a digital divide, this one will be between those who will prefer to use ready-made applications and those who are building ways or searching on their own to find the needed

solutions. This will occur especially for the simpler functions, where a ready-made application could save time and brain energy to obtain the pursued goals. Instead of couch potatoes you'll have app potatoes."

Consultant and researcher **Stowe Boyd** responded that people are quickly moving away from browser-based access to the app-based model of Web access, and he noted a number of factors. "Apple and other platform companies can retain greater control of the user experience, and guarantee a uniformly better user experience in the app model, based on a controlled distribution of apps through platform-based app stores. This also has enormous economic incentives for app and platform companies, since blocking low-cost, low-quality apps raises the average price for accepted apps."

Boyd said the ideas behind what is known as the 'open Web' are based on relatively old principles, including disconnected computers, HTTP information protocols, and the desktop operating system of folders, files, and executables. "Platform companies—especially Apple and Google—are moving to new meta-architecture principles, such as tablets, touch, and gestural interfaces, ubiquitous connectivity, and social networking," he noted. "These are being baked into the core platforms so that app developers will be able to take advantage of them, natively, without having to reinvent those wheels over and over again. Note that this provides a second and enormously large economic leverage for app developers, and by extension, for users. Put another way, the platform companies will push a great deal into their infrastructure, and app developers will be able to push much higher into ultrastructure, providing a much richer user experience via post-browser-Web apps."

Boyd predicted browser-based access is nearing its end. "In the very near-term—like five to seven years—the browser will drop from the most-used tool to the least-used, because of this change," he said. "Just look at how people use their iPhones. The browser will be something like the terminal program on the Mac: a tool for programmers and throwbacks, only occasionally used by regular folks. A few years ago, I worked on a project for the Mozilla foundation, on the future of the browser. I was the first to raise my hand and say that in ten years the browser would be dead. The Mozilla guys laughed it off, but I am standing by my original prediction."

An anonymous respondent said apps serve human needs for easy access to get what they want and the Web will simply be an invisible aspect of Internet architecture. "People don't understand how the Internet works now," he said, "and apps minimize the problems inherent with viruses, poor functionality, and malware. Apps will continue to proliferate, especially as mobile phones are increasingly used to access the Internet. It is not that the Web will be unimportant; it will just become part of the underlying technological framework that users acknowledge but do not understand."

Apps are easier to turn into profits, or 'monetize'; those who see them dominating share fears for the future

Many survey respondents say the current evolution in mobile Internet access is being dominated by a focused attempt to find ways to derive profits from the global network. "The corporate push is to close off the Web and rely upon apps, as they are easier to control and turn into commodities for sale," wrote **Jesse Drew**, an associate professor of technocultural studies at the University of California-Davis. "It is another click toward stripping citizens of their ability to create and control their technological environment."

David Ellis, director of communication studies at York University and author of the blog *Life on the Broadband Internet*, shared historical parallels and said the Web is being altered by social and economic forces. "The apps model as developed by Amazon, Apple, Google, and the like is another form of the walled garden made notorious by AOL. Then, as now, large numbers of people online are going for this model, and mostly for the same reason—convenience. Starting in the late 1990s, Steve Case saw a huge market among newbies who had come recently to dialup and had no idea how to navigate around the Web, let alone use dedicated Internet protocols like FTP. That model finally broke because a) broadband happened and b) the newbies grew up and wanted to venture out past AOL's proprietary offerings. What's different today is we're getting a lot more growing in our gardens. They look better, offer more choice, and get real things done reliably. What's not so different is we've still got the walls. Or to put it in Jonathan Zittrain's terms [in the book *The Future of the Internet—And How to Stop It*], a lot more tethered appliances—think iPad—and fewer generative devices—think iMac, though even here Apple is tying us tighter and tighter to their servers and commercial services (no more OS on a disc). The apps model looks like it's going to win, though not necessarily because of the apps themselves.

"I sometimes think I'm giving up too much freedom of choice by sticking with Macs, or putting too many eggs in Google's basket," Ellis continued. "But wild horses couldn't tear me away from my MacBook Pro or Google Analytics. On the other hand, loyalty to these 'controlled' devices and services isn't the same thing as running everything from the app store. The research indicates most people use only a tiny fraction of the apps available, and many downloads get used once and then vanish. I'm therefore not convinced apps will make general-purpose browsers and computing devices disappear. Nor am I sure that having 130 apps (like my daughter does) is a way to make your life more convenient. But I have to admit the 'open' Web is certainly changing—just ask the 750 million people on the anti-Web, also known as Facebook."

