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UNINTENDED CONSEQUENCES OF VERIZON'S FIBER TO THE PREMESIS

An Interactive Qualifying Project Report

Submitted to the Faculty of

WORCESTER POLYTECHNIC INSTITUTE

In partial fulfillment of the requirements for the

Degree of Bachelor of Science

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Abstract

Verizon's new service, fiber to the premises, converges voice, video, and data into a single delivery method, a fiber-optic cable. Verizon is concerned with the potential unintended consequences of the new service - specifically the increased upload capabilities delivered to users. This project focuses on potential new activities that are as yet unknown that can be used on the new system.

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Executive Summary

We first began work on this project in B term. We put some ideas down on paper, but for the most part our objective at that point was to get a solid idea of what the project was all about. We met with Bill Garrett at the Waltham Verizon facility several times within the months of November and December. At one point we also got the opportunity to talk to Joanne LaCourse, the employee in charge of usability services. It was extremely helpful to meet with Joanne and find out how our work would be affecting her group as well.

When we first started working at Verizon, we did a lot of research. We researched pretty much everything imaginable about the internet, from basic history, to current FiOS users, to what other broadband companies are doing. We also found out from Verizon some of the services they wish to implement, or are working on developing currently.

Objective

Verizon's services for residential customers currently include long distance plans and high-speed DSL connection to the Internet. To stay competitive, Verizon is preparing to release a new Fiber To The Premises (FTTP) service that incorporates voice, video, and data service. This service is the first of its kind. Where other telecommunications companies such as Cablevision and Charter Communications offer the trio of services, Verizon will be the first to offer it with a single connection to the household.

Verizon is on the cutting edge of delivering new services to families and businesses. The advent of this new technology will lead to unintended consequences. In the past the unintended consequences of high-speed Internet access (cable or DSL) included music downloading through peer-to-peer file sharing. The law, which had to react to the new service, negatively impacted customers' families and service providers. Households were downloading programs available online and using them illegally and not always realizing the consequences of their actions. Service providers came to a point where they were being subpoenaed for their customer's records.

Knowing that new services can create new and unexpected behaviors among customers, Verizon is seeking to learn about the unintended consequences of their FTTP Service.

Our intent is to investigate the unintended consequences of the new FTTP Service. How will the average family use it? How will enthusiasts use it? Through surveys and focus groups, we intend to explore and learn what imaginative and unintended uses customers may create beyond what Verizon

engineers envisioned.

1.0 Literature Review

1.1 Brief History of the Internet

Slight technological advances were made since mid 1900's which led to the eventual development of what we consider today to be the internet. In 1992 the World Wide Web was released and ever since it has been rapidly growing. Services were suddenly becoming available online. In 1994 you could order a pizza from Pizza Hut online. In the same year, the first online bank opened up. Today, there are several different varieties of services available. Most brick-and-mortar stores also feature an online version so that you can "window shop" online before coming into the stores. Others prefer just to save time and do shopping online entirely.

The internet has changed the way we do things. With direct deposit being mandatory with many workplaces and online banking options, some people do not even find it necessary to ever go to a bank. Banking can either be done online, or if cash is needed, most people find themselves dealing with an ATM, not a bank teller.

Instead of calling people on the phone, email is quicker and more efficient at times, especially within companies. What seems to be endless information is available within a few clicks on the mouse. The internet makes us feel like we have the entire universe at our fingertips.

The internet has undergone changes in speeds, and will continue to do so. With every change that is made, it is only natural that society will react and adapt

to the new and more efficient ways. People will become more innovative and start using the internet for things previously thought not possible.

1.2 Change from Dial-Up to Broadband

With fiber-optic internet solutions rapidly growing across the country, it is natural to wonder how this will affect the current state of the internet and how society will react to it. In order to get a better idea of these things, studying the changes that occurred when the general public switched from dial-up to broadband is helpful. Verizon especially is unaware of what users are going to do that has been previously unthought-of and other unintended consequences of high bandwidth.

When broadband was first offered to consumers, people became more digitalized. They were faced with the ability to do more online than ever before and statistics show that people took advantage of this: online entertainment (i.e. games, music, video clips) rose to 40% of broadband users versus the 24% of dial-up. Online shopping, banking and other transactions were positively affected too, as the number rose from 21% to 36%.

UCLA conducted the same study in the years 2000-2002 regarding the internet and how people were using it. From their study, it is clear that in those three years, dial-up usage was decreasing and broadband and DSL access was rising, as seen in the following graph.

