

ABSTRACT

Title of Document: A LOCATION-BASED COMMUNICATION
PLATFORM: INTEGRATING FILE SHARING
WITH INTERPERSONAL CONTACT

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Sharing on the Internet, even among computing devices in close proximity, is both inefficient and inconvenient. Online services and websites do not take advantage of easily obtainable geo-locational data that can improve sharing. We at Team FLIP have extended an existing mapping system called TerpNav with functionality that allows proximate users to interact and collaborate while sharing digital information. This study demonstrates both the feasibility of and demand for a more efficient and interactive method to exchange information among proximate networks of people.

A LOCATION-BASED COMMUNICATION PLATFORM: INTEGRATING FILE
SHARING WITH INTERPERSONAL CONTACT

By

Team FLIP (File Lending in Proximity)

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Thesis submitted in partial fulfillment of the requirements of the Gemstone Program
University of Maryland, College Park
2012

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Acknowledgements

First and foremost, we would like to thank our mentor Dr. Jim Purtilo who has provided us with invaluable guidance and wisdom. We would also like to thank Mr. Jim Miller for helping us with literary research and perfecting our thesis. Thanks to SEAM, who contributed greatly to what the FLIP application is today. We further appreciate the Gemstone program and staff for giving us the opportunity to pursue undergraduate research. Finally, we would like to thank our friends, family, and peers for their support throughout the years. You have all made our Gemstone experience one to remember forever.

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Chapter 1: Introduction

“Can you hear me now?” Since the advent of mobile telecommunications, the Internet, and the ever-blurring line between them, the marketing stress has always been the actual mobility of these devices. Advertisements continually emphasize how much more flexible and convenient one’s life will be when daily tasks can be done on the move rather than in a few set places. This model implies a world in which people are constantly in motion, and while before these travels were a chore now they can be merged with work and leisure with these new technological wonders. However, it is then very crucial that we ask how often we, and therefore by association our mobile devices, are actually in motion?

The average adult travels 32 miles in a day, and while that may seem a lot one has to consider that they are almost guaranteed to end the day in the same place they started - home. Coupled with an average commute of 25 minutes, this leaves little more than enough travel time to cover one’s trip to work and back. Meanwhile, the typical adolescent travels 8 miles per day, 4.6 of which are to school and back. This shows some room for multiple trips, possibly to sports practice or other leisure activities less present in an adult’s daily routine. While there is no data on college students, the figure would logically be lower. Given that the University of Maryland’s campus is only about 2 square miles, a student with four classes with locations spread generously around campus would walk about 3.5 miles. The reduced traveling distance can be attributed to most students living on or nearby to campus.

These distances may appear dramatic, but they are merely the result of geographical differences between the dominant focuses of our lives. These priorities

include one's home, work, possibly school, and then whatever leisure for which they have time left. Each of these communities is centralized around a geographical location, and involves a network of people united in one focus. People on the whole spend a very minuscule amount of time actually in motion, and are in fact simply using their mobile devices in multiple settings. It is this reality that completely counters the traditional thought regarding mobile devices and illustrates the necessity for a new model.

The current Internet focuses on connecting everyone and everything, and is very useful for this purpose. However, for the average person communicating with someone across the world or even the country would probably be a rarity, and a unique event in their day. The vast majority of the time we are actually in close contact with our intended audience. We mostly just need to talk to those aforementioned core groups of people such as family, friends, classmates, and colleagues. These groups are even focused around a central location. We see our family at home, classmates at school and colleagues at work. So if we are generally pretty near our audience, how does our technology join the conversation? This question leads directly to the idea of the geocentric Internet. How does the Internet aid and enhance communication between people who are actually very near to one another?