An anonymous respondent said, "The future will depend on how powerful the oligopoly will be in creating a stratified system wherein the Web is deemed low-class and is therefore underfunded and slowed via corporate and regulatory connivance." Another anonymous survey participant wrote, "Authorities will, piece-by-piece, eliminate the free Web through regulation, licensing, and firewalls that respect country borders. The Web will be more like cable TV via apps; everything will be either pay-as-you-go or advertising-supported."

Brian Trammell, a researcher at the Swiss Federal Institute of Technology, says the "dream of the Web as an open, level playing field" was "dead after its first ten years." He wrote: "The Web is already moving toward a delivery platform for AJAX/Javascript/Flash 'apps' masquerading as websites, so the line between an 'open Web' and an 'app-dominated world' is kind of an arbitrary one. Certainly, the world is moving away from open protocols where anyone can play to proprietary, more easily monetizable services (e.g. Twitter or Facebook messaging instead of SMTP/IMAP). HTTP will probably continue to be an important transport/session layer protocol, and Web browsers will continue playing a part in application access and installation. But the dream of the Web as an open, level playing field where anyone can publish or provide services was as dead after its first ten years, as it was in the case of radio. Security threats—real and imagined—will tend to decrease the appeal of the open Web for both providers and consumers; for example, electronic banking, where the risk of a security breach is especially high, is already moving toward closed access on the customer end (virtualized or dedicated PCs for customer access, or proprietary devices for session and transaction verification)."

Former White House technology advisor **Susan Crawford**, a professor at Harvard University and founder of OneWebDay (http://onewebday.org/), responded, "I'm sad about this. Really sad. Apps are like cable channels—closed, proprietary, and cleaned-up experiences. As at Disneyland, there are no back alleys or surprises—anything unexpected was planned by someone at headquarters. I don't want the world of the Web to end like this. But it will, because people's expectations have been shaped by companies that view them as consumers. Those giant interests will push every button they can: fear, inexperience, passivity, and willingness to be entertained. And we'll get a cleaned-up world that we can be perfectly billed for. It's not good. It wasn't the point of the decentralized Internet. Even the commercial Web wasn't the point of the decentralized Internet. It was all supposed to be about human communication, unlimited, unfiltered, and full-bandwidth. But instead of being known (which is the goal of humans, always) we'll be counted by apps. Some of us will continue to ignore apps, and in turn we'll be thoroughly ignored and rendered irrelevant by the new world. But when you're bored, come visit."

Survey participants who expressed concerns about a future dominated by app-enabled Internet gateways primarily see apps as "closed" and the Web as "open."

Seth Finkelstein, professional programmer and Electronic Frontier Foundation Pioneer Award winner, responded, "I wish it weren't true, but the history of enclosure, centralization, and consolidation makes me very pessimistic about the open Web winning over the closed apps. There will always be a Web, but it may end up like the imagery of a person standing on a soapbox, referred to more for its romantic symbolism than mattering in reality."

Mark Callahan, artistic director for Ideas for Creative Exploration at the University of Georgia, agreed, writing, "There seems to be a steady trend toward 'app' culture. The idea of the 'open Web' will exist as a quaint notion in 2020, tinged with nostalgia and faded utopian desire."

Kevin Carson, a research associate at the Center for a Stateless Society, predicted, "It's the Apple 1984 ad all over again, but this time the Big Brother on the telescreen is Steve Jobs and the hammer thrower's wearing a Linux penguin on her t-shirt."

Richard Titus, a seed funding venture capitalist at his own fund, Octavian Ventures, worried over the survival of serendipity, saying it depends upon the Web. "What apps do terribly is the thing that makes so many like John Perry Barlow afraid of this stage of evolution," he observed. "The Web is about discovery and serendipity, it's about finding something you weren't looking for; to lose that would be to take a step back in our progress as intellectual humans, the equivalent of burning a digital book."

Ebenezer Baldwin Bowles, owner and managing editor of corndancer.com, also expressed concerns about controlled devices, responding, "Apps are the logical extension of a late 1990s movement among freelance developers that produced thousands of snippets of software known as 'shareware,' some freely given for the love of the game, others launched into the Web in hopes of attracting donations or enticing users to purchase more robust versions of the snippet, now known as the app. There is nothing new but the level of corporate control—much higher—and the narrowing of options for the individual. Apps are also an outgrowth of a Web that has slowly but inexorably come to be dominated by a handful of major players and the insatiable institutional greed that motivates them to develop and promote tightly restricted and highly monetized iPads, Kindles, Nooks, Droids, and all the other sleek little tools and playthings

designed, ultimately, to smother individual initiative and strengthen corporate control. This shall not change for the better by 2020."