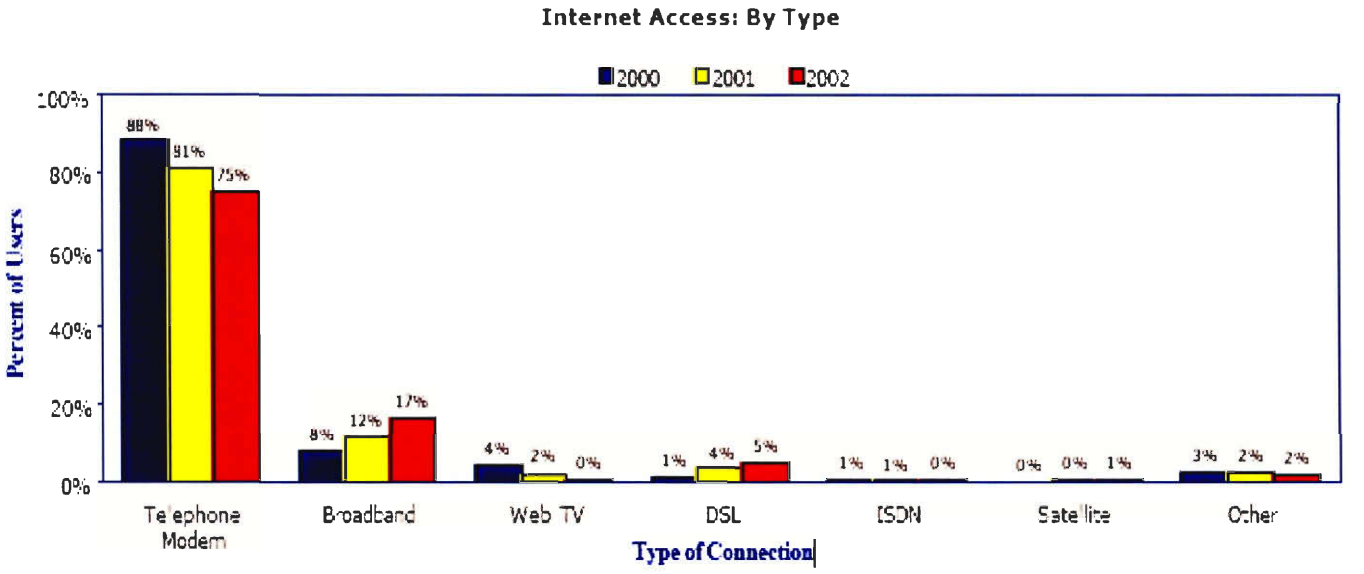


Figure 1.1

As part of the study, UCLA determined how often high speed users took part in popular internet activities, such as online shopping and instant messaging, as compared to those who used dial-up. In all cases, high speed users spent more time each week online than those using their telephone lines.

One previously popular activity has been steadily decreasing as internet use increases: watching television. Loyal viewers are not budging, but others are gladly giving up some of their shows in order to spend a few more hours online. The people who do not give up their television time entirely for use of the internet problem do both at the same time.

It has been found that those who are non-internet users do not use the internet mostly because they do not have computers. As technology increases and it becomes less expensive to buy a computer, the number of people who do

not use the internet will decrease. This is especially transparent be cause 47% of non-users said that in the next year they would be very likely to log on.

In recent years, as many as 91.8% of internet users said that the internet is an important source of information. Among new users, approximately 60% have said that is extremely important. Experienced users have ranked the internet above other popular resources as important sources of information, such as magazines, books and the newspaper.

On the contrary, users are not convinced that the internet is a good source of entertainment. Nevertheless, more broadband than dial up users think that it is, which supports the thought that with more bandwidth, there will be more entertainment value to the internet.

Another popular use of the internet is communication. Between instant messaging and emailing, sometimes communicating online can be more efficient than on the phone. As for multitasking, you can use these means of communication while partaking in many other things, such as doing online research, or online shopping. In addition, you may use pictures and other files you have on your computer to communicate your point better. Phones just don't offer that kind of service.

While it is a valid concern that people feel like we are all losing human contact because the internet is replacing the need for it. However, in a study which asked people if they thought they spent more or less time with the friends and family since they started using the internet, an overwhelming majority said that it's the same amount of time as before.

The current generation of children growing up probably does not remember a time without the internet, or they have always had it. This is very important, because to many of them, the internet is a normal part of life. The people who remain to be non-users are the people who are not able to adapt as well to new technology, unlike the children, who do not know anything different.

According to research done by Boston University Medical center, 85% of internet users go online at least once a day. This high percentage suggests that people have successfully integrated the internet into their everyday lives, and that this will only continue to happen. Even if people do not change their habits, technology keeps pushing forward and eventually people are forced to adapt.

1.3 Strategies of Telecommunication Companies

2.0 Methodology

Verizon is seeking to understand the implications and consequences of their new fiber to the premises service. A survey was produced and targeted at the appropriate group of the market. The target groups were early adopters and innovators.

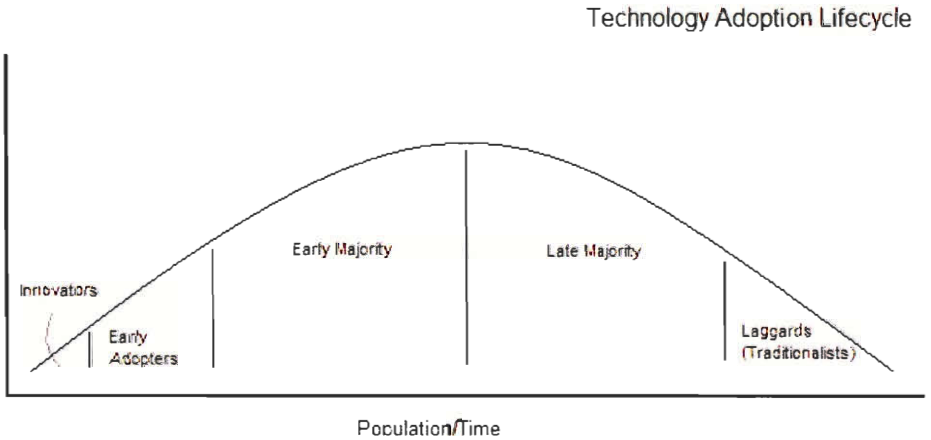
2.1 Objectives of the Survey

The intent of this project is to determine the unintended consequences of a new service. In order to look ahead at what might happen, some consideration has to be given to the current state of the practice. This directly led to the surveys objectives.

1. Determine how target users are currently using the Internet.
2. Determine how target users may potentially use the Internet with increased upload capability.

2.2 Targeting the User Group

Figure 2.1 represents the technology adoption lifecycle (Cravotta 2003). In this



model, Innovators, or bleeding-edge users, like technology for its own sake. They are most likely to try a new service or product knowing that their experience will not always be optimal. For example, in a software package, innovators would expect to find bugs or features that don't function as intended. In return, innovators expect a high level of support from the manufacturer or provider. All comments and technical issues are expected to be handled by support staff. For Verizon, innovators represent customers who are eager to sign up for the FiOS service because it is the newest, fastest service available.

Early adopters often have a vision of how to use new technology that will benefit them. For Verizon, users who see a potential advantage in switching to FiOS represent early adopters.

For the purpose of this survey, the innovators and early adopters are the groups being targeted. Successful establishment of a customer base before the product reaches the "Early Majority" phase is a critical milestone. Between early adopters and the early majority there is a gap, sometimes referred to as the chasm of death. In this time, the product will either catch hold or it will fail. College students were targeted for this survey because of their classification as "early adopters and heavy users of the Internet." A study from the Pew Internet & American Life Project reports that by the time today's college students entered higher education, computer use was a daily part of their routines, either at home, school, work, or a combination thereof.

