

THE INTERNET AND THE WORLD WIDE WEB ARE NOT THE SAME THING

Many times, the terms “Internet” and “World Wide Web,” or even just “the web,” are used interchangeably. But really, they are *not* the same thing at all! The Internet is an interconnected network of networks. Many services run across the Internet: electronic mail, voice and video, file transfers, and, yes, the World Wide Web.

The World Wide Web is simply one piece of the Internet. It is made up of web servers that have HTML pages that are being viewed on devices with web browsers. It is really that simple.

● Brief History of the Internet

In the early days of computing, computers were seen as devices for making calculations, storing data, and automating business processes. However, as the devices evolved, it became apparent that many of the functions of telecommunications could be integrated into the computer. During the 1980s, many organizations began combining their once-separate telecommunications and information-systems departments into an information technology, or IT, department. This ability for computers to communicate with one another and, maybe more importantly, to facilitate communication between individuals and groups, has been an important factor in the growth of computing over the past several decades.

Computer networking really began in the 1960s with the birth of the Internet, as we’ll see below. However, while the Internet and web were evolving, corporate networking was also taking shape in the form of local area networks and client-server computing. In the 1990s, when the Internet came of age, Internet technologies began to pervade all areas of the organization. Now, with the Internet a global phenomenon, it would be

unthinkable to have a computer that did not include communications capabilities. This chapter will review the different technologies that have been put in place to enable this communications revolution.

IN THE BEGINNING: ARPANET

- The story of the Internet, and networking in general, can be traced back to the late 1950s. The US was in the depths of the Cold War with the USSR, and each nation closely watched the other to determine which would gain a military or intelligence advantage. In 1957, the Soviets surprised the US with the launch of Sputnik, propelling us into the space age. In response to Sputnik, the US Government created the Advanced Research Projects Agency (ARPA), whose initial role was to ensure that the US was not surprised again. It was from ARPA, now called DARPA (Defense Advanced Research Projects Agency), that the Internet first sprang.

ARPA was the center of computing research in the 1960s, but there was just one problem: many of the computers could not talk to each other. In 1968, ARPA sent out a request for proposals for a communication technology that would allow different computers located around the country to be integrated together into one network. Twelve companies responded to the request, and a company named Bolt, Beranek, and Newman (BBN) won the contract. They began work right away and were able to complete the job just one year later: in September, 1969, the ARPANET was turned on. The first four nodes were at UCLA, Stanford, MIT, and the University of Utah.

Over the next decade, the ARPANET grew and gained popularity. During this time, other networks also came into existence. Different organizations were connected to different networks. This led to a problem: the networks could not talk to each other. Each network used its own proprietary language, or protocol (see sidebar for the definition of protocol), to send information back and forth. This problem was solved by the invention of transmission control protocol/Internet protocol (TCP/IP). TCP/IP was designed to allow networks running on different protocols to have an intermediary protocol that would allow them to communicate. So as long as your network supported TCP/IP, you could communicate with all of the other networks running TCP/IP. TCP/IP quickly became the standard protocol and allowed networks to communicate with each other. It is from this breakthrough that we first got the term Internet, which simply means “an interconnected network of networks.”

As we moved into the 1980s, computers were added to the Internet at an increasing rate. These computers were primarily from government, academic, and research organizations. Much to the surprise of the engineers, the early popularity of the Internet was driven by the use of electronic mail (see sidebar below, Fig 2).

Using the Internet in these early days was not easy. In order to access information on another server, you had to know how to type in the commands necessary to access it, as well as know the name of that device. That all changed in 1990, when Tim Berners-Lee introduced his World Wide Web project, which provided an easy way to navigate the Internet through the use of linked text (hypertext). The World Wide Web gained even more steam with the release of the Mosaic browser in 1993, which allowed graphics and text to be combined together as a way to present information and navigate the Internet. The Mosaic browser took off in popularity and was soon superseded by Netscape Navigator, the first commercial web browser, in 1994. The Internet and the World Wide Web were now poised for growth. The chart below shows the growth in users from the early days until now.