It's 'appening' right now: The emerging trend is accessing apps in the cloud, and 'appification' is under way

People are already conducting a lot of their mobile-apps-based and PC-based communication in the cloud—on remote servers accessed through the Internet—and the experts expect that evolution to continue to expand. **Steve Jones**, a distinguished professor of communication at the University of Illinois-Chicago, said apps are already a dominant gateway through which many people focus online processes. "The degree to which people interact through apps is already quite high," he said, "and it is only a matter of time until the majority of users of major sites like Facebook, Google, and others will be thoroughly via apps."

Cathy Cavanaugh, an associate professor of educational technology at the University of Florida-Gainesville, predicted, "App development and use will be become easier and more inclusive as low-threshold development tools become as widespread as office productivity tools. Education will turn to app development as a project-based demonstration of learning and to custom, adaptive assessment apps for other measures of learning. Individuals will use app creation and modification as a creative medium."

Anita Salem, a consultant and human systems researcher at the Naval Postgraduate School, said, "Apps are here to stay; I see them merging into the Internet as cloud applications, available 'as needed.' I suspect that the apps will also start to merge into more robust combinations that are task-oriented for the business sector. For personal use, apps will remain small and will be localized to specific functions. This makes sense economically for suppliers and purchasers."

Tom Hood, CEO of the Maryland Association of CPAs, observed that his teenage and young adult children sleep with their smartphones and said he sees a combination of approaches. "The dizzying pace of adoption in the mobile category makes me believe that the apps are the future," he wrote. "Access to the open Web, useful focused apps, and cloud-based applications via mobile devices will be the most likely outcome in 2020. I am also wondering how the semantic Web (Web 3.0) will influence these predictions—will they be apps, open-Web or both?"

Ondrej Sury, chief scientist at the Internet registry for the Czech Republic, CZ.NIC, said big data in the cloud is the predominant looming trend. "Even though the apps may be seen as more secure, the world is moving to the direction of offloading your data with big providers and it's really not important what protocol the people will use when accessing them," he wrote. "The problem with this trend is that the people will have less control over their data, there will be more snooping and more control from governments and big companies. It also means less privacy, which we also can see under the excuse of more 'security.' I actually think that there will be a gap—there will be a mass of people who will prefer convenience over privacy and security, and there will be people who will guard their privacy, and then something in between."

"The app revolution will soon be complete," wrote an anonymous survey participant. "Users welcome trusted intermediaries provided they feel they are getting maximum choice and good value. Well-designed apps will emerge to accommodate user-generated content and make it much easier to find and use. Apps will also create a more efficient marketplace through which creators can harvest value for their innovations, far more easily than the repeated, failed efforts to monetize 'Web content.' Apps Store providers can ensure that apps are bandwidth-efficient,

that they protect consumer privacy, that their provenance can be more readily known to potential users, etc. While there are some potential trade-offs on 'openness,' the apps marketplace should be sufficiently competitive such that anyone with a legitimate product will have the opportunity to reach an audience—probably far more readily than most innovators can through the Web. By no means will the Web disappear—it will serve a critical free-speech function. But it will not be where livelihoods are made."

An anonymous respondent wrote, "We will see an 'app-ification' of the Web itself, something we're already witnessing, as people's use of the open Web goes far beyond information retrieval on 'sites.' Browsers, design, and coding techniques have already made 'Web apps' a common thing. There will probably be less of a gap between the capabilities and behavior of 'native apps' and 'Web apps' in the not-too-distant future."

Jeff Eisenach, managing director and principal at Navigant Economics LLC, said, "Digital tools that park some code on the device and some in the cloud (apps) will continue to proliferate, along with tools accessed through generic browsers ('Web pages') and tools that reside only on the device."

Paul Gardner-Stephen, rural, remote and humanitarian telecommunications fellow at Flinders University, noted, "HTML5 and other technologies will continue to blur the line between Web and app, until the average end user would have difficulty assessing the meaning of this question."