2.3 Developing the Survey

A report from the Pew Internet & American Life Project explains how "college students' Internet habits can yield insight into future online trends." College students were one of the first groups to have broadband Internet readily available. Yahoo, Napster, and Google are just some examples of what college students have produced and demonstrate that these users are pioneers of new Internet technology.

Therefore, it was the intention of the survey to look ahead to the future of broadband Internet usage. Specifically, with increased upload capability, what new uses and activities can Verizon expect? The survey was designed to utilize a mix of factual and subjective question.

Appendix A is the first version of the survey.

Factual Questions

Factual questions were used to gather data on how respondents are currently using the Internet. The objective of the factual question was to illustrate what the user defines as its purpose as well as what methods the user was utilizing to complete their intended purpose. Multiple questions were used for the same objective to alleviate any lost data from "recall challenges."

The first question invited an open-ended response: "What are you using the Internet for currently?" This question was intended so that respondents could explain what their purpose for using the Internet is.

The fourth question in the survey fulfilled the second-half of the objective by allowing respondents to demonstrate the methods by which they satisfied their intended purpose. The question provided a list of online activities (e.g., send files via email, host files from your computer, upload music to a server) that respondents said they used either hourly, daily, weekly, monthly, or never. Other factual questions accomplished the objective of determining the hours during a day that the Internet is being used. One consideration of the new service that Verizon was load on the network – was there a time that load would be low? Two questions were used to gauge when respondents passively and actively used the Internet. Passively using the Internet was defined as "online but away." In these cases, a respondent may be signed on to an instant messaging service and have walked away while the client was still running. Active use of the Internet was defined as "sitting at your computer doing things." Although this breaks with recommended practices of avoiding ambiguous questions, the authors felt that respondents, college students, would be able to tell the difference.

Subjective Questions

Subjective questions were used to gather data on how respondents may use the Internet. Specific attention was paid to increased speeds for uploading. Through a short narrative and a chart comparing online speeds, the authors intended the respondents to realize that the capabilities of increased upload time using Verizon's FiOS service was much higher than any service that they were currently using.

Respondents were then given an open-ended question to theorize how they would use the Internet with faster upload capabilities.

The second subjective question focuses on how respondents would perceive their change in use of the Internet with increased upload capability. The same set of methods for achieving an intended purpose was taken from question four and given to respondents again. This time they were asked to indicate whether they thought their use of a particular method would increase, decrease, or stay unchanged. This question achieved the objective of determining how old methods would change in frequency of use because of the new service.

Appendix A contains the original survey.

2.4 Testing the Survey

As part of running a successful survey, the draft survey was tested on a small group of target users. By testing out the draft survey, the authors were able to determine any ambiguities or uncertainty in questions that could only be realized by people not already familiar with Verizon, FTTP, or FiOS.

The survey was tested on seven random individuals. The survey was given orally. The surveyor wrote respondents' answers and thoughts. Although the final survey would be delivered on paper and respondents would fill in their own answers, this method of delivery was chosen for the test to gauge respondents' reactions to the questions.

Question 1

The original text of question one reads: "What are you using the internet for currently?" This question was perceived by respondents to mean "What are you

using the internet for currently, as you fill out this survey?" This question was rewritten to reflect the authors' intent of discovering how respondents use the Internet while they are at home. The updated question reads: "Think about your internet use. When you are online, what are some activities you partake in?"

Question 4

This question was the last factual question that was attempting to establish what methods respondents use in order to complete their intended purpose of using the Internet. One of the activities originally listed was "Use P2P file sharing applications." The authors felt that the target users, college students, would intrinsically know that P2P stood for "Peer-to-Peer."

Peer-to-Peer file sharing systems are programs such as KaZaA and Bit Torrent. They allow users to share files across the Internet. In KaZaA, users input a search term, which searches through all the files on the network and returns the hits to the user who initiated the search.

Question four was rewritten to provide example of P2P file sharing applications. The question in the final survey read, "Use P2P (peer to peer, ie: Kazaa, bit torrent) file sharing applications."

Question 5

Question five was the first subjective question of the survey. The objective that this question was satisfying was what new ways respondents would utilize the Internet if they had increased upload capability. The original question read:

> You now have at least 5mbps downstream and 2 mbps upstream. How might you treat the Internet differently?

In the test run of the survey, respondents did not immediately think of a response. In two of the test surveys, the surveyor spoke about some potential uses of increased upload capability (as well as increased download capability). The surveyor mentioned some possible applications that are not practical today that would be practical with increased upload capability.

This impromptu conversation sparked the imagination of the respondents in question, and they were then able to then elicit a response to the question. Therefore, in the final version of the survey, the question provides some examples of activities that can be accomplished online with upload capabilities similar to those of FiOS.

The final question reads:

> You now have at least 5mbps downstream and 2 mbps upstream. Statistics show that people make their lives more digitalized whenever there is an increase in their Internet bandwidth. What are some ways in which you might do this? (Watch movies online/share personal video with family and friends, video instant messaging/conferencing, etc).

Special attention was paid to writing the question so that all respondents would interpret it in the same way. Appendix B contains the final survey.

2.5 Survey Delivery

A class of thirty students were administered the final survey. The class was Production Systems Design, a course that is frequently taken by students whose major is outside of the Management Department. Information systems majors who are acutely aware of Internet trends and new products also take the class.

Between these two groups, the authors are confident that the population was representative of potential innovators and early adopters referenced by the technology adoption lifecycle.

3.0 Results and Discussion

The survey went well for the most part. We were a little disappointed to see that students did not do well with the open ended part, which we intended to use to see what other young, innovative minds may imagine up. Only a few students actually bothered to write things in for that section, and otherwise it was left blank. Besides that, all other answers were satisfactory.

It was found that most people use the internet for email and using instant messenger programs, such as AOL Instant Messenger, with eighteen and twenty-one people using each, respectively. Other popular activities include using the internet for researching or just surfing through random sites. Some used it for news or multimedia purposes, including searching for TV theme songs. Shopping, banking, fantasy sports, weather, games, filesharing and use of myWPI portal were also among answers listed.