Our preliminary research found that it is actually very inefficient in these circumstances. The vast majority of peer to peer communication through the Internet takes place through remote email clients. These technologies take the literal form of traditional mail, focusing around messages sent specifically from one address to the

next. Relying on this traditional model requires every user to specify an address at which they can be reached. This concept was designed simply to fit the familiar “mail” metaphor, and was not necessarily the most efficient way to connect with one another. Our online presence does not have to revolve around an arbitrary identifier. People should be sharing with people, not inboxes. Shared files will obviously be associated with discrete identifiers; however, this idea should not be the focus of the user experience.

Consider a group of people in a room together whose conversation brings up the idea of sharing a digital file amongst them. This collaboration could be between students, colleagues, friends, or even multi-role groups such as a professor and students, presenter and audience, or employees and management. All people find themselves in these positions regardless of the roles they play. In fact, most address this situation multiple times a day, assuming different roles for each transaction. Regardless, this generic scenario includes the possibility of multiple transactions of any file type between any number of senders and receivers. Under these criteria which Internet technologies answer the call to action?

Currently email’s prevalence and ease of use make it the default medium. According to a recent Pew Internet survey, 92% of online Americans use e-mail, with 61% using it in the average day (Purcell, 2011). However, group meetings are generally called for the very purpose of people interacting, most often collaborating. If they only needed to send items to one another via email there would have been no reason to get together. Email exists as an impersonal tool, for better or for worse. In addition, the transaction requires every party’s email address. The users then have to

go around the room garnering the email addresses of their recipients. This process works for one or two people but quickly becomes tiresome with larger groups. When lecturers addressing larger audiences are considered, this task becomes beyond impractical.

A variety of services exist that try to attach a more modern user interface to this aging service. The main point of these technologies is to provide remote hosting services and then allow a user to upload files to this location. From there, the user can share the location of this file with one or more other users. All of the parties involved can then view and/or edit said file. The most popular of these products is Dropbox, which provides a very slick and intuitive user interface. The problem remains that Dropbox is still reliant on email and so still suffers from all of the problems inherent of being associated with an Internet address. While sharing files is slightly easier and more visually appealing, the initial costs of acquiring every person's address are now added on top of the cost of setting up an individual Dropbox account.

Free upload websites exist specifically to allow users to host a file online with a unique URL. Other users can then download the file from their web browser through said URL. Yet these websites are often difficult to navigate due to excessive spam and little real organization. Many have also operated with questionable legality, as evidenced by the Federal Bureau of Investigation's recent seizure of the website megaupload.com and arrest of its operators.

Many Internet users belong to one or more social networks, the most popular of which being Facebook. These allow one to upload files while remaining legal, for now. Yet these include their own difficulties as they are designed for browsing rather

than finding. In order to find a specific posted file another user would have to wade through much unrelated data such as their friends' status updates, general interests and family vacation pictures to get to the file for which they came to the site.

Unfortunately all of the connectivity offered by the Internet comes with a huge amount of baggage. Every Internet technology has some address to which we send this file. But within these scenarios why does anyone need this address? All parties are within earshot, they know exactly where the other is. In reality the general population has taken this wonderful tool and simply assigned it the role of fixing all of their problems. The Internet is far from the most effective way of dealing with these types of transactions, but is consistently tasked with handling them. The main casualty of this misappropriation is the division of the transaction into two components: online and offline. Conversations that lead to one party requesting digital information from the other suddenly come to a halt. In order for this transaction to occur, both people must now retreat to their separate in-boxes. There are now two interactions, one face-to-face and the other from behind computer screens. Despite the fact that the vast majority of personal data is digital, it cannot be added to a conversation because as soon as it is everyone involved must wade through one of these cumbersome systems to the point that the discussion is over.

Research Questions

In an effort to address these issues, we asked the following research questions to guide our project:

1. How can we create a file sharing system that allows users to connect to each other within a geographic area, starting with the University of Maryland?
2. How will this affect communication within classrooms, workplaces, and social settings?
3. How can a system like FLIP be used to benefit research in location based wireless networks?
4. To what extent will users be willing to adopt location based applications, particularly ones used for file sharing?