Rob Scott, chief technology officer and intelligence liaison at Nokia, proclaimed there is no doubt that Web apps will replace native apps on network devices of all types. "Once HTML5 browsers and fully capable Web runtimes are in place on the common Kindle through iPhone, the Web app will begin replacing native apps," he said. "There will still be plenty of native apps in use to offer the utmost in user experience and performance, but the vast majority of applications look and work as much as their predecessors do while being served from the cloud rather than the local window manager.

"The problem of intermittent failure of Web apps due to loss of connectivity," he added, "is addressed by putting the 'server' on the user's device and allowing it to act in a cached mode when connectivity is lost. While this cannot work for tasks requiring live network access, such as financial transactions, this limitation also exists for the native apps and thus presents no new problems."

Another anonymous participation observed, "I currently see a broad degree of support from industry for purely Web-based systems. Google and Microsoft are clearly behind this and, strangely enough, I see Apple as also supporting this trend through its ongoing development of WebKit. So far as that support continues, I see the future of applications to be descendants of HTML5 and not iOS, Android, or WebOS. Cloud-based applications are better for everyone in the system—developers, providers, consumers, and enterprise—for this to fail."

Microsoft Research and Harvard expert **danah boyd** agrees the future of the Web and apps is not an either/or game. "Both will be used more heavily than either are used today," she responded, "and, given the early stage of apps, it will appear that they are used even more. But the vast majority of apps are simply a wrapper around Web content that makes it as accessible as a bookmark, and the 'Web' is filled with DRMed content already. So creating a clean division between Web and apps is going to be more impossible anyhow."

Nathaniel James, a social innovation consultant and former director of OneWebDay, said most consumers will follow the technology that is "affordable, readily available, and provides an intuitive user experience," adding, "The massive investment and rapid adoption of the apps model suggests its strong standing vs. open Web technologies. However, even if the apps model does predominate, the open Web will continue to thrive, sometimes in parallel to, sometimes interoperatively with, apps. The global Internet user population will be massive, some markets will prefer the benefits of free, open technology, and a lively community of Web developers will steward an open innovation space on the Web."

Many trust in HTML5 and say that improving Web functionality will be a key to its utility

The engineers and research scientists who continue to work on the Web's evolution have been rolling out the semantic Web—what some people call Web 3.0. Today's sophisticated Internet users go online expecting to find high-quality interactive experiences that incorporate their geolocation, preferences, animations, HD-quality video, and augmented-reality functions, to name just a few advanced characteristics. Many experts say the continued success of the Web is dependent upon the ongoing development and acceptance of HTML5, the latest version of the HyperText Markup Language used to create Web pages.

HTML5 is most often used to refer to what is actually a suite of approaches (including HTML5, CSS, SVG, WOFF, and others) that Web architects are using to orchestrate interactive text, graphics, video, audio and other elements users wish to implement. The evolution to HTML5 is allowing people to create more dynamic Web content, making it possible to write browser-accessible Web apps that are as appealing and interactive as the device-specific apps so popular now on smartphones and tablets. The newest versions of browsers, including Firefox, Internet Explorer, and Safari, can easily read HTML5 pages without using "plug ins" which can sometimes cause usability problems. While HTML5 is still under development, it is being actively deployed; broad interoperability for the full suite is targeted for 2014. Many survey respondents said Web evolution will be significant over the next few years, heightening its relevance and functionality. They say the apparent separation consumers perceive between access through mobile apps and access on the Web will disappear.

"I would bet that HTML5 is going to make the Web very attractive. There are a lot of advantages to an open Web, and I would hate to see that go away," said **Hal Varian**, chief economist at Google.

Bruce Nordman, a research scientist at Lawrence Berkeley National Laboratory, responded, "Apps and Web will both be winners, as many apps will be written in successors to HTML5 and so the distinction between the two will be less obvious and less important than it is today. There is some burden to having an app, so that there is a limit on how many people are likely to need or want, with ordinary Web services filling in the remainder."

