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The Internet: How It Got Here and Where It's Going

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To even begin imagining the future of the internet and the web, it is important to know the history of each. It is impossible to chart a trajectory without knowing both where something started and where it currently is. Since both the internet and the web are such integral parts of life in the 21st century, it is important to know where they are taking us.

First, we should draw a distinction between the internet and the web. Though the two are often conflated, they are distinct entities. The internet is hardware — a physical way of connecting networks of computers. The word itself is derived from "internetwork" (meaning "a network of networks"), since it is really a network made up of nearly innumerable smaller networks. It may help to think of the internet as a digital version of a system of interstate highways, state highways, and roads. The web, on the other hand, is software made up of the websites you visit. If the internet is a system of roadways, the web is the gas stations, shopping malls, libraries, museums, and other sites you visit. Completing that analogy, your web browser is the car you drive along the roadways to visit those sites.

As such, it is possible to use the internet without using the web, but it is not possible to use the web without using the internet. When you use an app (such as Outlook or K9) on your computer or phone to send and receive emails, those messages travel over the internet (hardware), but you are not using the web (software), since you are not actually visiting a website. From the above, it is easy to see that, just as roads precede gas stations, shopping malls, libraries, museums, etc., the internet precedes the web.

History of the Internet

In 1962 — 30 years before Al Gore claimed that he "took the initiative in creating the Internet" — the Advanced Research Projects Agency (ARPA, which had only been created four years previously) laid the *actual* groundwork for ARPANET, which would eventually become the internet. That same year, MIT Professor J.C.R. Licklider began writing papers suggesting the possibility of an "Intergalactic Computer Network" encompassing almost everything the internet would eventually become. More immediately, though, his ideas of how computers could share resources and information led to plans for the creation

of ARPANET, which was launched in 1969 and was declared operational in 1970. ARPANET's original purpose was to link computers at Pentagon-funded research institutions over telephone lines.

The creation of ARPANET was the answer to a Cold War concern. Military leaders realized they needed a computer network system that did not have a single point of failure. Such a system could not have a headquarters or central location that could be knocked out to bring the network down. ARPANET ticked off those boxes, even though its purpose was much more academic than military. As more and more colleges and universities connected to ARPA, it began to take on the structure military officials had hoped for. The internet of today — though much larger — still resembles that original structure.

Throughout the 1960s and 1970s, ARPA — which became DARPA (Defense Advanced Research Projects Agency) in 1972 — solved a series of problems related to creating a network of multiple computers with different operating systems and ways of sharing information.

One major obstacle was that, in the 1960s, computers were almost always custom-designed and custom-built for a specific purpose (and for a specific company, organization, or department of the government). Operating systems were written for each specific machine and purpose, so there was no such thing as standardization. To help solve this problem, ARPA's Information Processing Techniques Office introduced the concept of "subnetworking" by using standardized communication processors — known as Interface Message Processors (IMPs) — as relays. An IMP was an early type of router that allowed the various and sundry computer networks at universities, companies, and government departments to communicate with other networks by connecting to the general subnetwork system. ARPANET — using this subnetwork model — was activated in 1969 and began growing rapidly.

But while IMPs and subnetworking solved the problem of connecting computers that would otherwise have been incompatible with each other, this solution was a trade-off that introduced a new problem: Since the IMPs needed to handle the subnetworking were the size of refrigerators and carried a price-tag of roughly $2,700 in 1965 (over $25,000 in 2023), getting connected to ARPANET was out of the budget for many universities and companies, and even some departments of the government. For almost all individuals, connecting to ARPANET approached a financial impossibility.

Old school: Before standardized internet protocols made internet access affordable, getting "online" meant purchasing a router the size of a refrigerator and carrying a price-tag higher than many new

cars. (AP images)

A more affordable — and more practical way — had to be found.

Working with some of the best minds at MIT, UCLA, Stanford, Bell Labs, IBM, RAND, and other universities and companies, ARPA/DARPA created standard communication and packet-switching protocols, including TCP/IP (Transmission Control Protocol/Internet Protocol), which is still the standard protocol used for the internet today. TCP/IP allowed for more standardized communications between computers and networks, and it did so without the need for spending a small fortune on an IMP.

In 1973 and 1974, Vinton Cerf and his networking research group at Stanford worked out the details of TCP/IP. The first two-network TCP/IP communications test was performed between Stanford and University College London in 1975, followed by a three-network communications test between sites in the United States, the U.K., and Norway in late 1977. Between 1978 and 1983, several other TCP/IP tests were conducted at various other locations, and in March 1982, the U.S. Department of Defense established TCP/IP as the standard protocol for all military computer networking. TCP/IP was permanently activated as the standard for ARPANET on January 1, 1983.

