

Tubes

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In Wichita, Kansas, Michael wakes up at 5:30 AM. He walks straight to his computer, not wasting a minute. His first task is to check his email to see if he got a promotion. The second objective on his list is to check the minute-by-minute stock market updates. Across the globe in Colombo, Sri Lanka, Mahinda comes home from a long day at work. After quickly saying “Hi” to his kids, he goes to the family computer to play the popular game “World of Warcraft.” These scenes are common in 2007. Over 40 years ago when the idea of the Internet was first born, these tasks were unthinkable to even the greatest minds.

The Internet has made the jump from a private military operation to a worldwide network of information. Understanding the way the Internet works and the terms used to describe it can be a daunting task, often overlooked by the average user. Every day people now hop on the net to check their email, chat with friends, or browse the web without thinking about what they are using. Today, the average user is exploiting the Internet for recreation and education alike.

During the late 1980’s and early 1990’s, when the Internet was in its infancy, only government officials and experts in the field developed and maintained its infrastructure, and the general public simply began using it. Today however, because of privatization and tools that make it more user-friendly, everyday people are able to develop, maintain, and use the system.

The Internet is a “network of networks.” It is a public, worldwide system of interconnected academic, government, business, and domestic computer networks. Access to the Internet has increased dramatically in the past few years. Cell phones, palm pilots, and portable game systems now connect to the Internet. The Internet has

become a major source of leisure. Some people play online video games, while others download music and chat with friends. The Internet has also revolutionized the workplace, making it easier for employees to find and share information. Educational institutions now take advantage of the Internet by posting assignments online and making resources, such as libraries, readily available for students and teachers. The computers connected to the Internet operate services such as the World Wide Web, Email, and file sharing.

The World Wide Web, or the web, is a system of linked web pages or text documents that users can view by using a web browser. These pages contain images, text, and other forms of multimedia. Oftentimes web pages contain links to other web pages and documents/files. "The Web would fundamentally change the Internet, not by expanding its infrastructure or underlying protocols, but by providing an application that would lure millions of new users" (Abbate 213). Before the Web, the only functions of the Internet were email and file sharing. The Web has enabled people to interact with others who live at opposite ends of the earth. The Web is a relatively free medium of expression; there is no higher authority or publisher, as is the case with books. Websites like "Wikipedia" allow for users to contribute their own knowledge to an ever-growing encyclopedia. This has offered almost anyone the opportunity to create a webpage, whether it is a personal site, or a site for his or her business. A recent study reports there to be approximately 11 billion web pages on the web (Alessio). Today, people often fail to realize the differences between the Web and the Internet. The Internet is simply the infrastructure; a platform in which other services operate. The World Wide Web is a system of interlinked web pages.

Email, originally called mail, or “net notes,” existed even before the idea of the Internet existed. Email is essentially a way of sharing information by sending messages from computer to computer. In the 1970’s, emails accounted for 75% of Internet traffic (Zakon). Emails were sent with exclusively text-based applications, unable to display graphics. Emails contained research papers or simple text-only messages. Today, unlike 20 years ago, emails contain a lot of multimedia content, such as images, audio files, or video files, and are much easier to send and receive. In the 70’s, one would have to navigate through text-based programs, whereas today, one can simply point and click. File sharing was the other major application of the Internet in the 70’s and 80’s. File sharing shares similarities with email, but it is more geared towards sharing with the public. Files were uploaded to servers for easy access for others, as they are today.

Packets are blocks of information carried by computer networks, such as the Internet. They simply carry data. The data is bundled into packets because transferring packets over the Internet is more efficient and reliable than sending raw data. Packet switching takes place when these bundles of information are routed between computers, cell phones, or any device connected to the Internet. The packets are transported to their destination by the fastest route using advanced mathematical equations (Howe).

ARPA, the Defense Advanced Research Projects Agency, is an agency operating within the Department of Defense. ARPA was, and still is, responsible for the funding and development of technology for the military. Research ARPA did in computer networking led to the foundation of the ARPANET and later the Internet. The National Science Foundation, or NSF, is a United States government agency that supports

research in science and engineering. The NSF played a large role in the development of the Internet.