Alexandra Samuel, director of the Social + Interactive Media Centre at Emily Carr University, predicted, "A year or two from now, the ascendance and elaboration of HTML5 is going to make the distinction between apps and Web seem somewhat artificial. We're already seeing the rise of mobile-optimized HTML5 sites that are designed to be locally stored, like apps, on a smartphone or tablet device. What we haven't got quite yet is a standard, cross-platform way to attach a payment mechanism to those sites (which are often sites that could be described as Web-based applications) so that people can be asked to pay for HTML5 apps the way they do for

Apple or Android apps. Some manufacturers (notably Apple) will be strongly motivated to create developer tools that make native apps superior to HTML5-based apps, but the advantages of cross-platform portability and pricing, not to mention anxieties about vendor lock-in, privacy, etc., will likely make HTML5-based apps a strong, if not dominant, part of the app market. The real question is whether consumers will perceive those HTML5-based apps as part of the Web. What is worrying is a landscape in which so many people interact with the Web through these tiny little pinholes created by individual apps. If users' experience of the Web is largely through the lens of their apps, will they still perceive themselves as users of the Web? Will they feel like they have a stake in Web standards, access, interoperability, and net neutrality? Given how hard it is to engage today's users in these issues, it's hard to see how people who have grown up or lived behind the app wall will really feel connected to the Web as a whole."

Christian Huitema, distinguished engineer at Microsoft, responded, "Apps are nice, but both users and providers are starting to rebel against the 'walled gardens.' We are already seeing the pendulum swing back towards the Web, with many companies bypassing the app store and delivering their content using HTML5."

A lack of 'walled gardens' is a perceived strength of the Web today

While some people see publishers' desires for revenues as a driving force for an apps-dominant world, **Mike Liebhold**, senior researcher and distinguished fellow at The Institute for the Future, is one of many survey respondents who are confident that the economic angle will actually keep the Web on top. "The Web will be stronger than ever although apps will continue to be popular simply because many small developers appreciate app stores as commerce platforms," he said. "Many large content and commerce service providers are growing resistant to sharing revenues with app store operators, and so will increasingly directly offer advanced services on the Web built on standard capabilities like HTML5 and subsequent developments."

A number of respondents shared Liebhold's view. One anonymous survey participant wrote, "As devices, operating systems, and soft/hardware variants multiply, the Web will be increasingly seen by content providers as a more lucrative place to develop applications (rather than a specific piece of hardware or software). Developers will rather create one Web- or cloud-based program that works on everything, rather than several different applications. As companies like Apple control their app stores with iron fists, we'll see software developers exploiting new Web technology to reach the widest audience and prevent a middle-person from skimming a percentage of profits."

Pete Cranston, a digital media and information and communication technologies for development consultant based in Oxford, UK, commented, "Walled gardens don't survive forever in the Internet. As cheap, reliable, fast connectivity spreads, the open Web will continue to offer the best opportunities for innovators and market-breakers, especially as Internet-based economies grow in competition to the US."

An anonymous survey participant wrote, "This is largely a distinction without a difference. The apps that thrive will not be walled gardens, which is kind of what the *Web Is Dead* argument implies, but different and more useful viewpoints on the larger Web which make it easier to navigate and use for a single task. So really the answer is both of the above."

Another anonymous respondent observed that "not all information can be gracefully atomized to the size of a mobile phone, and people probably won't be doing most of their 'deep dives' on

the phone on the subway—the app is the ocean surface for floating and swimming, the Web is the ocean for diving."

Apple has been in the media spotlight significantly more than competing mobile software and hardware corporations the past few years, with most of the attention focused on the success of the iPhone, iPod, iPad, and App Store. An anonymous survey respondent reacted, "Apps are a passing fad generated by the Apple marketing machine and the artificial constraints imposed by its business model. There's no reason the open Web will not come to provide the same benefits that people get from apps, while still holding on to its own strengths. The interoperability that the Web offers will trump the walled-garden silo, approach. The tide has already started to turn on this with magazine publishers creating Web apps instead of Apple apps so they don't have to be at the mercy of Apple's monopolistic business dealings."

Microsoft was mentioned in another anonymous respondent's reply: "While apps are prevalent now, they will eventually overreach and the market will react to the concentration of power, just as it did against Microsoft."

And another anonymous participant wrote, "As we know from the Apple vs. Microsoft cycle of the 1980s and 1990s, you can't run a high-margin, high-volume business through apps, and the new capabilities of the browser will make it the pre-eminent high-volume platform. Like automobiles or phones before it, the Web will be so vital by 2020 people will take it for granted. The average citizen born after 1995 won't be able to imagine a world without the Web any more than the average citizen born after 1950 could imagine a world without trucks."

With ubiquitous connectivity comes a need for more simplicity

A number of survey participants said the positive evolution of targeted apps and the Web will require the innovation of better approaches for managing information needs.