It was also in 1983 that MILNET (a subset of ARPANET designated for unclassified Department of Defense traffic) was broken off into its own network. By 1990, ARPANET was shut down and the internet was its own functional entity. By the very early 1990s, educational institutions, companies, and individuals were going "online" via the World Wide Web with the advent of commercial Internet Service Providers (ISPs) such as America Online.

History of the Web

As the internet began to emerge from ARPANET in the late 1980s, some began to envision a standardized way for people and institutions to use the internet to access information from computers all over the world. This was not so much a new vision as a "catching on" to Licklider's idea of an "Intergalactic Computer Network" to share computer resources and information. Now that the network existed, it was time for a way to use that network in a way that allowed anyone with a computer to share and access information over that network.

As a result of that idea and the reality of the emerging internet, Tim Berners-Lee — an English computer scientist working as a software engineer at CERN (the large particle-physics laboratory near Geneva, Switzerland) — proposed an information-management system that would employ several emerging technologies. The Web Foundation — an organization founded by Berners-Lee to preserve a free and open web — explains that scientists from all over the world would travel to CERN to use its massive particle accelerators, but Berners-Lee noticed that they were having difficulty sharing information. He is quoted as saying, "In those days, there was different information on different computers, but you had to log on to different computers to get at it. Also, sometimes you had to learn a different program on each computer. Often it was just easier to go and ask people when they were having coffee."

Obviously, finding a colleague during a coffee break meant having to wait for the needed information. What if the information was needed immediately? What if the colleague with the information had already returned to his home in another part of the world and finding him during a coffee break wasn't

an option? Berners-Lee considered how to solve this problem, and came up with an idea that he believed would not only solve the problem, but also have broader applications. With millions of computers connected through the rapidly developing internet, Berners-Lee realized those computers could send data back and forth by utilizing an emerging technology called hypertext.

In March 1989, Berners-Lee drafted a document called "Information Management: A Proposal" to explain his plan for "the web" to his bosses. But — as the history of the world shows us — neither visionaries nor their visions are always accepted and embraced immediately. That was the case with Berners-Lee's vision of the web. His proposal was initially shot down. His boss at the time, Mike Sendall, made notes on the cover of the document describing the proposal as "vague but exciting." Sendall would not agree to make the web an official CERN project, but eventually consented to give Berners-Lee time to work on the project. Berners-Lee began working on "the web" project in September 1990. He appears to have worked quickly, because within a month, he had written all three of the technologies that remain fundamental to the web even today. Those technologies are:

HTML — HyperText Markup Language, which serves as the formatting language for the web.

URI — Uniform Resource Identifier, which acts as a type of unique "address" used to identify each resource on the web. Today, it is commonly called a Uniform Resource Locator (URL).

HTTP — Hypertext Transfer Protocol, which allows for the retrieval of linked resources from across the web.

The website for the Web Foundation explains that Berners-Lee also "wrote the first web page editor/browser ('WorldWideWeb.app') and the first web server ('httpd')." Also, "By the end of 1990, the first web page was served on the open internet, and in 1991, people outside of CERN were invited to join this new web community."

But the growth of the web brought new challenges. Berners-Lee quickly realized that the web's real potential would only materialize if it could be used by everyone, everywhere, without them having to pay a fee or ask for permission. That last bit is terribly important, given that government is constantly acting as if (a) the web would not exist if government regulation had not made it possible (which is demonstrably false), and (b) only ongoing government regulation can keep the web safe, open, and free.

As it turns out, it was not regulation — government or otherwise — that made either the web or the internet what they are; it was a lack of regulation that did so. As Berners-Lee says of the decision to unleash the web, "Had the technology been proprietary, and in my total control, it would probably not have taken off. You can't propose that something be a universal space and at the same time keep control of it."

Revolutionary idea: With the emergence of the internet, Tim Berners-Lee — an English computer scientist working as a software engineer at CERN — proposed an information-management system in 1989 that would become the World Wide Web. (AP images)

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The Web Foundation explains the importance of that decision: "[Berners-Lee] and others advocated to ensure that CERN would agree to make the underlying code available on a royalty-free basis, forever." Going on, the Web Foundation states, "This decision was announced in April 1993, and sparked a global wave of creativity, collaboration and innovation never seen before." As a result of the decision to unleash the web, "In 2003, the companies developing new web standards committed to a Royalty Free Policy for their work. In 2014, the year we celebrated the web's 25th birthday, almost two in five people around the world were using it."