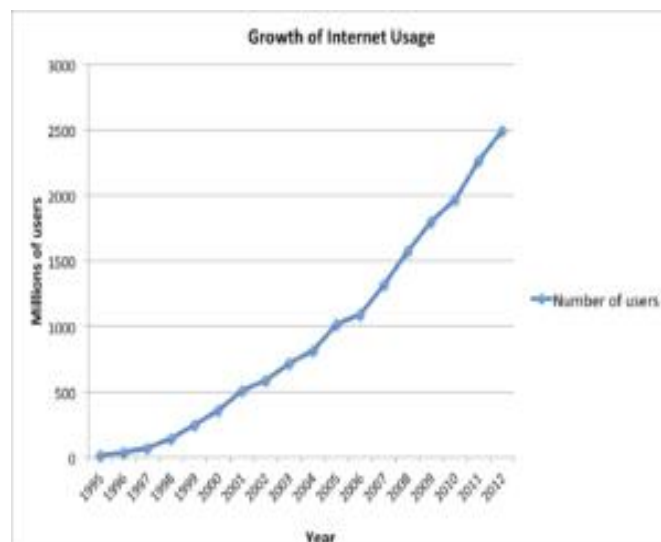


Figure 2. Growth of Internet usage, 1995–2012

(source: InternetWorldStats.com.)

THE DOT-COM BUBBLE

- In the 1980s and early 1990s, the Internet was being managed by the National Science Foundation (NSF). The NSF had restricted commercial ventures on the Internet, which meant that no one could buy or sell anything online. In 1991, the NSF transferred its role to three other organizations, thus getting the US government out of direct control over the Internet and essentially opening up commerce online.
- This new commercialization of the Internet led to what is now known as the dot-com bubble. A frenzy of investment in new dot-com companies took place in the late 1990s, running up the stock market to new highs on a daily basis. This investment bubble was driven by the fact that investors knew that online commerce would change everything. Unfortunately, many of these new companies had poor business models and ended up with little to show for all of the funds that were invested in them. In 2000 and 2001, the bubble burst and many of these new companies went out of business. Many companies also survived, including the still-thriving Amazon (started in 1994) and eBay (1995). After the dot-com bubble burst, a new reality became clear: in order to succeed online, e-business companies would need to develop real business models and show that they could survive financially using this new technology.

WEB 2.0

- In the first few years of the World Wide Web, creating and putting up a website required a specific set of knowledge: you had to know how to set up a server on the World Wide Web, how to get a domain name, how to write web pages in HTML, and how to troubleshoot various technical issues as they came

up. Someone who did these jobs for a website became known as a webmaster.

- As the web gained in popularity, it became more and more apparent that those who did not have the skills to be a webmaster still wanted to create online content and have their own piece of the web. This need was met with new technologies that provided a website framework for those who wanted to put content online. Blogger and Wikipedia are examples of these early Web 2.0 applications, which allowed anyone with something to say a place to go and say it, without the need for understanding HTML or web-server technology.
- Starting in the early 2000s, Web 2.0 applications began a second bubble of optimism and investment. It seemed that everyone wanted their own blog or photo-sharing site. Here are some of the companies that came of age during this time: MySpace (2003), Photobucket (2003), Flickr (2004), Facebook (2004), WordPress (2005), Tumblr (2006), and Twitter (2006). The ultimate indication that Web 2.0 had taken hold was when Time magazine named “You” its “Person of the Year” in 2006.

THE GROWTH OF BROADBAND

- In the early days of the Internet, most access was done via a modem over an analog telephone line. A modem (short for “modulator–demodulator”) was connected to the incoming phone line and a computer in order to connect you to a network. Speeds were measured in bits–per–second (bps), with speeds growing from 1200 bps to 56,000 bps over the years. Connection to the Internet via these modems is called dial–up access. Dial–up was very inconvenient because it tied up the phone line. As the web became more and more

interactive, dial-up also hindered usage, as users wanted to transfer more and more data. As a point of reference, downloading a typical 3.5 mb song would take 24 minutes at 1200 bps and 2 minutes at 28,800 bps.

- A broadband connection is defined as one that has speeds of at least 256,000 bps, though most connections today are much faster, measured in millions of bits per second (megabits or mbps) or even billions (gigabits). For the home user, a broadband connection is usually accomplished via the cable television lines or phone lines (DSL). Both cable and DSL have similar prices and speeds, though each individual may find that one is better than the other for their specific area. Speeds for cable and DSL can vary during different times of the day or week, depending upon how much data traffic is being used. In more remote areas, where cable and phone companies do not provide access, home Internet connections can be made via satellite. The average home broadband speed is anywhere between 3 mbps and 30 mbps. At 10 mbps, downloading a typical 3.5 mb song would take less than a second. For businesses who require more bandwidth and reliability, telecommunications companies can provide other options, such as T1 and T3 lines.

WIRELESS NETWORKING

- Today we are used to being able to access the Internet wherever we go. Our smartphones can access the Internet; Starbucks provides wireless “hotspots” for our laptops or iPads. These wireless technologies have made Internet access more convenient and have made devices such as tablets and

laptops much more functional. Let's examine a few of these wireless technologies.