Wesley George, principal engineer for the Advanced Technology Group at Time Warner Cable, noted that progress is all moving us toward "ubiquitous connectivity." He responded: "The best application will win, whether it's categorized as an app or part of the Web (2.0, 3.0, 5.0, 42.0, doesn't matter really). The lines between 'the Web' and 'apps' will continue to blur, with the important thing being that the method employed makes the task easier, more intuitive, more convenient, richer, and better tailored to the device being used to complete the task. The only constant is that the ubiquitous connectivity that terms like 'the Web' have come to represent will continue to be stronger than ever in users' lives."

Marti Hearst, a professor at the University of California-Berkeley and advisor to start-ups and the major search engine companies, said, "Apps and the Web will co-evolve and each adopt characteristics of the other, and by 2020 we'll have some other model entirely. In more detail, the importance of apps will continue to grow, but after a while, people will have too many to scan through, and then people will require a way to manage apps, including a way to search them. Meanwhile, the Web is being very much changed and influenced by apps, and every year, what it means for something to 'be on the Web' changes. There will always be a need to find general information, and apps by their nature do not provide a centralized way for information to be shared. There will then be a need for a way for apps to communicate among themselves, be better found by search engines, and so on, and they will become more Web-like."

Some survey respondents said people don't distinguish between approaches.They just want access to what they need. "People *never* cared about the Web vs. apps and devices,"

commented **Mark Walsh**, co-founder of geniusrocket.com. “They want free stuff, entertainment, and services when they want them, and on the device they have in front of them.”

An anonymous survey respondent expressed the frustration many people are feeling in regard to the staggering amount of choices, writing, “What I see is *a reduction in variety* within (not across) areas of activity. There is a confusing and frustrating array of hardware, software, apps, websites, etc. Choosing from among them and then using them is burdensome. While learning and getting accustomed to any one of these is not that hard, the diversity of them, with their different interfaces, is already problematic. When I come back to a piece of software or an app that I use infrequently, I have to figure out once again how *this one* works. So I see whatever will simplify and unify our activities as being popular. As much as we worry about, say, Apple or Google, their consistency across many instances of use makes them easier to deal with. I see economy of effort, combined with quality of service, as the overriding criteria by which most people will make most such choices.”

There will be a blended world where each structure has its place, and they converge

Jeffrey Alexander, senior science and technology policy analyst at SRI International’s Center for Science, Technology, and Economic Development, sees the best future as a mix now being explored by companies like Amazon. “In general the Web will come to resemble a segment within the ‘app economy’ more than the reverse,” he wrote. “The current incarnation of the Web will continue to be important for certain kinds of human-computer interaction, particularly those that require sustained attention and a richer media experience. However, the rise of cloud computing infrastructure means that apps will have comparable processing power and capability as traditional Web applications, and in many cases will be superior to our conception of today’s Web. Amazon’s new cloud-accelerated browser is an indication of where the Web is going, where more Web-delivered solutions will combine the best of local processing power and cloud-based distributed computing.”

Miguel Alcaine, head of the International Telecommunication Union office in Honduras, said while apps will be dominant, the open Web will retain some importance. “The apps might grow up in restricted and guarded Internet spaces as opposed to the open Web,” he predicted. “Although it is less likely, they can also grow with their roots in an open Web. The open Web will remain an important place for technology people, probably with interoperability standards allowing people to switch between applications. There will be less and less things you can do if you decide to remain anonymous.”

Mark Watson, senior engineer for Netflix and a leading participant in various technology groups related to the Internet, says the Web itself is going to become more app-like, and he wonders how it will continue to be monetized. “The evolution of the platform available in Web browsers means that the experience when you visit a webpage and the experience when using an app will converge, possibly to the point where there is little practical difference between a ‘bookmark enabled for offline use’ and a ‘downloaded app,’” he said. “Already many apps just render a Web page in a ‘chromeless’ browser window, so the distinction becomes a very thin one based on the UI used to launch the app/page. A different slant on the question is: What will be the dominant monetization strategy for Web pages and apps? The current app-store model includes a one-time-up-front-payment model, which doesn’t really exist on the open Web. It could be that this difference in monetization models is the only practical difference between apps and webpages.”

An anonymous respondent noted, “The Web is the ocean. Apps are islands. Water and islands co-exist. Some people prefer to swim, sail, and explore. Others prefer to sunbathe, settle, and, on occasion, island hop. Most people do a mixture of both. I think this will become more streamlined over time, but I don’t think of the apps/Web question as a battle with one winner.”