In essence, Berners-Lee "open-sourced" the web by refusing to "own" his creation. By assuring that anyone could access the code, Berners-Lee created a situation where the web belongs to *everyone* and innovation was able to flourish. That freedom and innovation has led to a web that is a major means of communication, education, business and finance management, and more. It has grown at an exponential rate. By the end of 1992, there were somewhere between 50 and 60 websites. The next year, there were hundreds. By the end of 1994, there were thousands. Today, there are around 200,000,000 active websites. To call the web a phenomenon would not do it justice.

Web 1.0 to Web 3.0

Both the internet and the web have evolved as newer, more powerful technologies have been developed. This is to be expected. All technology progresses, as each generation of engineers and inventors innovates and builds on the work of previous generations. It would seem strange if people were still watching movies on VHS tapes all these decades after entertainment companies figured out how to get video and audio to play from reels of magnetic tape. In fact, even the DVD — which began replacing VHS in the late 1990s — seems to be at an end with digital streaming services and downloads now on the scene. Time and technology stand still for no one.

Likewise, almost no one outside of rural areas and developing countries is connecting to the internet via dial-up modems anymore. In fact, most internet-connected devices do not even use cables anymore, with high-speed WiFi and broadband services having all but replaced that technology for most users. Faster and more powerful ways of connecting to the internet have brought with them the ability to send and receive much larger amounts of data. Data that would have taken a 56K modem weeks or months to download can now be retrieved in minutes.

And just as the internet has gone through a succession of changes, so too has the web.

The first generation of the web is known as Web 1.0. It existed from the early 1990s until the mid 2000s, and was almost entirely about consuming information. Most websites were "static" and visitors read them, but did not interact with them. Web 1.0 could be categorized as read-only. On the plus side, web 1.0 was decentralized — no one entity (or even group of entities) controlled the web. Decentralization had been one of Berners-Lee's original non-negotiables.

Web 2.0 began in the late 1990s and makes up most of the web today. This iteration of the web is more interactive. Whereas Web 1.0 was made up of static pages and was read-only, Web 2.0 is dynamic and is read/write, allowing users to interact with the websites they visit. Examples are the ability to comment on articles; vote in online surveys; make social-media posts, blogs, and podcasts; and post videos. Sadly, with the advent of Web 2.0, Berners-Lee's non-negotiable of decentralization was largely lost as major media companies — such as Facebook, Apple, Amazon, Netflix, Google, and others — grew to dominate and control large portions of the web. These companies harvest user data at a rate only rivaled by the amount of data harvested by three-letter federal agencies, and they make billions of dollars a year manipulating users and selling their personal data to advertisers.

Web 3.0 (also known as Web3) is the newest iteration of the web. While web 2.0 is still the dominant form of the web today, Web3 is already in place and is gaining ground. If Web 1.0 was read-only, and Web 2.0 is read/write, Web 3.0 is read/write/interact, with promises of allowing users to engage more fully with web content.

The architects of the emergent Web 3.0 promise that it will take the best of Web 2.0 and return to the decentralization of Web 1.0. And they promise that it will do so by using artificial intelligence, machine learning, and metaverses — with the web "governed" by a "liquid democracy." The concept of "liquid democracy" is found in many descriptions of Web 3.0 and is closely connected to the idea of Decentralized Autonomous Organizations (DAOs).

Advocates of DAOs claim that it is a model that could eventually replace governments that suffer from corruption and needless deadlock. They claim that by employing "liquid democracy," DAOs offer the best of a majority-rules government and a direct majority-rules system to allow citizens all over the world to take matters into their own hands instead of waiting for corrupt politicians to debate and vote. Via "liquid democracy," the code of the DAO would allow the will of the majority to be enacted automatically.

So, Web 3.0 will be based on the idea that the majority rules. One does not have to spend more than a few minutes pondering the implications of a web led by majority rule to realize that such a web would *ipso facto* and *de facto* exclude any "unapproved" views. If patriots are concerned about censorship under Web 2.0, just wait for the "liquid democracy" of Web 3.0.