- Wi-Fi – is a technology that takes an Internet signal and converts it into radio waves. These radio waves can be picked up within a radius of approximately 65 feet by devices with a wireless adapter. Several Wi-Fi specifications have been developed over the years, starting with 802.11b (1999), followed by the 802.11g specification in 2003 and 802.11n in 2009. Each new specification improved the speed and range of Wi-Fi, allowing for more uses. One of the primary places where Wi-Fi is being used is in the home. Home users are purchasing Wi-Fi routers, connecting them to their broadband connections, and then connecting multiple devices via Wi-Fi.
- Mobile Network – as the cellphone has evolved into the smartphone, the desire for Internet access on these devices has led to data networks being included as part of the mobile phone network. While Internet connections were technically available earlier, it was really with the release of the 3G networks in 2001 (2002 in the US) that smartphones and other cellular devices could access data from the Internet. This new capability drove the market for new and more powerful smartphones, such as the iPhone, introduced in 2007. In 2011, wireless carriers began offering 4G data speeds, giving the cellular networks the same speeds, that customers were used to getting via their home connection.

- BLUETOOTH –while Bluetooth is not generally used to connect a device to the Internet, it is an important wireless technology that has enabled many functionalities that are used every day. When created in 1994 by Ericsson, it was intended to replace wired connections between devices. Today, it is the standard method for connecting nearby devices wirelessly. Bluetooth has a range of approximately 300 feet and consumes very little power, making it an excellent choice for a variety of purposes. Some applications of Bluetooth include: connecting a printer to a personal computer, connecting a mobile phone and headset, connecting a wireless keyboard and mouse to a computer, and connecting a remote for a presentation made on a personal computer.

- VOIP — a growing class of data being transferred over the Internet is voice data. A protocol called voice over IP, or VoIP, enables sounds to be converted to a digital format for transmission over the Internet and then re-created at the other end. By using many existing technologies and software, voice communication over the Internet is now available to anyone with a browser (think Skype, Google Hangouts). Beyond this, many companies are now offering VoIP-based telephone service for business and home use.

❖ Important People in Internet History

- **Robert Kahn and Vinton Cerf** — Technology continued to grow in the 1970s after scientists Robert “Bob” Khan and Vinton “Vint” Cerf developed transmission control protocol and internet protocol, or TCP/IP, a communications model that set standards for how data could be transmitted between multiple networks. ARPANET adopted TCP/IP on January 1, 1983, and from there researchers began to assemble the “network of network” that became the modern internet.

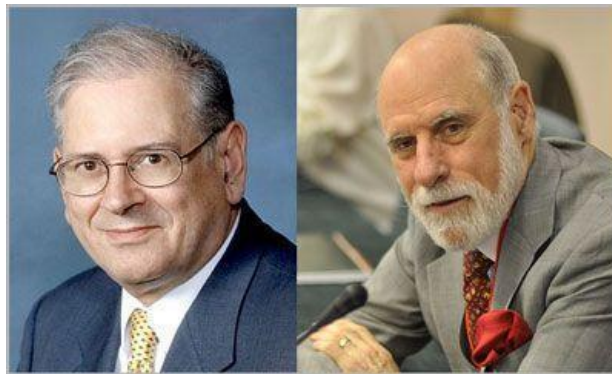


Figure 3. (Left) Robert Kahn and (Right) Vinton Cerf

(source: <https://co.pinterest.com/pin/438467713694729950/>)

- **Tim Berners-Lee** — invented the World Wide Web (www).



Figure 4. Tim Berners-Lee

(source: https://en.wikipedia.org/wiki/Tim_Berners-Lee)

- **Joseph Carl Robnett Licklider** – first coined the concept of intergalactic network of networked computer after ARPA (Advance Research Project Agency).



Figure 5. JCR Licklider

(source: https://en.wikipedia.org/wiki/J._C._R._Licklider)

- **Donald Watts Davies** – created the typical Packet switching network at National Physical laboratory Britain which revolutionizes the data communications in various fields (1964–1967).



Figure 6. Donald Davies

(source: https://en.wikipedia.org/wiki/Donald_Davies)

- Ray Tomlinson — introduced electronic mail that can send messages across distributed networks.



Figure 7. Ray Tomlinson

(source: https://en.wikipedia.org/wiki/Ray_Tomlinson)

- **Daniel Karrenberg** — Created the first ISP or Internet Service Provider.



Figure 7. Daniel Karrenberg

(source: https://en.wikipedia.org/wiki/Daniel_Karrenberg)