ARPANET (The Advanced Research Projects Agency Network), developed by the Department of Defense, was the first packet-switched network. It was the predecessor of the Internet and laid the foundation for the Internet. Host computers, responsible for information held in packets, were connected to switching nodes, which would direct the packets to their correct destinations. There were far fewer hosts, computers, and nodes connected to the ARPANET during its first years than there are connected to the Internet today (Zakon). The initial network consisted of four computers: one located at UCLA, one at Stanford, one at UC Santa Barbra, and one at the University of Utah. At the end of ARPANET's life, the entire ARPANET was switched over to the NSFNET, and the NSF took over as the backbone for the Internet. The NSFNET was another internet, compatible with the protocols used by the ARPANET. The switch to the NSFNET "marked the end of military operation of the Internet." (Abbate 195)

The history of the Internet and networks in general is crucial to understanding how people are able to navigate through the Internet. The history of the Internet begins in 1957, when the Department of Defense established "ARPA", Advanced Research Projects Agency in response to Sputnik, an artificial earth satellite from the Soviet Union. The United States government felt threatened by the Soviet Union and it feared that the USSR would outsmart the US and exploit military technologies (Zakon).

In the 1960's, ARPA started studying "cooperative network of time-sharing computers" (Zakon). Two computers, one at MIT and one in Santa Monica, were directly

linked with a 1200bps (bytes per second) phone line. Another computer was later added to form “The Experimental Network.” The idea of an “ARPANET,” or ARPA network, is brought up. Papers are published on packet switching. The Department of Defense (DoD) forms the ARPANET in the interest of expanding knowledge of networking. There are four nodes or computers connected to the ARPANET at this point: one at UCLA, one at Stanford, one at UC Santa Barbara, and the last at University of Utah. (Zakon)

In 1970, AT&T set up cross-country cables between UCLA and BBN Technologies (located in Cambridge, MA) at a speed of 56kbps(kilo bytes per second). The majority of traffic on the ARPANET was email, according to an ARPA study, and more user-friendly email programs were developed. The first international links, one at the University College of London and one in Norway, were added to the ARPANET in 1973. A protocol called the Network Voice Protocol, developed in 1963, enables calls over ARPANET. “We do not have the skill or the time to choose words so carefully when composing a message that a unique intended tone always shines through. Instead, the tone is often omitted, and hence is ambiguous” (Picard 87). So smileys, or “Emoticons” were developed to add some humor and texture to the text-only nature of emails.

Some of the greatest and most challenging changes were made in the 1980’s as Internet popularity evolved. ARPANET was split into MILNET and ARPANET. Computers were shipped with networking software. Newsgroups, today known as discussion forums, were formed in which users could post messages. By the late 1980’s, the ARPANET became obsolete, its lines were being overloaded, and the switches were worn out. The National Science Foundation was given the responsibility of operating the Internet backbone. At this point, the Internet was privatized, and control

was shifted away from the government into the hands of civilians. Several companies therefore shared the responsibility for the Internet backbone. Commercial, social, and recreational activities became acceptable.

In 1990, the ARPANET was officially decommissioned, and the last of its hardware was shut down. All users and content on the ARPANET made the move to the NSFNET. The NSFNET was a better network. It had improved hardware, faster connections, and most importantly, a larger user base. The switch to the NSFNET caused very little disruption for Internet users. The Internet continued to grow; new networks were added every day. Since the Internet was no longer in the hands of the government, users felt more comfortable on the Internet.

In the 60's, 70's, and 80's, experts in the field and government officials were the only people who had the access and the knowledge required to use the ARPANET. They didn't use the ARPANET for recreation. "At the beginning of the 1980s, the Internet included only a relatively small set of networks, most of which had direct links to defense research or operations" (Abbate 182). Not only was access to the ARPANET difficult to obtain, it was cumbersome to navigate for the average person. Users, "theoretically had access to some of the most advanced computer systems in the United States; however, using those remote systems could be difficult, impractical, or unappealing" (Abbate 86). Not only was it hard to use, the content did not concern anyone but the government and certain education institutions.

As developers and maintainers, experts and government officials ensured that the ARPANET was in good health and researched ideas for further expansion of the

network. The government played a critical role in the development of the Internet by providing money and resources to embellish it.

The United States poured much more money into basic computing research than did the United Kingdom, and most of that money was channeled through the Department of Defense. Not only did Roberts have a generous budget for his project; he also was able to call on computer experts from around the country to help build the network. (Abbate 40-41)

The United States was compelled to begin and continue development of the ARPANET for fear that other countries or organizations would beat them to the plate. The United States was particularly worried about the Soviet Union, which proved that it had the resources to launch an earth satellite.