Hypotheses

We then developed the following hypotheses to test with our research:

1. Peer-to-peer file sharing is something that Internet users are both interested in and engaged in.
2. The use of location-based technology is prevalent among Internet users today.
3. Geo-centric users would benefit from a file sharing system built to take advantage of their shared location.
4. Current Internet technologies for file sharing do not take advantage of readily available user-location data.
5. There is a desire among Internet users to receive more information tailored to their location and the events around them.

Through our research, we recognized the need for a location-based file sharing application. In our study, we created FLIP (File Lending in Proximity) with the goal

of providing people with an easy, convenient, and safe way of sharing files among proximate users. FLIP organizes each user's networks as a layer, so can also separate transactions between multiple groups of users. These layers could represent various hierarchies of the same network such as project teams or various levels of management. Or, they could involve completely separate groups such as a person interacting with different social circles. These groups can also overlap to mirror real world situations. A student may wish to receive lecture material from a professor, supplementary material from a TA, as well as homework advice from a friend, without interaction between these parties.

Now FLIP as it stands today is not a bulletproof, complete application but a robust prototype sufficient for us to evaluate our hypotheses. The underlying TerpNav (Cigna et. al 2009) mapping capabilities have proven to be tremendously reliable, and the core engine has served the campus consistently for several years. Our apparatus benefits from this quality and performance. The research detailed in this report actually shows that the FLIP system can be considered on the same level of convenience as file-sharing technologies, such as Dropbox, flash drives, file-hosting sites like MediaFire, and AirDrop. However, the better mousetrap approach alone is not revolutionary. The truly remarkable result from this research is the success of this new communication model proposed by the FLIP system and its accompanying research.

By recognizing and managing nearby users, FLIP provides the ability to seamlessly bring digital information into the conversation. FLIP strives to allow interactions to reach a point where there is no longer a harsh contrast between the

conversation and its online equivalent, and this dynamic vastly improves real-life interchanges.

Relationships between professors and students, employers and colleagues, businesses and customers, and most importantly just between any group of people in a room together, no longer have two separate interactions because the digital and physical world work as one.

Chapter 2: Literature Review

Research for this project is grouped in five different categories: ad-hoc networking, file-sharing, location services, wikis and social networking. This chapter chronicles the progression of our project from its inception to its current state.

Ad-hoc Networking

Our team formed under the goal of revamping electronic music distribution, but quickly broadened our scope to all file sharing through wireless networking. The problem we saw was the inconvenience of sharing electronic files. When two people have a conversation face to face, sometimes the need arises to transfer digital data from one of their electronic devices to the other. At the time, we would have thought of an email attachment as the fastest way to transmit a digital file. But why go through the Internet when the recipient is standing right in front of you? Shouldn't there be a faster and more direct way?

In discussing these questions, we considered the concept of ad-hoc networking, which simply refers to a collection of devices that connect to each other wirelessly but still operate independently from one another. Imagine connecting two devices with a USB cable. Our idea was to create this sort of connection wirelessly and with multiple connections. There are two ways of implementing wireless ad-hoc networks: “single-hop” and “multi-hop”. Single-hop was limited in that one device could only share data with devices it was directly connected with, and there is an upper limit to the number of unique connections that a single device can make. Multi-

hop allows a device to connect with another that it is not directly connected with, but indirectly through other devices. To extend the cable metaphor, multi-hop systems would allow two iPhones connected to a single computer to communicate to each other through the computer.

We saw myriad uses for ad hoc multi-hop networks. On a college campus, where virtually the entire campus has wireless coverage, ad hoc networking is not typically necessary. But outside such an environment, the need for direct connections with others becomes more apparent. For example, a group of researchers at Texas A&M University came up with a disaster response system called DistressNet that operates using ad hoc networking protocol. DistressNet's purpose is to provide infrastructure with which rescue teams can work in the wake of a significant natural disaster (George et al). The system uses different levels of connections to form a larger network that includes all rescue workers, first responders, support staff, and site overseers.

