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INTERNET TECHNOLOGIES

An Interactive Qualifying Project Report

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WORCESTER POLYTECHNIC INSTITUTE

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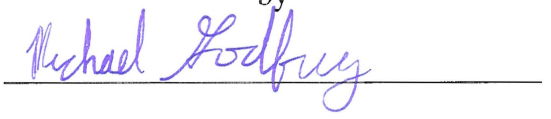
by



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Approved:
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Preface

This document does not include my entire project. This project was originally started in 1997. The original project entailed the creation of a web site for the "Freedom Football Conference". The project was finished and graded, but it never got passed in. The project has been misplaced sometime during the last 7 years and neither the Student or the project advisor had retained a copy.

This document is intended to suffice for the completion of the degree requirements form. I had permission from Prof. Hart and Prof. Defalco to create this write up in it's limited capacity. In no way does it accurately represent the original work of the project, which would be wildly outdated and inaccurate.

Abstract

The purpose of this IQP project is an examination of the current state of the internet technologies and provides direction for the future of the Internet. Using data and literature gathered from science journals along with periodicals and online sources, this project will attempt to give a glimpse of future internet technologies.

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1.0 Introduction

The internet started in 1969. Since its inception, the Internet has grown from four host computer systems to over ten million. The Internet is made up of computer networks which link computers and servers together. The major means of communication is through a protocol called TCP/IP. Servers utilize software to provide and serve information and clients use software to view the information. The Internet can be considered the transport vehicle for which the information stored in files or documents travel to get from one computer to another. "The Internet itself does not contain information. It is a slight misstatement to say a "document was found *on* the Internet." It would be more correct to say it was found *through* or *using* the Internet. What it was found in (or on) is one of the computers linked to the Internet."

Some of the basic uses of the internet are:

- The World Wide Web (WWW)
- Electronic Mail (e-mail) - Email is form of electronic messaging that uses standard conventions for communicating and delivering content (message text) over the Internet.
- Instant Messaging (IM) – IM is a web based service that allows users to send short messages immediately to individuals connected to each other. Without the store-and-forward delays inherent in E-mail.
- File Transfer Protocol (FTP) – FTP is a way for people to share files, such as music and videos, among each other and the rest of the world by uploading them to servers and allowing others to download them to their own computers using clients.
- USENET (a news service) - USENET (Unix User Network) is a system of bulletin boards where you and anyone else can post messages and people will read and reply to them. As with IRC, you will find boards set up for all sorts of groups of people.

2.0 World Wide Web

The World Wide Web (WWW) incorporates all of the services listed above and many more. You can retrieve documents, view images, animation, and video, listen to sound files, speak and hear voice, and view programs that run on practically any software in the world, providing your computer has the hardware and software to do these things.

The WWW is the reason the Internet has become as popular as it has. This is the part of the Internet that the majority of users see, the websites and the pages that make them up. The web is the most widely used service of the Internet, accessed through a web browser like *Internet Explorer* or *Netscape Navigator*. These pieces of software are gradually integrating other parts of the Internet into them (most notably email and ftp), so that eventually we will have one interface to the entire array of services the Internet offers.[2.]

The web is an immense collection of web pages, linked together with hypertext links. Thousands of new pages of information are added to the heaving web every hour. Each page is placed on a *server*, a computer continually connected to the rest of the web. The information is then available to anyone else with access to the Internet. Web pages can have a mixture of text, graphics and multimedia. Nowadays, there's information on practically anything you could be interested in available somewhere on the web. You can use a search engine to find what you want. [2.]

3.0 History of the Internet

First came the invention of the telegraph, then the telephone, then the radio. All these technologies laid the foundations of the modern internet with their ability to communicate date over wire and air. The success of the internet is largely owed to the government, academia and industry for there continued investment in research and development of internet technologies. The following chapter will give a very brief overview of the history of the internet.

3.1 Fundamentals of the Internet

The fundamentals of the Internet were formed when packet-switching networks came into operation in the 1960s. Transmitted data is broken up into small packets of data, sent to its destination, and reassembled at the other side. This means that a single signal can be routed to multiple users, and an interrupted packet may be re-sent without loss of transmission. Packets can be compressed for speed and encrypted for security. Computers at the time were massive, primitive structures. The only type of network in operation before was made up of terminals that logged into mainframes. This is similar to the present-day client/server relationship we have with the modern Internet, except the computers are usually comparable in terms of power, and so the Internet is known as a peer-to-peer system.[2.]