In the 70's and 80's, users who were not experts or government officials were scarce. "Each page spawned gives me a feeling of being under time pressure and I feel a need to escape to where I can be in control" (McCarthy 134-135), recounts a user without much, if any, experience using the Internet. Not only did average users have a hard time figuring out how to use the Internet, but also it was difficult, at best, to find relevant information. "Just finding out what was available on the ARPANET could be difficult...the difficulty of learning about host resources was a major obstacle for new users" (Abbate 86-87). Search engines like "Google" did not yet exist. Users needed to know the exact location (within the Internet) of the host computer where the information was housed.

Before the 1990's, the ARPANET had an acceptable use policy, expressing that the Internet was for open research and education only, and outlawed commercial and

recreational activity. This agreement intruded on users' free speech:

“Americans tend to disapprove of government involvement in providing commercial goods or services...the NSF managers believed that the only politically feasible way to accommodate commercial users on the Internet would be to remove it entirely from government operation” (Abbate 195).

Essentially, this meant moving the Internet to the private sector, privatizing the Internet.

“With privatization, the Internet was opened up to a much larger segment of the American public, and using it for purely commercial, social, or recreational activities became acceptable...the internet became a topic of public discussion and ordinary people began to debate the advantages and pitfalls of going online.” (Abbate 199-200)

Several companies, like AT&T and Verizon, had expressed interest in selling Internet access to commercial customers but could not because of the acceptable use policy in effect in the 80's. “‘Privatization’ is the idea that government information should be turned over to the private sector for exploitation” (Kahin 319) With privatization, anyone, not just academic and government institutions, would be able to use the Internet in a democratic way. The Internet now had the same rules of free speech that newspapers and magazines had.

The World Wide Web also helped popularize the Internet by providing a visual point-and-click interface for content. “The World Wide Web was beginning to make information sources widely available on-line. Prior to that time, personal computers were used mostly for word processing, accounting, playing games, and communicating via e-mail” (Stefik 50). Services were developed to help locate information on the Internet, but nothing would be as helpful as the World Wide Web. “The Web completed the

Internet's transformation from a research tool to a popular medium by providing an application attractive enough to draw the masses of potential Internet users into active participation" (Abbate 217) Connections between websites on the Web were not made using step-by-step logic. They were lateral connections, not hierarchical connections. Programs designed to surf the Web exploited computers' graphical interfaces, offering users a point-and-click method of navigation. The Mosaic web browser was the first of its kind to offer this. The browser allowed images to be included in a web pages' content. The point-and-click method appealed to users with less experience on the net. Before web browsers existed, users had to use drab text-only programs that appeared daunting; users needed to know certain commands used for navigation. One flaw of the Web was that people still needed to know the exact address of the website; there were no search engines as there are today.

Perhaps the most important tool made available to users was the search engine. A search engine is a phone book for the Internet. One searched for something, pizza for instance, and was given results for websites about pizza. Users no longer needed to know the exact address of a website. Instead, they could navigate themselves to a search engine, such as "Google," and type in what they were looking for. Other tools have emerged over the past 10 years that make it easier for users to use the Internet to its full extent. Social networking sites, like Facebook and MySpace, have become very popular for kids and adults alike. These are websites where people can share information, make new friends, and communicate with peers. Every day, new features are added to these websites to make it easier for people to broadcast information about themselves and others. There are other types of services, such as Flickr, which allows

amateur photographers to share, give, and receive feedback on photographs. Flickr has enabled hundreds of aspiring and professional photographers to publish their photos on the Internet. Other types of services, such as Wordpress, enable people to create their own weblogs (blog for short), a type of Internet journal. Today, all you need to create a blog is an email address, a name, and a password.

In 2007, the average user is becoming more of a developer and maintainer.

Users are creating their own content and publishing on the Internet:

The Web drew on new computing technologies (particularly the personal computer and its graphical user interface) and its promoters thrived in the new commercial environment for Internet services. The Web also continued the tradition of decentralized participation in the creation of the system, encouraging individual users to add new content and tools. (Abbate 220)

Many users are posting videos on YouTube (a video sharing website), uploading photos to Flickr, making friends on Facebook, and creating their own Podcasts (Internet radio shows); they can hardly be considered average users any more due to privatization and user friendly tools.

In the future, the gap between users and developers will close. The Internet is still in its infancy, and thus there is room to grow. A new movement started in 2004, called "Web 2.0," strives to fill this divide. According to Tim O'Reilly, the founder of Web 2.0, it "is the business revolution in the computer industry caused by the move to the Internet as platform, and an attempt to understand the rules for success on that new platform." It is an attempt to bring users closer to the Internet. Terms like simplicity, user-centered, collaboration, trust, mobility, and usability describe the ideology of Web 2.0

(Cremonini). The future will present more opportunities for people to develop, maintain, and use the system.

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