One answer that was particularly interesting was the use of Facebook. This website allows students to connect to other students from their school, or at other universities. Only select schools are able to sign up and currently from Worcester Polytechnic Institute alone, there are more than 3262 users. This is very interesting because of the speed that it caught on. This kind of service may

be what the future of communications is. A user can easily search for and reconnect with an old friend who maybe moved away in first grade. It would be interesting to see how other sites such as this continue to develop over the next years and with higher speeds available, maybe they can begin to offer more.

Some features of Facebook include being able to create groups and you can also list what classes you are taking. I think a video meeting option right on the site for groups to have online meetings would be a feature that students would be likely to use.

With our survey we also looked at how much time people spent on their computers: actively and passively. Just fewer than 50% keep their computer online all day with some program potentially running the whole time (such as an instant messenger client with an away message up) whether or not they are there.

Next we wanted to find out how often avid internet users participated in certain activities affected by upstream speeds and how changes in their upstream time would reflect their online activities.

3.1 Uploading Files to a Website

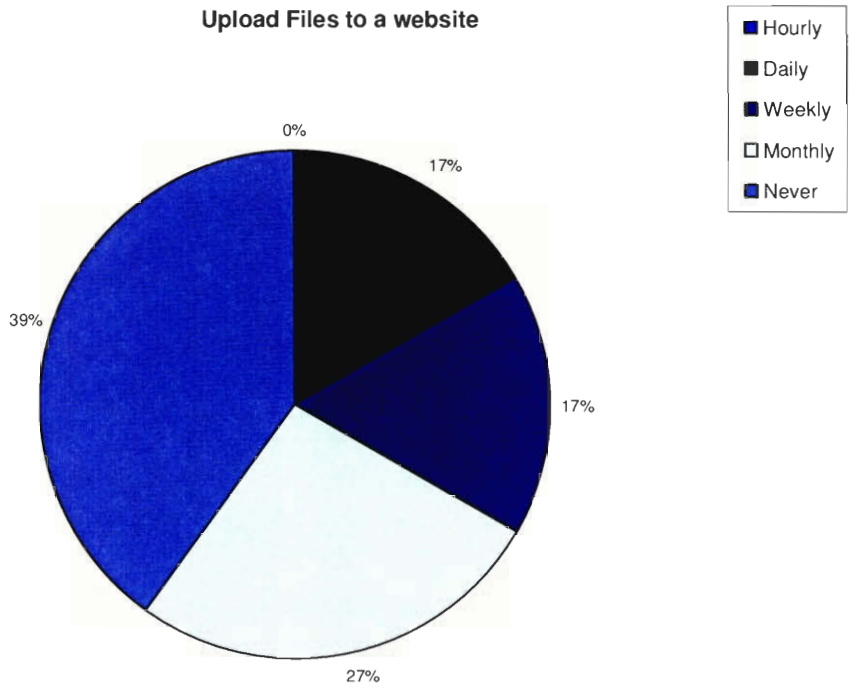


Figure 3.1

Just over a third of the people never upload files to a website, while almost an equal amount are likely to upload files weekly or more often. A smaller percentage did this monthly.

3.2 Sending Files Via E-Mail

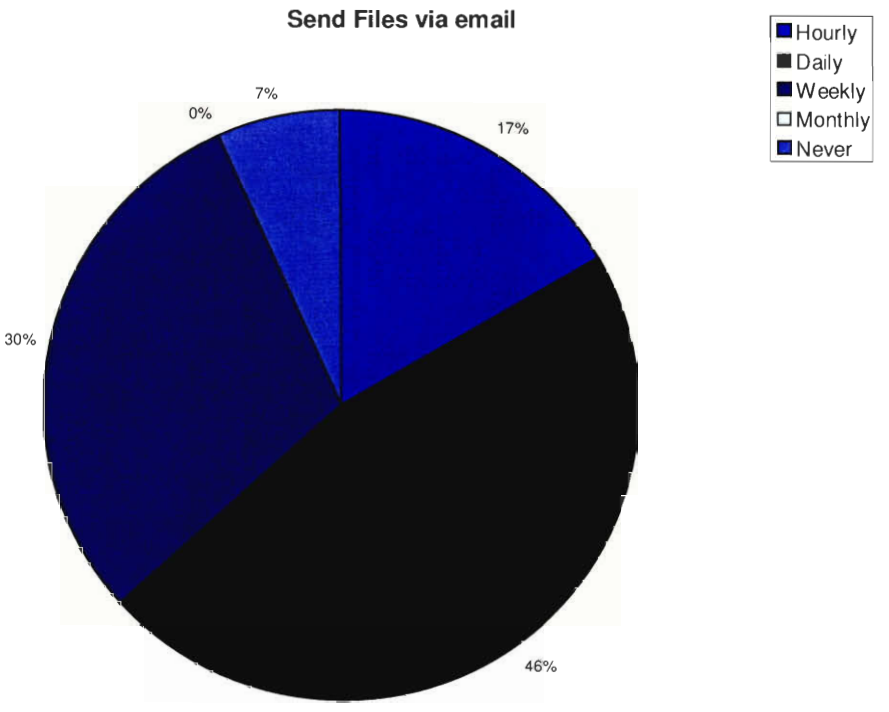


Figure 3.2

Just under half of the users take advantage of sending email attachments on a daily basis. With faster speeds, people may be inclined to send more and larger files, such as pictures or videos. Only a small percentage (7%) never sends files via email.