Not only is Web 3.0 read/write/interact, it is also described as "semantic," since it shares and connects content on the web by searching and analyzing that content based on the ability to understand the meaning of words and phrases. This, along with natural language processing, allows Web 3.0 to distinguish information in a way similar to — *and sometimes better than* — humans to return more relevant results and to do so more quickly than ever before. Advocates of Web 3.0 promise that computers will become more intelligent and able to do more tasks for users. Further, with Web 3.0, information on the web is more connected because of the idea of semantic metadata. This allows a level

of connectivity that leverages all available information.

Another layer of this would be that the web would become literally ubiquitous. Web 3.0 content will be accessible by more and more applications, and almost all devices will be connected to the web all of the time so that web-based services can be used at all times and in all places.

This would mean that the web — driven by AI, machine learning, natural language processing, Big Data, metaverses, and "liquid democracy" — will be everywhere you go. If that sounds creepy and dystopian, that's because it probably is — if for no other reason than the fact that there is often an extreme disconnect between promises made and the methodologies for fulfilling those promises.

Since Web 3.0 is still emerging, there is hope that in its final iteration, it will keep its promises without sacrificing basic privacy and other freedoms. And if that fails to be the case, there is hope that — as users employ available technological tools to protect their own privacy and other freedoms — the next iteration of the web (4.0) will return to those basic principles.

This is important, because Berners-Lee was correct way back in the beginning: Though a *particular website* is the property of its owner, *no entity or group of entities owns — or should control — the web itself*.

The web has brought people together in ways never imagined before its advent. The web has become a sort of community, or perhaps a community of communities. It could be likened to a large and diverse city with various sections, neighborhoods, schools, universities, libraries, and shopping centers. And as in such a city, not all sections are equal. The web has both "good sides of town" and "bad sides of town" as well as "nice places" and "bad places." You can visit websites that will teach you of religion or offer wholesome entertainment, and other websites that teach you useful things. Conversely, you can visit websites that promote satanism or pornography (or sometimes both). Even worse places exist on the web, and "internet crimes" including drug deals, murder-for-hire, scams, identity theft, hacking, and child pornography happen every day on the web.

Enter the Surveillance State

Governments use these bad things as pretexts for more and more regulation of both the internet and the web. Surveillance hawks continually introduce legislation and attempted regulation that are real threats to encryption and other tools that law-abiding citizens use to protect themselves from both hackers and unwarranted — and illegal — government surveillance. But just as government officials decry firearms in the hands of ordinary law-abiding citizens while surrounding themselves with armed guards, police, and military, the surveillance hawks decry those citizens' use of encryption and other privacy protections while using those same tools to protect their devices and communications. This is not mere hypocrisy — it is far worse than that. The philosopher-kings that would rule over us have two sets of rules, and they see themselves as above the rest of us.

As Edward Snowden revealed 10 years ago, government agencies routinely vacuum up almost all digital data, including browsing histories, calls, texts, emails, maps, calendars, and more. That data is then used to create startlingly accurate profiles of almost everyone. While the internet and web offer freedom and expression on one hand, the other hand is held by overreaching three-letter agencies that use the pilfered data to maintain and expand their rule. And surveillance hawks sit on both sides of the political aisle. To learn steps you can take to protect your digital privacy, see "Digital Privacy in a World

of High-tech Surveillance."

That the Surveillance State will use AI, machine learning, natural language processing, Big Data, and metaverses under the governance of "liquid democracy" to expand its surveillance capabilities is a foregone conclusion. This writer does not entirely object to any of these things *as a matter of absolute principle*. But in practice — and taken as a whole — they appear to be a recipe for a heaping serving of the promise and the delivery bearing no resemblance. Think of all of the liberty-stifling bills with names that promise more liberty.

Keeping the Internet and the Web Free and Open

Add to those dangers the fact that Berners-Lee — who began by stating, "You can't propose that something be a universal space and at the same time keep control of it" — is now proposing that the governments of the world should "keep control of it" by implementing and enforcing "Net Neutrality" — another of those proposals with a name that bears no resemblance to its actual purpose or practice. It is important to note that just because Berners-Lee gave us the web way back in the 1990s, it does not naturally follow that he should have the final (or even more weighty) say in the direction it goes next. After all, he was the one who said, "Had the technology been proprietary, and in my total control, it would probably not have taken off. You can't propose that something be a universal space and at the same time keep control of it."

While the U.S. government played a major role in the creation of the internet, and Berners-Lee gave us the web, neither the internet nor the web belongs under the absolute control of Uncle Sam or any other "governing body." As Web 3.0 grows and becomes the norm, we — the people who use the web — should carefully choose how we do so. Our choices now may help shape the future of web 3.0, and will certainly help shape the next iteration of the web.

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