ARPANET

Licklider, a psychologist and computer scientist, put out the idea in 1960 of a network of computers connected together by "wide-band communication lines" through which they could share data and information storage. Licklider was hired as the head of computer research by the Defense Advanced Research Projects Agency (DARPA), and his small idea took off.

By 1966, MIT researcher Lawrence G. Roberts had developed a plan for "ARPANET", a computer network designed to withstand power outages, even if a few of the computers were inactive. The first ARPANET link was made on October 29, 1969, between the University of California and the Stanford Research Institute. Only two letters were sent before the system crashed, but that was all the encouragement the computer researchers needed.

More universities and hosts were added to ARPANET as the system stabilized, and by 1981, there were over 200 hosts on the system. A number of other computer networks sprung up in the wake of ARPANET, including the Merit Network, CYCLADES, and the first international packet network, IPSS. However, with so many differing systems, something had to be developed to integrate them all into one. Robert Kahn of DARPA and Vinton Cerf of Stanford University worked together on a solution, and in 1977, the internet protocol suite was used to seamlessly link three different networks. Using this new protocol for data transmission, the National Science Foundation created NSFNET in 1986, capable of handling 1.5 megabits per second, which replaced the now-outdated ARPANET.

Packet switching—today the dominant basis for data communications worldwide—was a new concept at the time of the conception of the ARPANET. Prior to the advent of packet switching, both voice and data communications had been based on the idea of circuit switching, as in the traditional telephone circuit, wherein each telephone call is allocated a dedicated, end to end, electronic connection between the two communicating stations. Such stations might be telephones or computers. The (temporarily) dedicated line is typically composed of many intermediary lines which are assembled into a chain that stretches all the way from the originating station to the destination station. With packet switching, a data system could use a single communication link to communicate with more than one machine by collecting data into datagrams and transmitting these as packets onto the attached network link, as soon as the link becomes idle. Thus, not only can the link be shared, much as a single post box can be used to post letters to different destinations, but each packet can be routed independently of other packets.[7]

The earliest ideas for a computer network intended to allow general communications among computer users were formulated by computer scientist J. C. R. Licklider of Bolt, Beranek and Newman (BBN), in April 1963, in memoranda discussing the concept of the "Intergalactic Computer Network". Those ideas encompassed many of the features of the contemporary Internet. In October 1963, Licklider was appointed head of the Behavioral Sciences and Command and Control programs at the Defense Department's Advanced Research Projects Agency (ARPA). He convinced Ivan Sutherland and Bob Taylor that this network concept was very important and merited development, although Licklider left ARPA before any contracts were assigned for development.[8]

Sutherland and Taylor continued their interest in creating the network, in part, to allow ARPA-sponsored researchers at various corporate and academic locales to utilize computers provided by ARPA, and, in part, to quickly distribute new software and other computer science results.[9] Taylor had three computer terminals in his office, each connected to separate computers, which ARPA was funding: one for the System Development Corporation (SDC) Q-32 in Santa Monica, one for Project Genie at the University of California, Berkeley, and another for Multics at the Massachusetts Institute of Technology. Taylor recalls the circumstance: "For each of these three terminals, I had three different sets of user commands. So, if I was talking online with someone at S.D.C., and I wanted to talk to someone I knew at Berkeley, or M.I.T., about this, I had to get up from the S.D.C. terminal, go over and log into the other terminal and get in touch with them. I said, "Oh Man!", it's obvious what to do: If you have these three terminals, there ought to be one terminal that goes anywhere you want to go. That idea is the ARPANET".[10]

Meanwhile, since the early 1960s, Paul Baran at the RAND Corporation had been researching systems that could survive nuclear war and developed the idea of distributed adaptive message block switching.[11] Donald Davies at the United Kingdom's National Physical Laboratory (NPL) independently invented the same concept in 1965.[12][13] His work, presented by a colleague, initially caught the attention of ARPANET developers at a conference in Gatlinburg, Tennessee, in October 1967.[14] He gave the first public demonstration, having coined the term packet switching, on 5 August 1968 and incorporated it into the NPL network in England.[15] Larry Roberts at ARPA applied Davies' concepts of packet switching for the ARPANET.[16] The NPL network followed by ARPANET were the first two networks in the world to use packet switching,[17][18] and were themselves connected together in 1973.[19][20] The NPL network was using line speeds of 768 kbit/s, and the proposed line speed for ARPANET was upgraded from 2.4 kbit/s to 50 kbit/s.[21]

By mid-1968, Taylor had prepared a complete plan for a computer network, and, after ARPA's approval, a Request for Quotation (RFQ) was issued for 140 potential bidders. Most computer science companies regarded the ARPA–Taylor proposal as outlandish, and only twelve submitted bids to build a network; of the twelve, ARPA regarded only four as top-rank contractors. At year's end, ARPA considered only two contractors, and awarded the contract to build the network to BBN Technologies on 7 April 1969. The initial, seven-person BBN team were much aided by the technical specificity of their response to the ARPA RFQ, and thus quickly produced the first working system. This team was led by Frank Heart. The BBN-proposed network closely followed Taylor's ARPA plan: a network composed of small computers called Interface Message Processors (or IMPs), similar to the later concept of routers, that functioned as gateways interconnecting local resources. At each site, the IMPs performed store-and-forward packet switching functions, and were interconnected with leased lines via telecommunication data sets (modems), with initial data rates of 56kbit/s. The host computers were connected to the IMPs via custom serial communication interfaces. The system, including the hardware and the packet switching software, was designed and installed in nine months.