3.3 Sharing Files Over Instant Messenger

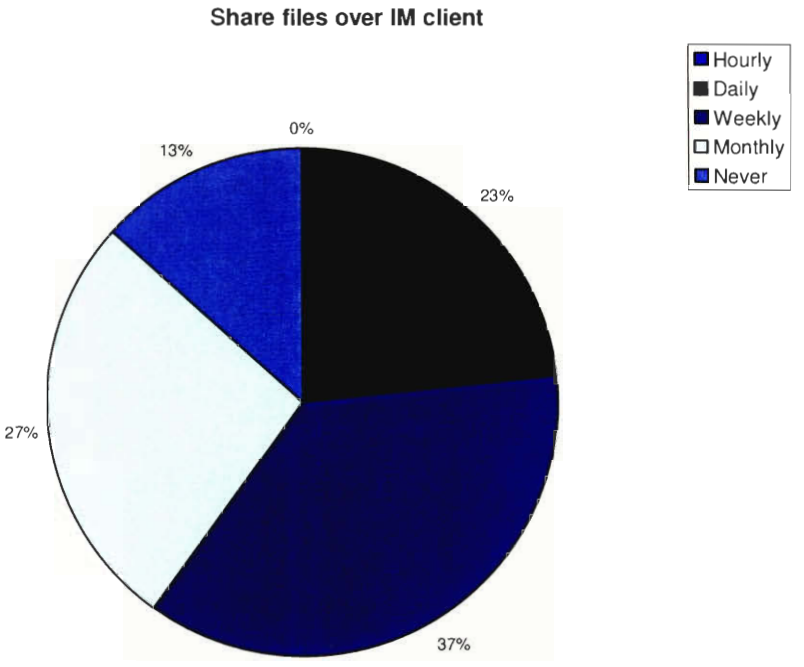


Figure 3.3

While there are no users who share files over instant messenger hourly, most people do this monthly or more often. The most popular group for this was the weekly group. Sometimes sending files over IM is faster and if it is a picture, it feels like instant gratification for what you were looking for.

3.4 Host Files from Your Computer

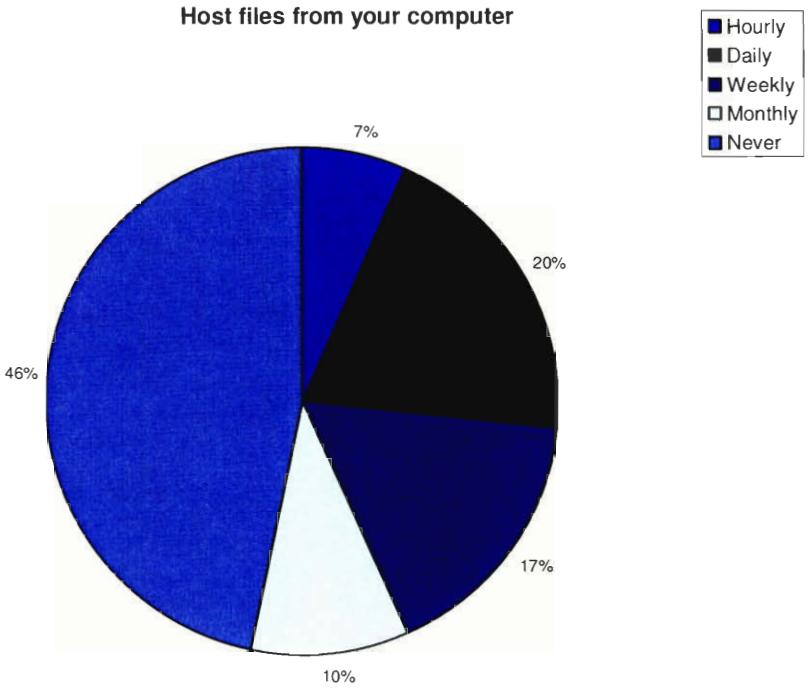


Figure 3.4

Hosting files from your own computer is not a popular activity for many, but others do it hourly or at least daily. In a later question, it was found that almost 20% of the people would do this more with higher internet speeds.

3.5 Play Games

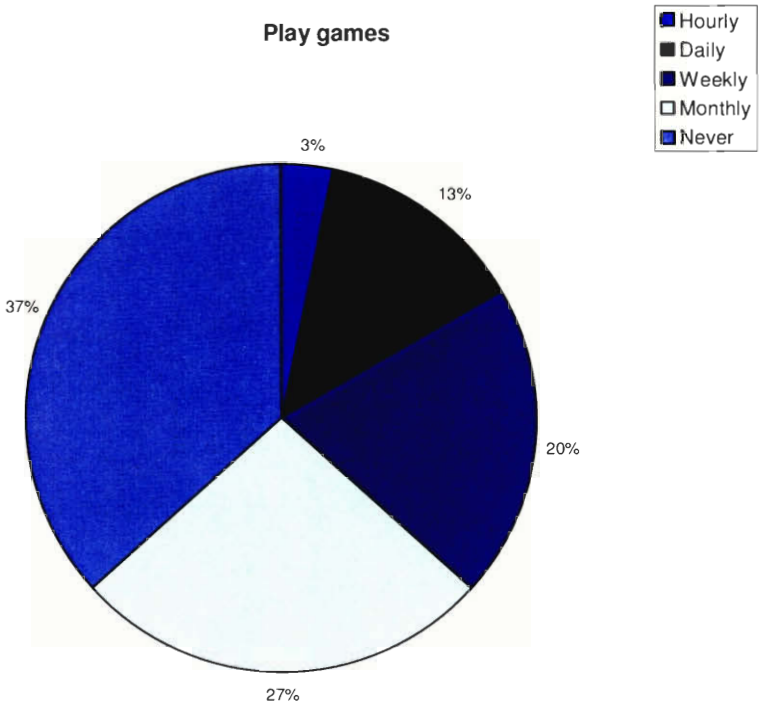


Figure 3.5

Some online games require fast speeds, and of course any game would be difficult to play with lagging speeds. As seen from the pie chart, a large percentage of people play games on a regular basis.