3.2 ARPANET

Early packet-switching networks were set up in Europe. Development of a similar system began in America in 1968, and went into operation the year after in the US Defense Department's Advanced Research Projects Agency (ARPA) was created. The ARPANET used Network Control Protocol as its transmission protocol from 1969 to 1982, when NCP was replaced with the now widespread TCP/IP. [2.]

Now that the technology was in place, strategies were put forth on what to do with it. Eventually, the first large-scale Internet was created — a set of interconnected US military computers. The idea was, if an attack was laid down on one part of the system, the rest of the system would still be operational enough to blow the hell out of whoever was attacking the country. Alternatively, losing the mainframe in a centralized system would spell disaster. This was during the height of the Cold War, and the inevitable nuclear war looked very close to happening. [2.]

Services like Email found their first usage through the ARPANET system, and its obvious benefits were lauded by all who participated. The popular bulletin-board system, Usenet was developed between the 70s and 80s. Around this stage all of the main universities in the US were connected to the network and used it for transmitting experimental data and educational resources. It was found to be an excellent method of sharing information. In 1973 the first international (and indeed intercontinental) connection was made to the University College of London in England.[2.]

3.3 The rise of USENET

USENET contributed more than anything else to the way the Internet began to take off. The spirit of information sharing and discussion that is the hallmark of the net was encapsulated in this system. Usenet is considered to have begun in 1979, and went through a few revisions. In an early triumph for freedom of speech, the restrictions on taboo subjects like recreational drugs were circumvented by independent people setting up their own servers and hosting discussions there instead of on the main ARPANET servers, where this was forbidden. New transmission methods were developed, the standard becoming NNTP (Net News Transfer Protocol), which is still in use today. [2.]

The introduction of personal computers in the late 70s brought a large new audience to the developing Internet. They used email and participated in discussions on networks like Usenet, Bitnet and Fidonet, which eventually were all joined together. The Internet was growing exponentially. IRC (Internet Relay Chat) became available in 1988 and communities formed in rooms. [2.]

3.4 The World-Wide Web

It was only in 1991 that what we now call the World-Wide Web was introduced, developed by Mr. » Tim Berners-Lee, with assistance from Robert Caillau (while both were working at » CERN. Tim's now a member of the » W3C). Tim saw the need for a standard linked information system accessible across the range of different computers in use. It had to be simple so that it could work on both dumb terminals and high-end graphical X-Window platforms. He got some pages up and was able to access them with his 'browser'. [2.]

Quickly researchers got interested and started designing web sites and browsers. In 1993 the first proper web-browser, Mosaic, took the Internet by storm; having been developed at the National Center for Supercomputer Applications (NCSA). As soon as it was ported to PCs and Macs it immediately affected a boom in web usage. [2.]

Quickly services were set up for domain registration and sites began turning up on the web, running on very basic HTML. Even at this stage, malicious viruses and worms were infiltrating computers connected to the Internet. The web had an incredible 341, 634% annual growth rate. Important sites like the White House and Pizza Hut appeared. Online shopping sites showed up. The www was quickly the most popular service on the Internet. It was around 1995 when the first large ISPs like AOL and CompuServe began offering Internet access to the masses. Technology like Sun's Java and search engines are released. The somewhat legendary browser war was in full swing between Netscape and Microsoft, with new browser releases coming every month and the web becoming increasingly fragmented. Despite this, the public's enthusiasm for the Internet went unbridled. [2.]

Today, in whatever year this is, the web is still growing at an amazing rate. Technology has improved considerably, and the web is regarded as an indispensable tool for education, business and entertainment. There are billions of pages on the web, with thousands more being added every hour. The Internet is a system that is nigh-on impossible to destroy, and looks set to become an ever-larger influence on the world in the future. [2.]