An anonymous respondent noted, “The very notion of ‘apps’ vs. ‘Web’ misses the point of changes in infrastructure that are rather closer on the horizon. This does not even take into account two extraordinarily important things: 1) The majority of the world accesses network communications via a mobile phone (and though network access is patchy at best, apps in this case are far more efficient) and 2) apps *and* Web are becoming very much interconnected with cloud. It is *the cloud* that is poised to change how things are done for work, play, and communication and apps *and* Web will provide interfaces.”

Apps vs. the Web is ***not*** the issue

A number of survey participants challenged the framing of the question. Their responses add a lot to the conversation. Many of the strongest arguments were made by anonymous respondents. Following is a representative collection of those responses:

> “Apps and Web browsers are delivery mechanisms—the emphasis will shift strongly to services. The winning services and sites will be accessible by whatever means and device the user has—browser or specific app framework. Consider the number of popular websites that support Web, app, and customized mobile access today. The underlying Web technology will remain important, as developing for the Web will make it easy to roll out apps for the multiple app frameworks that will be viable in 2020. No, the iPhone is not going to conquer the world, neither will Android, and I expect there to be at least one more viable mobile app platform in that timeframe.”
>
> “This is asking the wrong question. We talk about the Web as if it were the HTTP servers that make it up, but it really is the information contained in it that’s important. Prior to HTTP, we had FTP and Gopher. The proliferation of the Web is actually continuing in the various apps available, the Web is not being supplanted by the apps. So ‘one or the other’ is probably the wrong question. A better question might be—‘How is the evolution of the Web best represented by apps—momentary overlay or paradigm shift?’”
>
> “The answer is somewhere in between. The biggest factors here are going to be issues of perceived control (by users and governments), monetization of content, customization, and the level of sophistication of users. As a result, I expect a bimodal distribution describing app use vs. online use, with the majority using a hybrid approach.”
>
> “The question is not that the Web will be less important or useful. The point is—the Web will be still important or useful but most devices and apps will find a more direct way to perform directly through the Internet (though not through the Web) several functions—such as entertainment media, weather information, banking, etc.”
>
> “Opportunities to integrate data with physical spaces are under utilized, today, which means in 2020 there will be more ‘apps’, but they won’t displace certain Web-only applications where screen ‘real-estate’ and heavy-weight computation are necessary resources. The limits of ‘ubiquitous computing’ will become more clear, as the hardware limits for battery life and network connectivity limit the scale of computation for certain applications on mobile devices.”

"App monocultures will not predominate, and in the absence of a single target platform for development, it's simpler and more profitable to develop for the Web, and not be beholden to an app store or platform vendor. Obviously, apps will continue, as will app stores, but they'll continue to be mass-market outlets for lightweight products on the one hand, and very narrow vertical outlets for very specific platform-dependent professional tools on the other, while the entire middle-ground will continue to belong to the Web."

"The improved capabilities of mobile devices, plus the added efficiency, convenience, and enjoyment of using purpose-built apps will shift the consumer and non-IT specialized worker's focus rapidly to native code apps. The distinction between phone and tablet will disappear, becoming more of a matter of how much text or graphics you want to see in what size. With free or inexpensive apps for 90% of consumer's needs, that is where further investment will focus. Organizations will deploy apps for single-purpose internal functions. The World Wide Web will still exist for free-form research and use."

"Basically, in the current client and server silo model these are the two choices. But personal data stores and VRM will disrupt that model so the client and server or cow/calf model that the Web currently is built around will shift dramatically over the next nine years. At that point, neither one of the scenarios conveys what will really happen."

Some see a new user-interface paradigm that is still not visible on the horizon

Sam Punnett, president of FAD Research, was one of several survey respondents who predicted access will become more seamless. "By 2020 the specificity of apps vs. Web vs. anything else will begin to fade," he said, "as there will likely be more sophisticated ways of engaging programs through input methods using voice, gesture, possibly even hard wiring [in humans] either through implants or sensors. What this should tend to do is to further drive the technology into the background. We won't care whether it's an app, Web app, or other devoted software as long as it gets the task performed seamlessly. If I had to place my bet, the Google approach and openness will trump the Apple approach of exclusivity."

William Schrader, independent consultant and founder of PSINet, said a lot can happen in just eight years. "The Web and the apps will be *one* and the same," he predicted. "The app, if accessed by a large screen (formerly known as a computer) will automatically slide into a large-screen mode to allow more advertising and ease of reading, navigation, and additional information. The webpage will sense when the user leaves the computer and transfer the same information to the departing user's smartphone (or other device). Hundreds of examples might be stated which are all within reach with today's technology and innovative spirit. But, once we allow for eight more years of experimentation, technology innovation, and the co-mingling of 'telephone'—laptop, tablet, smartphone, and all the rest—we must be prepared for the unknown. Yes, this will be an interesting eight years."