3.6 Use Peer-to-Peer File Sharing Applications

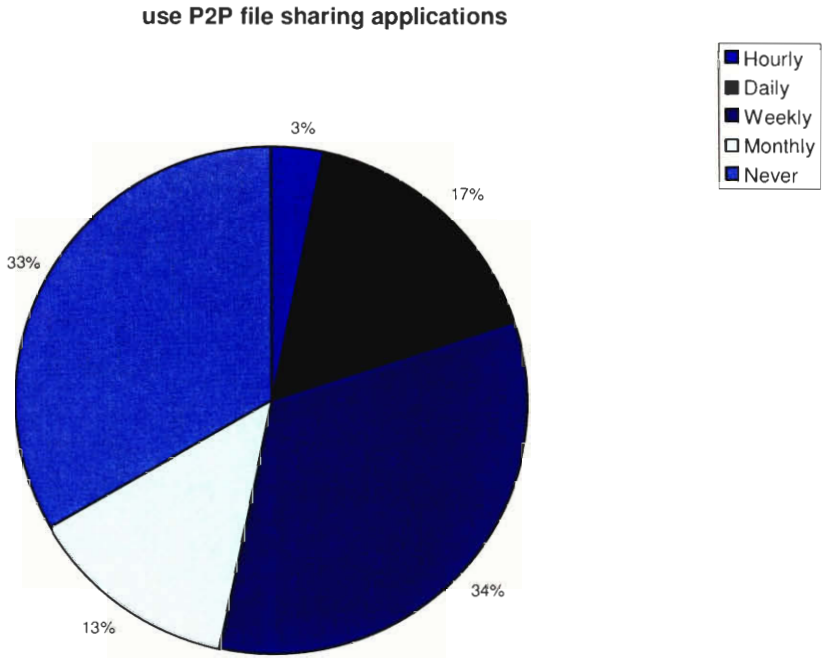


Figure 3.6

Two-thirds of all the users surveyed use a peer-to-peer file sharing program on a regular basis. Higher upstream and downstream speeds can only positively affect their usage because it will make better quality media easier to download. In addition, it will also prompt new types of media. Instead of focusing on obtaining music from the internet, videos will be more available. New services will emerge that can support this market so that hopefully society can avoid any illegal activity, unlike what happened with mp3 files.

3.7 Upload Music to a Server

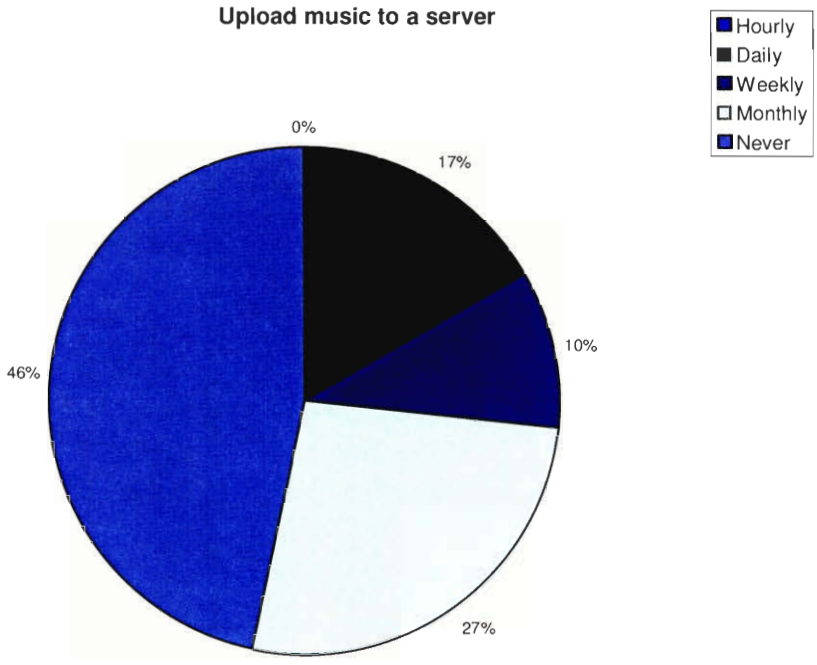


Figure 3.7

As seen, almost half of the survey participants do not upload music to a server at all, and almost a third does not upload music to a server on a regular basis. Many probably do not have a need to do this, while others are just not satisfied with the efficiency of the process due to their upstream network speed.

3.8 Upload Videos to a Server

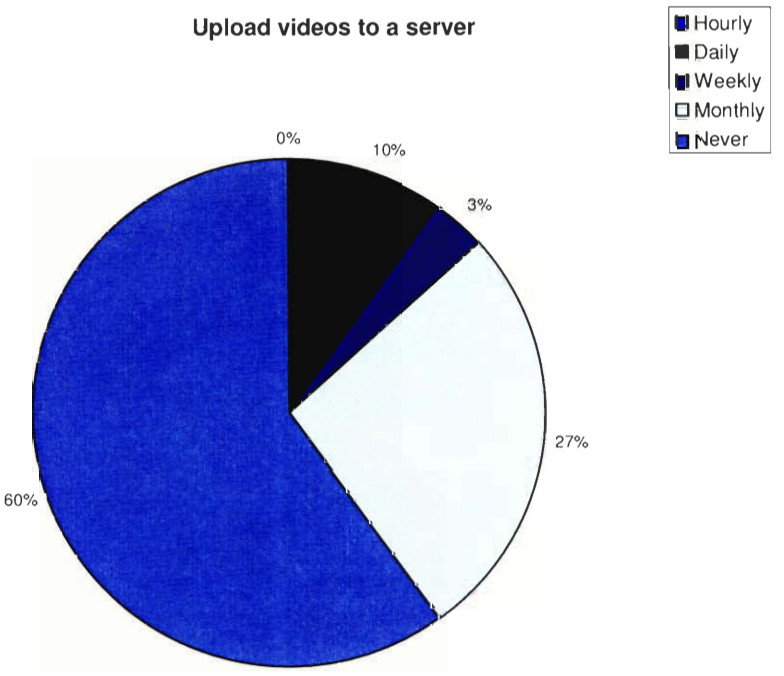


Figure 3.8

Unlike music, there is a very high percentage of users who never upload video to a server, or they do it very rarely. Based on the fact that more users never partake in this activity than with music, it is clear that people just do not currently have the upstream capacity to do this in a manner which would be deemed effective for their needs.