4.0 Current State of the Internet

About 85% of companies that utilize the web use high speed connections, usually referred to as broadband. The latest data from the Pew Internet & American Life Project [4.] shows that broadband , which promises an explosion of feature-rich Web applications, is finally becoming a significant factor among Internet users. Some of the basic findings of a February poll indicate that 68 million Americans log onto the Internet via a broadband connection either at home or at work. Of that population, 48 million people -- about a quarter of American adults -- have broadband capability at home. Since March of last year, the use of high-speed Internet connections is up 60 percent. [4.]

The following chart shows internet usage by the top 25 countries with the highest number of Internet Users.

Top 25 Countries With The Highest Number Of Internet Users[3.]

#	Country or Region	Internet Users, Latest Data	Population (2004 Est.)	Internet Penetration	Date of Latest Data	% of Users
1	United States	199,096,845	294,540,100	67.6 %	Nielsen//NR Jan/04	26.9 %
2	China	79,500,000	1,327,976,227	6.0 %	CNNIC Dec/03	10.7 %
3	Japan	57,200,000	127,944,200	44.7 %	ITU Dec/02	7.7 %
4	Germany	45,315,037	82,633,200	54.8 %	Nielsen//NR Jan/04	6.1 %
5	United Kingdom	35,089,470	59,157,400	59.3 %	Nielsen//NR Jan/04	4.7 %
6	South Korea	29,220,000	47,135,500	62.0 %	KRNIC Dec/03	4.0 %
7	France	22,233,907	59,494,800	37.4 %	Nielsen//NR Jan/04	3.0 %
8	Brazil	20,551,168	183,199,600	11.2 %	Nielsen//NR Jan/04	2.8 %
9	Italy	19,900,000	56,153,700	35.4 %	ITU Dec/02	2.7 %
10	Canada	16,841,811	32,026,600	52.6 %	Nielsen//NR May/02	2.3 %
11	India	16,580,000	1,088,056,200	1.5 %	ITU Dec/02	2.2 %
12	Spain	13,751,602	41,895,600	32.8 %	Nielsen//NR Jan/04	1.9 %
13	Australia	13,474,392	20,226,100	66.6 %	Nielsen//NR Jan/04	1.8 %
14	Taiwan	11,602,523	23,073,800	50.3 %	Nielsen//NR Jul/01	1.6 %
15	Netherlands	10,806,328	16,364,500	66.0 %	Nielsen//NR Jan/04	1.5 %
16	Mexico	10,033,000	102,797,200	9.8 %	ITU Dec/02	1.4 %
17	Poland	8,880,000	38,158,100	23.3 %	ITU Dec/02	1.2 %
18	Indonesia	8,000,000	221,777,700	3.6 %	ITU Dec/02	1.1 %
19	Malaysia	7,841,000	24,645,600	31.8 %	NITC Jun/03	1.1 %
20	Sweden	6,906,091	8,995,900	76.8 %	Nielsen//NR Jan/04	0.9 %
21	Russia	6,000,000	146,743,800	4.1 %	ITU Dec/02	0.8 %
22	Turkey	4,900,000	75,058,900	6.5 %	ITU Dec/02	0.7 %
23	Thailand	4,800,000	64,337,900	7.5 %	ITU Dec/02	0.6 %

24	Hong Kong	**4,661,589**	7,394,170	63.0 %	Nielsen//NR Jan/04	0.6 %
25	Switzerland	**4,430,800**	7,433,000	59.6 %	Nielsen//NR Jan/04	0.6 %

5.0 Future of the Internet

The future of the internet is wide open. The applications seem limitless and the technologies seem like they belong in the Star Trek era. The following lists a few of the possible advances in internet technologies.

5.1 Internet Speeds

Currently the major forms of broad band available for home usage are Cable and DSL. These speeds on average range 500 - 600 kbps, with cable modems generally faster. These technologies use TCP-IP protocol to transfer data, this protocol was developed in the early 80's and needs serious updating. Advancements in the TCP-IP protocols will make these speeds seem like we've been moving at a snail's pace. New protocols that are being tested (such as BIC-TCP, Reno TCP HS-TCP, Fast TCP, S-TCP, HSTCP-LP, H-TCP) could achieve transfer speeds of up to 6,000 times faster than that of current broadband speeds. [5.] WOW!

5.2 Wi-Fi location growth (Wireless-Fidelity)

In a few short years, the number of wireless connections to network services is expected to eclipse that of landline connections.