The lowest level of this system is called BodyNet, which refers to monitoring systems worn by first responders and rescuers. These monitors have ad hoc wireless capability and exchange information with one another pertaining to the physical status of the wearer, as well as location and other various bits of information. The next level, VehicleNet, then gathers the information exchanged by BodyNet and organizes it. The VehicleNet nodes, as the name suggests, are located on vehicles near sites where those wearing BodyNet monitors are working. The vehicles then communicate with "AreaNet" hubs, which are static nodes that can monitor the

activity of all the nodes in the area. The AreaNet then grows as more workers arrive and thus the pertinent network can cover the entire disaster area (George et al).

We looked for a collection of devices that connect to each other wirelessly and form an interconnection that allows these devices to remain independent. This concept has been proven to work with Microsoft Windows with the IEEE 802.11 protocol, which can use "multi-hop" (the ability to connect to a remote machine using an intermediary device that is also part of the network) capabilities even with machines that are only designed to be compatible with single hop (Yinan, Song, Xueping, & Weiwei, 2008). However, the method described in most research is a circumvention of intended functionality; most of the research we have encountered relies on "hacks" rather than technologies that will actually appear in consumer devices. For example, the implementation developed by Yinan et al required the researchers to write their own driver that was specific to the one platform they were working on.

Furthermore, while Sharafeddine and Maddah (2011) proposed a new lightweight form for energy-efficient mobile-to-mobile file sharing applications, the technology is not yet readily available to the public. The proposed scheme is to exploit the difference between sending compressed data and sending small amounts of data. The data would be sent in a lower number of bits if compressed, meaning less energy is transmitted.

One issue with ad hoc networking is its ability to support a large number of nodes. In "Safari: A self-organizing, hierarchical architecture for scalable ad hoc networking" (Du et al., 2007), the authors address the issue of scalability of learning

and maintaining routing states for large ad hoc networks. They developed an architecture called Masai, which is a scalable and self-organizing protocol. Masai organizes nodes into different cells and this allows both stable and mobile nodes to interact with each other and smoothly transition in order to deliver packets successfully. This addresses our team's original concern of mobile nodes; how would the flow of information through the remaining nodes be affected if one node were to leave? Nonetheless, this protocol is not widely available to the public and we did not have sufficient time or resources to study how to implement this protocol in an ad hoc system that we would build.

So how could we use existing and available technologies to build such a system? One of the options is Bluetooth, which is a viable option when dealing with direct linking of two compatible structures with wireless capabilities under limited circumstances. While Xiao and Pan (2005) show that Bluetooth can allow devices to share information with one another within a certain distance, it is not an ideal platform upon which to create an ad-hoc file-sharing mechanism. The Bluetooth concept requires one device to assume the role of "master," while the other is "slave" (Xiao & Pan, 2005), but a system like this leads to problems when trying to create a system that can easily expand and contract. If a master of several slaves were to drop out of the network, this could result in many slaves losing their connectivity. Their article points out that while it is possible to do ad-hoc networking with Bluetooth, an ad-hoc network requiring multiple "hops" - meaning one where information is retrieved from a device more than one connection away - is at best algorithmically expensive and at worst technically impossible.

Wi-Fi has several advantages over Bluetooth, which makes it a more suitable candidate for use in the technology we hope to see in the future. While Bluetooth has a very limited range of 10 meters (McDermott-Wells, 2005) Wi-Fi has a greater and more flexible range. Bluetooth is also much slower, with a transfer rate of 1 megabit per second whereas Wi-Fi can transfer up to 3 megabits per second (Rashid & Yusoff, 2006).