3.9 Potential Usage

Finally, seen in the graph pictured below, in all cases, there is a solid group of people who would do each of these activities more than they do now if higher upstream speeds were available to them. There are a couple people who

would do these same activities less, however it is likely that it is because they are substituting it with an activity that they could previously not do because of their internet speeds.

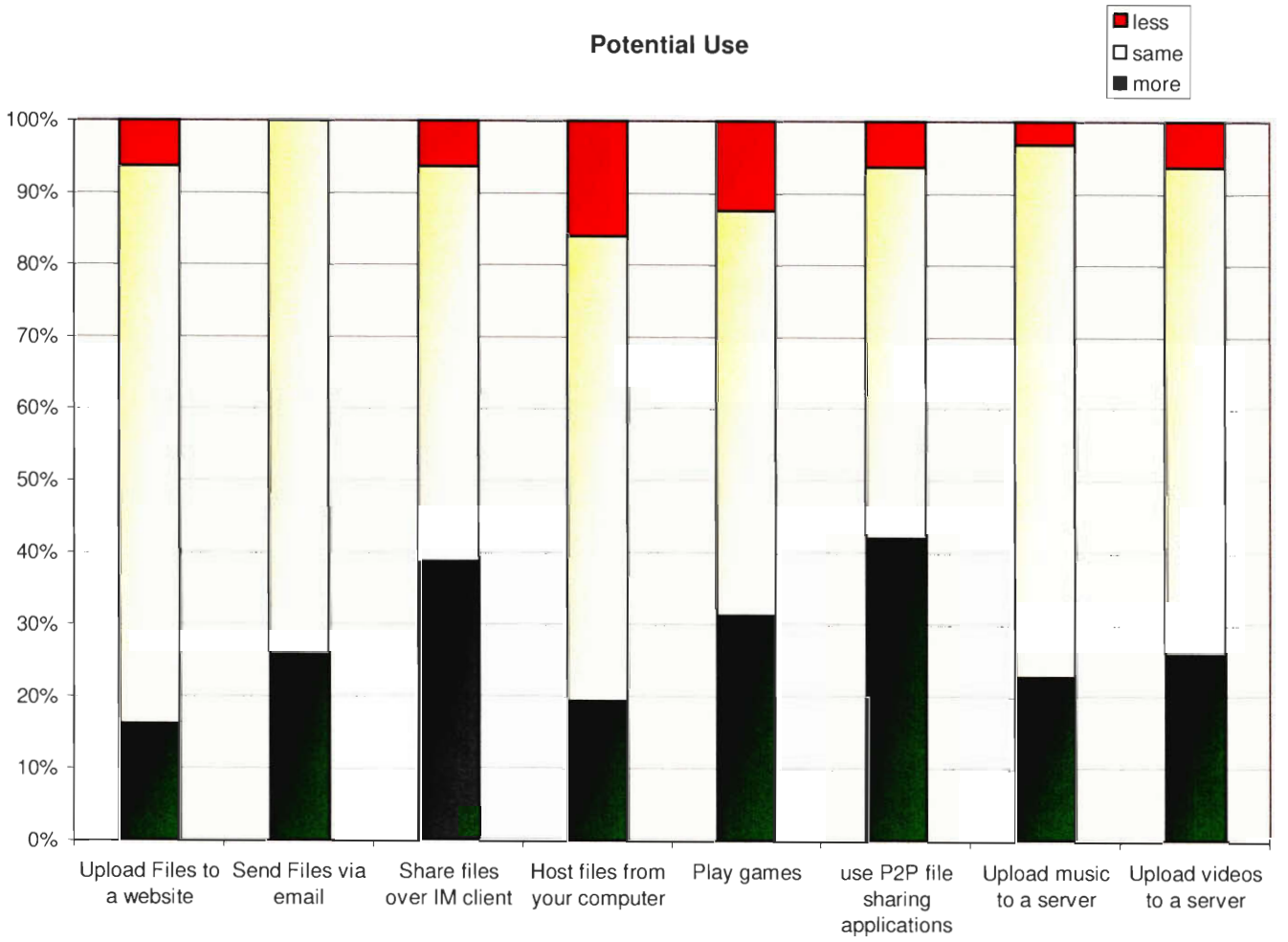


Figure 3.9

Conclusion and Suggestions

After taking into consideration user input and our own theories about what will occur when the general public starts using a fiber internet solution, we have concluded

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Internet Usage Survey

Current Internet Usage:

What are you using the internet for currently?

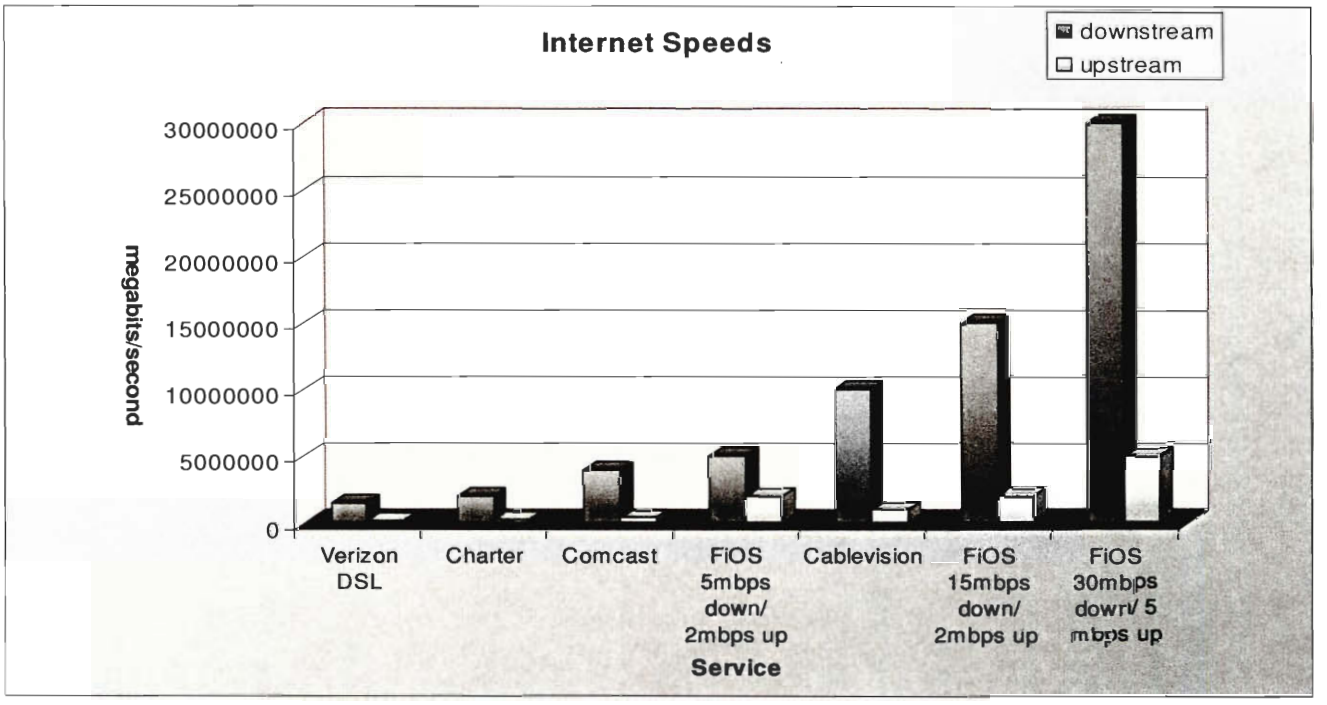
How many hours per day are you passively using the internet (ie: leaving aim on with an away message even though you're not there)?