Susan Price, CEO and chief Web strategist at Firecat Studio LLC, expects rapid evolution of the user-interface or UI. "Apps mirror the human need for discrete labels and a mental model that helps us focus on one activity at a time," she noted. "The construct of a 'webpage' is probably on the way out, but the construct of a 'website' as the virtual representation of a business,

organization, or individual, will continue to be needed. As UI technology develops, more virtual-reality experiences will allow us to 'visit' such a virtual establishment with an avatar, say. We'll transcend the 'page' model as these interfaces become more seamless and easy to use."

Amber Case, CEO of Geoloqi, is an anthropologist who studies the ways in which humans are implementing new technologies. She said she shares the views of writer and consultant Sheldon Renan. He argues that the concept of communications through tools such as the 'Internet' or 'apps' will shift and people will adopt the idea of *Netness*. "Information will be able to speak on networks," Case said. "Networks, fields of connectivity, and the idea that everything is loosely entangled will be the norm. The paradigm will be that 'everything wants to be connected,' 'connectivity is opportunity,' and connectivity will make the invisible visible. Opportunities will be lateral, allowing different information stores and devices to connect to other stores. Networks will be redundant and loose instead of tight and brittle as they are today. If one cannot connect on one network, or a device switches off, another network will arrive to take its place. The 'World Wide Web' will be a term no longer used. Perhaps we will use a simple term meaning connected or not. Connectivity = life."

Above all, humane approaches should prevail

Where are we heading? **Richard Lowenberg**, director and broadband planner for the 1st Mile Institute and a network activist since the 1970s, offered this:

> "Openness is a critical concept, which like 'sustainability' is over-used but largely misunderstood or applied. Tools and apps will continue to be driven by user needs, innovation, creativity, and consumerism. They will foster difficult, reactionary, and disruptive changes throughout the world if not developed in concert with humane approaches to our complex needs for better resource distribution, health and well being, sustaining energy strategies, and economic valuation based on the little bit we know about our place in the world which goes beyond the dangerous machinations of legacy political economics. Where is the app that allows us to simply view the slowly rotating earth from space? Where are leaders calling for simulation systems that allow us to view and run scenarios for improved local decision-support? *'Where is the knowledge we have lost in information'* (T.S. Eliot)?"

About the Pew Research Center's Internet & American Life Project

The Pew Research Center's Internet & American Life Project is one of seven projects that make up the Pew Research Center, a nonpartisan, nonprofit "fact tank" that provides information on the issues, attitudes and trends shaping America and the world. The Project produces reports exploring the impact of the Internet on families, communities, work and home, daily life, education, health care, and civic and political life. The Project aims to be an authoritative source on the evolution of the Internet through surveys that examine how Americans use the Internet and how their activities affect their lives.

The Pew Internet Project takes no positions on policy issues related to the Internet or other communications technologies. It does not endorse technologies, industry sectors, companies, nonprofit organizations, or individuals.

URL: http://www.pewInternet.org

About the Imagining the Internet Center at Elon University

The Imagining the Internet Center's mission is to explore and provide insights into emerging network innovations, global development, dynamics, diffusion and governance. Its research holds a mirror to humanity's use of communications technologies, informs policy development, exposes potential futures and provides a historic record. It works to illuminate issues in order to serve the greater good, making its work public, free and open. The center is a network of Elon University faculty, students, staff, alumni, advisers, and friends working to identify, explore and engage with the challenges and opportunities of evolving communications forms and issues. They investigate the tangible and potential pros and cons of new-media channels through active research. Among the spectrum of issues addressed are power, politics, privacy, property, augmented and virtual reality, control, and the rapid changes spurred by accelerating technology.

The Imagining the Internet Center sponsors work that brings people together to share their visions for the future of communications and the future of the world.

URL: http://www.imaginingtheInternet.org

Methodology

The survey results are based on a non-random, opt-in, online sample of 1,021 Internet experts and other Internet users, recruited via email invitation, Twitter or Facebook from the Pew Research Center's Internet & American Life Project and the Imagining the Internet Center at Elon University. Since the data are based on a non-random sample, a margin of error cannot be computed, and the results are not projectable to any population other than the experts in this sample.