The protocol that we originally planned to use was Wi-Fi Direct, an official extension of IEEE 802.11. The Wi-Fi Consortium intends Wi-Fi Direct to be a standard that exists for all platforms and will require only a manufacturer-written driver upgrade. Wi-Fi direct "will be built directly into consumer electronics and automatically scan the vicinity for existing hotspots and the gamut of Wi-Fi equipped devices, including phones, computers, TVs, and gaming consoles" (Kharif, 2009). Wi-Fi Direct is an implementation of the Ad Hoc feature of the 802.11 protocol. It will allow devices to act as both access points and connected devices, requiring no external infrastructure but the devices. However, the release of Wi-Fi Direct was repeatedly delayed, and we couldn't keep waiting for a technology that our project hinged on. For this reason, we decided to use the Internet and go through a centralized server after all, simulating the type of connections that would be made available through these technologies, even though it was not our original intention.

File Sharing

Studies have shown that the most common files searched for on existing file-sharing systems are music files (View of the Data on P2P," 2009). The same study

also demonstrated that people who shared the most files had the most file type searches in common with the others in the survey. These figures are important to note because they show how we should tailor our software to different uses.

Another study about a product idea similar to ours, Push!Music (Hakansson, Rost, & Holmquist, 2008), demonstrates that a peer-to-peer mobile file-sharing system had great success when implemented in a social situation. The researchers defined success as a significant increase in the number of file transactions between users, as well as positive qualitative feedback. This particular method of sharing, peer-to-peer instantaneous music sharing, causes a rapid increase in sharing activity. The exact sharing process happens as follows: a mobile device with Push!Music checks for nearby devices with the program and connects to them wirelessly. Media agents then check the status of media on these devices, matching music amongst them. Based on users' sharing settings, new music will jump from device to device, resulting in a network of shared media. While certainly a source of inspiration for our project, their system only allowed transfer between two users and added few new innovations to the field of software engineering. Push!Music's success within the confines of this study reflects positively upon our team ambitions for peer-to-peer sharing.

A study about the willingness of people to share and what causes people to share files with one another also contributes to our product design. The results show that people will share depending on (a) Emergency, (b) Trust of the initiator, (c) Gender, (d) Individual benefit, and (e) User familiarity with technology (van de Wijngaert & Bouwman, 2008). Using these key points, we can determine the success

of our unique application of existing technology. We can infer that the second most important of the file-sharing prerequisites, “trust,” can easily be established with our software due to the proximal nature of sharing when using our product (Morvan & Sené, 2006). Gender, for us, will be evident, and individual benefit will be immediately discernible when in close contact with the file sender. People will often literally be able to see the other person they are sharing with, providing both an implicit trust and means to determine the worthiness of this person in keeping with the criteria. According to the van de Wijngaert & Bouwman (2008) study, our project will be successful upon application because the standards by which people judge whether or not to share their files are all met by our product. The study further showed that ad-hoc networking is a viable system to use when dealing with activity of this nature.

Location-based Sharing

It’s easy to assume that wireless networks work flawlessly when implemented, but that is far from the truth. Any applications that use these networks are only as good as the networks themselves. While FLIP is focused mainly on creating software that allows connectivity between mobile devices based on proximity, we are also taking into consideration the stability of wireless mesh networks, as it is our hope to one day move our application off the Internet and allow for operation independent of a centralized infrastructure. There have already been advances in technology such as Wi-Fi Direct and the Serval Project (<http://www.servalproject.org/>) that are attempting to pave the way for decentralized communication, but how will they stand

up to the tests of network size and large numbers of relay nodes? In “Understanding and Tacking the Root Causes of Instability in Wireless Mesh Networks”, Aziz, Starobinsko and Thiran (2010) conclude that stability is not an issue in CSMA-based linear wireless mesh networks with only three-hops. After three-hops, a “stealing effect” overtakes the nodes and creates significant transmission delays. This is potentially a problem with FLIP’s hopes for the futureintended usage since we hope to have information jumping across several nodes if the application is to be removed from a centralized server.