How many hours per day are you actively using the internet (actually sitting at your computer doing things online)?

How often do you partake in the following activities?

	Hourly	Daily	Weekly	Monthly	Never
Upload files to a Web site					
Send files via email					
Share files over IM client					
Host files from your computer					
Play games					
Use P2P file sharing applications					
Upload music to a server					
Upload videos to a server					

Potential Internet Usage:



By looking at this chart you can identify what Internet Service Provider you may have now, and the Internet speeds you are getting from it. Verizon's new service, FiOS, has considerably faster downstream and upstream speeds than many of the others. Imagine that you were using this FiOS service as you answer these next questions.

You now have at least 5mbps downstream and 2 mbps upstream. How might you treat the internet differently?

Of the following, would you do more, less or the same?

	More	Same	Less
Upload files to a Web site			
Send files via email			
Share files over IM client			
Host files from your computer			
Play games			
Use P2P file sharing applications			
Upload music to a server			
Upload videos to a server			

Current Internet Usage:

Think about your internet use. When you are online, what are some activities you partake in?

How many hours per day are you passively using the internet (ie: leaving aim on with an away message even though you're not there)?

How many hours per day are you actively using the internet (actually sitting at your computer doing things online)?

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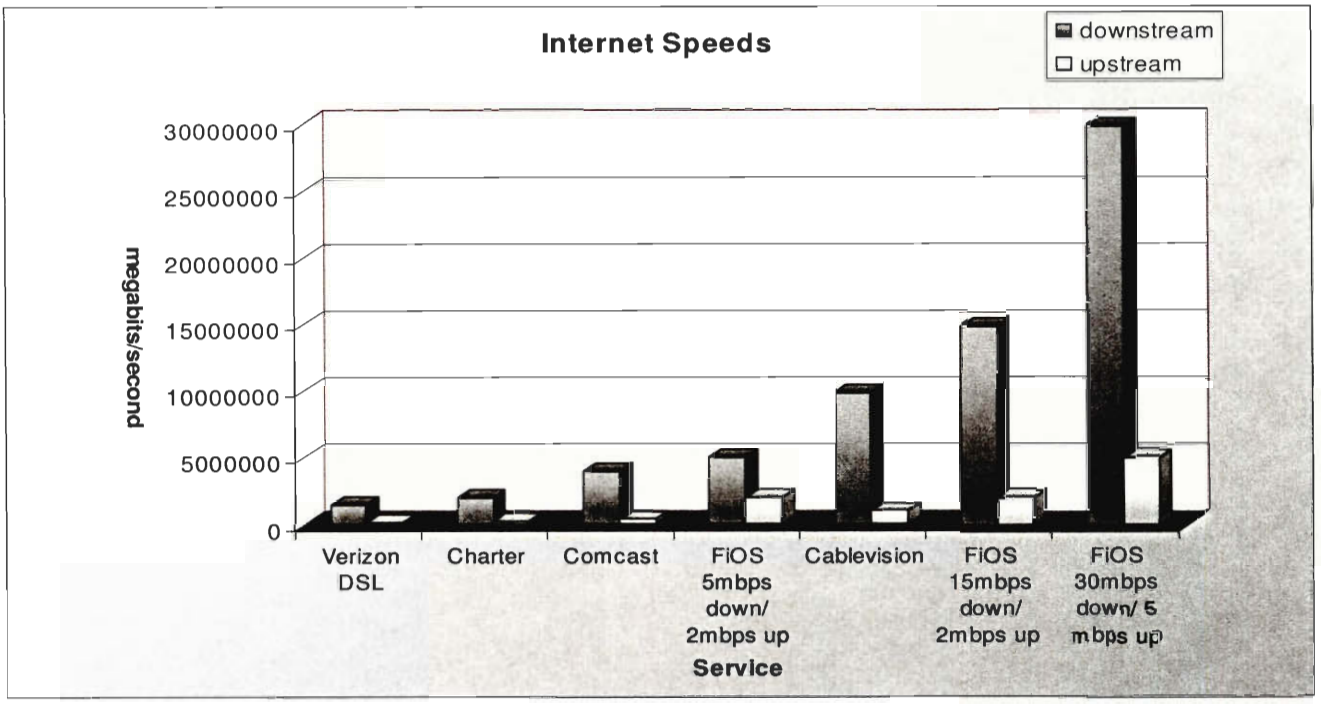
Potential Internet Usage:



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Of the following, would you do more, less or the same?

Upload videos to a server	More	Same	Less
Upload files to a Web site			
Send files via email			
Share files over IM client			
Host files from your computer			
Play games			
Use P2P file sharing applications			
Upload music to a server			