The World Wide Web

The world wide web, or WWW, was created as a method to navigate the now extensive system of connected computers. Tim Berners-Lee, a contractor with the European Organization for Nuclear Research (CERN), developed a rudimentary hypertext program called ENQUIRE.

The program was designed to make information readily available to users, and to allow a user to explore relationships between different pages (i.e. clicking to get to a different section of a website). By 1990, with the help of Robert Cailliau, Berners-Lee developed the skeletal outline of the internet, including a web browser and web server.

Unfortunately, the world wasn't ready for his ideas. The web was still a series of simple text pages, difficult to navigate, and inaccessible to most people. But all that changed in 1993, with the release of the Mosaic web browser, which allowed users to explore multimedia online. 1993 also saw the introduction of the first modern search engines. Though early search engines were primitive, mostly manual, and primarily indexed only titles and headers, in 1994 WebCrawler began to "crawl" the net, indexing entire pages of active websites. This technology opened the door for more powerful search engines, and made it possible to easily search through vast amounts of connected information.

In this same year, Berners-Lee founded the world wide web Consortium (W3C) to help further develop ease of use and accessibility of the web, and made it a standard that the web should be available to the public for free and with no patent.

Web 2.0

The aptly named dot-com boom of 1999 saw many people move their businesses online, such as newspapers, retailers, and entertainment offices. In those early days, websites traditionally created and published their own information, which was simply viewed by site visitors, with little to no interaction between creators and users. As the web continued to grow, users began to demand more interaction from the sites they visited, and the result — typically referred to as Web 2.0 — was a more social internet.

Web 2.0 is characterized by interactive websites, social knowledge sharing, user-generated content, online collaboration, embedded applications and multimedia, mobile connections, and — of course — social media. It is a web in which site owners and their audience interacts continuously, average users can become content providers, and visitors are able to create a unique, personal internet experience.

The Mobile Web

Around the same time as the internet was making the transition to Web 2.0, the world wide web also began to see a shift away from stationary desktops and bulky laptops, as more users began to access online content via their mobile phones. Early web-enabled phones had tiny screens, weak processors, and connected via slow wireless connections. As a result, viewing traditional web pages was a frustrating experience. However, as millions of smartphones started selling each year, the internet quickly adapted for mobile users.

Initially most websites accomplished this by creating an entirely separate site for their mobile audience. These sites used fewer graphics and a simplified text layout to improve transmissions speeds and readability. Over the next decade, however, mobile use continued to grow, mobile devices became more powerful, and mobile networks faster. Mobile website became capable of the same multimedia experience as traditional websites, and maintaining multiple sites became inefficient. Most website administrators have given up the separate site model, in favor of adaptive websites that adjust their layout based on the type of device being used or the screen size.

At the same time, as smartphones and tablets became the dominant mobile technology, many websites also began to offer similar features and content via mobile apps, which allowed them to take advantage of features specific to mobile devices and connect to users with real-time notifications. With annual smartphone sales now in the billions, and the majority of web browsing now being done on mobile devices, it is rare to find a site the is not mobile compatible; and soon, such sites will be completely obsolete.

Social Media

From its very beginning, the world wide web was seen as a social construct, connecting communities of scientist and researchers from all over the world. The more the system grew, the more connected the community became. In 1996, that connectivity took a huge leap forward with the introduction of ICQ, a free instant messaging application. Suddenly, internet users could communicate across any distance in real time. The following year AOL released its own Instant Message program, AIM, popularizing the new technology. 1997 also saw the introduction of the world's first blogs.

During this time, companies also began experimenting with specialized social networks, like Classmates.com, where users who already had an existing connection could reunite and communicate online. Then in 2002, Friendster introduced the world to social networking as we know it today, an online community designed to not only communicate with friends you already have, but to build new relationships through common friends and interests.

In 2003, MySpace and LinkedIn joined the social networking arena. Targeted primarily at young adults with its flashy customizations, music integration, and built-in blogging, MySpace popularized social media to millions of users. Taking a very different approach, LinkedIn targeted the business community, aiming to recreate the after-hours networking environment online. To this day, it remains the world's most popular professional networking site.

Three years later, the world of social media was forever changed with the public release of Facebook. Though it was launched in 2004, the site was restricted to college campuses for the first two years. After going public, the site quickly grew to hundreds of millions of users, and today it boasts over 1.5 billion active users each month.

The success of these early pioneers paved the way for new social media outlets such as Twitter, Pinterest, and Tumblr. Combined with the power of mobile, social networks have also become services, like Uber and Airbnb, allowing users to provide services traditionally only available through large business directly to one another.

The Internet of Things

The idea of connecting devices to the internet in order to control them from afar is nothing new, but as internet connections grow faster, connectivity technology becomes smaller, and the mobile world allows us to stay constantly connected, controlling things beyond just our computers has become the next logical step in the evolution of the web.

From dimming the lights in our living room to setting the DVR to starting our cars, the internet allows us to control everyday appliances from across the room or on the other side of the country. And as the internet of Things continues to grow, this connection has become a two-way communication. Our devices can now contact us, letting us know when our car needs maintenance, alerting us when the room temperature gets too low, and even telling us when we're out of milk. internet connected devices have become widespread, and the movement is only in its infancy. In the coming years, more and more of the devices we interact with every day will be just as connected to the world wide web as we are.

The invention of the internet was a large change for the world to adapt to. It has changed everything from business communications to social interactions, and as new technologies are introduced it will continue to change the way we live and work. It is a safe bet that there are many more fascinating innovations for it in our future.