One key enabler is the emergence of new wireless data services intended to provide high-speed access to corporate computing resources for mobile end-users, those at remote sites and even those at primary offices.[6.]

Even McDonald's restaurants have announced this April that they are going to outfit 6,000 of there stores with wi-fi connectivity.[8.]

5.3 Near Field Communication (NFC) technology

Near field communication (NFC) evolved from a combination of RFID and interconnection technologies, making it possible to connect any two devices to exchange information or access content and services simply by bringing them close together. [7.]

With NFC technology, a person would be able to "flash" a mobile phone or PDA within a few centimeters of a poster advertising a rock concert, for example, and download information about the show from a smart chip in the poster, buy tickets and store them electronically on the handheld device.[7.]

5.4 Replication of Human Senses (Virtual Reality)

The ability to transmit human senses over the internet is now becoming more of a reality.

5.4.1 Touch

Researchers at the University at Buffalo, New York, announced they have developed a system that lets one person experience the sense of touch felt by another. They said they could transmit the sensation across the Internet.[9.]

In about five years, people may use the system to feel the force and pressure Tiger Woods experiences every time he wallops a golf ball. It could be used in e-commerce, enabling buyers to feel fabrics before they buy. Or students could feel the precise pressure applied by brain surgeons as they remove tumors. They could potentially palpate the tumor, or any other organ, for themselves. [9.]

5.4.2 Smell

E-buyers soon will be able to "sample" candy, perfume, foods and other items they are considering buying via the Internet, extending their shopping experience with the added dimension of smell.[10.]

The technology involves creating a digital palette of scented oils that are emitted one by one or in combination by software that instructs a device called iSmell to emit the scent. The company claims scents such as candy are close to the real thing. The iSmell device will contain a cartridge that needs to be replaced. [10.]

The initial device will be able to blend about 128 scents into a theoretically unlimited number of smells. The ScentWare encodes odors as data, so candy, perfume or other items on Websites can essentially broadcast smells to be released by the iSmell device. [10.]

5.4.3 Taste

Imagine having the ability to taste cookies over the internet before you buy them in the grocery store.

Although there haven't been any attempts or experiments to recreate tastes, it seems reasonable that this too is a sense that can be transmitted over the internet, given that the human sense of taste comes down to five types of receptors that record bitter, sweet, sour, salty, and umami (glutamate receptor).

5.6 Video on Demand (VOD)

Imagine sitting in front of your TV and being able with the click of a few buttons on your remote to start watching any movie you desire. That is one example of VOD. This is the future of interactive TV, the ability to watch anything, anytime![11.]

Video on Demand (VoD) is an interactive multimedia system that works like cable Television, the difference being that the customer can select a movie from a large video database. Individual customers in an area are able to watch different programs when they wish to, making the system a realization of the video rental shop brought into the home. [11.]

6.0 Conclusions and Recommendations

The Internet and internet technologies have changed quite a lot since it came into existence in 1969. The internet was originally envisioned to support a multitude of functions including data sharing and remote access to collaboration. It has since produced technologies such as email and the World Wide Web. It has become a huge commercial success, virtually no businesses exists without a web site or access to the web.

With the availability of high speed networks growing rapidly and new and more powerful computing devices becoming available, a whole new assortment of technologies and applications are upon us, such as NFC technology mentioned above. The internet is growing and evolving. New technologies from hi-speed access and satellite access will create new applications, which will cause the internet to further evolve itself.

A challenging issue for the future will be how the internet handles the process of change as it evolves and grows. Due to the tremendous success of the Internet, the number of stakeholders have increased, who now bring an economic agenda as well as intellectual investment in the network. The internet has become a battle ground somewhat for control, control over the next set of protocols, domain names, technologies. It can be described as a struggle to find the next social structure that will guide the Internet into the future. [12.] This social structure will be hard to find due to the vast amount of stake holders. Standards bodies need to be formed and adhered too. It is the only way to assure a smooth transition to new technologies.

There are existing web and internet standards organizations. Standards bodies concern themselves with developing common protocols that encourage its evolution to help ensure interoperability. Having standards that everyone adheres to will reduce the cost and complexity of development, at the same time increase the accessibility and long-term viability of internet technologies.

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