However, Team FLIP acknowledged the difficulty in creating an application that relies solely on ad hoc networks as the venue for communication. Thus, as a stepping-stone, we developed an application that will use the Internet as infrastructure to determine which devices are proximate to each other. In "Discovering the architecture of geo-located web services for next generation mobile networks,” Linwa and Pierre (2006) discuss what transitions a mobile device must go through when leaving one geo-located web service to another. Geo-located web services (GLWS) are services on the web that are only offered to a certain geographical area, and once the user steps outside this area, the service can no longer be reached by that user. FLIP’s application is all about being able to access data while one is proximate to the data origin, and these geo-located web services are a good example of location-based access. The paper concludes that synchronous APIs are necessary for a smooth transition from one GLWS to another, and this should not be an issue since users running the FLIP application will be using the same API. This paper also introduces

the idea of having a migration manager, a part of the program that specifically helps devices detect and switch to other services.

One prominent concern FLIP has had about running a location-based application is the battery life of mobile devices. Any battery drains quicker when using geolocation due to the fact that the device has to constantly check-in with global positioning satellites. Even something as simple as operating on Wi-Fi leads to battery drainage. In "A Quantitative Analysis of Power Consumption for Location-Aware Applications on Smart Phones" (Anand et al, 2007), researchers tested various battery-saving methods and concluded that on average, a smart phone can run at most six hours while continuously using location services. To maximize the running time, they recommend that programmers should try to offload computation to servers whenever possible. This is a good suggestion for FLIP's Internet-based model but since FLIP hopes to move to ad hoc networking as the basis for inter-device communication, the battery life of these devices would most likely be shorter than if they operated FLIP's application that uses central infrastructure and servers. The researchers also suggest incorporating a motion-sensing mechanism where if a user is not moving, the device would check in less frequently than if the user were in motion.

In "An open architecture for developing mobile location-based applications over the Internet," Jose, Moreira, Meneses, and Coulson (2001) discuss the concept of creating an architecture that allows new components to be added or removed without having to change the central infrastructure of the application. This is particularly interesting for FLIP because we hope to create an application that is self-governing and constantly evolving through user-generated wiki data. The authors talk about

several models, one of which is a proximity-based model. In it, a client is able to set a specific range and discover other servers within that range. As FLIP also realized, this creates problems of scale and how large users want the range to be. Too small a range could mean that the open architecture is barely modifying itself, while a too-large range would mean constant change. Stability and speed issues also arise from this model.

Team FLIP hopes to improve the social lives of its users by allowing them to connect to each other in new ways. FLIP focuses on proximity and location-based file sharing in a social setting. In a world where connecting to the Internet means connecting to millions of others in unknown locations, it is beneficial to know what information is available and/or generated from the locations close to you in real life. According to Fusco, Michael and Michael (2010), adding a location-based service to a social network builds connectivity amongst users. Not only do we know who a user is online, but also where he is located. Users feel a greater level of relation to others users who are geographically close to them, and the information that these proximate users generate is perceived to be of higher relevancy.

Location-based services have the potential to strengthen connections between users but at the same time, privacy and trust are key components that determine whether relationships are positively or negatively affected. Providing greater security over a social network with location services builds trust among users, but this trust can easily be abused. FLIP is working to find a way to verify a user's identity or limit the application's audience in the beginning stages so that spam and other malware do not become an issue across the layers of file-sharing. Bhuiyan, Yue and Josang

(2008) propose that public reputation will be sufficient in a community of users who mind what others think of them. In the FLIP context, this is a good natural source of protection against unwanted actions or users because each file or object that a user uploads is tagged with a location and name, and users on FLIP layers are all proximate to each. This means that they should be more likely to be mindful of their reputation because they are not part of the anonymous web on FLIP, but rather identities that are recognized by members of the community around them.

"A Hybrid Mobile-based Patient Location Tracking System for Personal Healthcare Applications" (Chew et al, 2006) presents one area in which FLIP could potentially be useful: healthcare. While FLIP hopes to use its layered maps for security functions, this paper addresses the matter of emergencies and personal health monitoring. FLIP's intention of secure file-sharing means that when a user goes to a doctor or anywhere that requires him to give out sensitive medical information, others may only see that data when he is proximate. Once the user leaves, the offices no longer have access to this data, making it more secure for the user. Chew, Chong, et al. (2006) discuss how in emergencies, locating services could be life-saving. The importance of this could easily be worked into FLIP's application by having an "emergency" map layer where users could signal distress to those proximate to them.

Another setting that our team sees great potential for its file-sharing services is the office setting. Sharing based on proximity creates efficiency through bypassing unnecessary log-ins, typing of email addresses, and other hassles. FLIP creates an online environment that mimics the one in reality, where documents are distributed to users proximate to the owner, only it is in electronic form and physically tangible,

thus allowing users to connect instantaneously online in addition to offline. “An Indoor Location-Based Social Network for Managing Office Resource and Connecting People” (Wang et al, 2010) studies how efficiency in an office setting could improve by using Wi-Fi as a means of locating employees. In their study, employees use various mobile devices, laptops and computers running Nokia Find & Connect to manage office resources and connect with each other in a social environment. Their study looked at the increase in efficiency if users knew beforehand which office resources such as meeting rooms and desks were occupied. In the FLIP application, this is easily implemented as when users update their location, it is instantly shown on the map for others to see, i.e. a meeting room populated with dots means it is occupied.

Wikis:

The adage of “two heads are better than one” continues to be the basis behind crowdsourcing, the practice of outsourcing a task traditionally done by a small group of professionals to a very large group of laypersons. The wise combination of crowdsourcing and a team of administrators created the acclaimed Wikipedia, defining an entire genre of Internet activity. In theory the idea has been berated for years despite consistent acclaimed success. Critics of the Wikimedia projects assert that when the common person is given the ability to vandalize there is no reason to think they will not do so. Even Wikipedia has a page evaluating its own reliability (Reliability of Wikipedia, 2012). Nature magazine published an article evaluating the accuracy of a variety of sources and found Wikipedia to be about as accurate as the Encyclopedia Britannica (Nature, 2005). The study evaluated only a few of the

millions of articles that coincided with topics regularly hosted in the magazine. Within these topics not only were the categories of depth and coverage lauded as of a “high standard” but also contained low levels of “serious errors” relative to traditional encyclopedias. Furthermore, these serious errors were nearly always labeled as “errors of omission [of material designated ‘critical’],” rather than factual inaccuracies. A later study by IBM actually concluded that “vandalism is usually repaired extremely quickly - so quickly that most users will never see its effects” (2003, IBM). This research took place only two years after Wikipedia’s founding and long before its army of part-time experts, yet still found it to have “surprisingly effective self-healing methods.”

A wiki exists as a communal space open to contributions and edits from a large group of users. This space can then reflect whatever it is that the overriding majority demand. While each contributor may only have a small contribution, the teeming volume of other user contributions both create a fully detailed final product as well as edit out most errors and bias. The internet has proven able to empower these crowds to apply wikis to other applications, although Wikipedia remains the standard against which their success is judged.

Communal Space and Contributions through Crowdsourcing

The Internet in its entirety can easily be labeled a wiki, for its use and wonder come not from a single source but from the tremendously complex integration of piecemeal contributions. In Internet Law professor Jonathan Zittrain’s article, “The Generative Internet,” he praises the collaborative development of the Internet and the

technologies surrounding it. Zittrain supposes that had the Internet been closed to amateur tinkerers from the beginning, “many of its unusual and now central uses would never have developed because the software underlying those uses would have lacked a platform for exposure to, and acceptance by, a critical mass of users” (p. 1977). Essentially, the Internet was tailored to the very community forging it, ensuring its continued relevancy and use. Information sharing and cooperation have led to great advancements in the web, and by using a model which allows for collaboration and openness, Team FLIP hopes to create a long-lasting, generative software.

The academic community in particular remains adverse to skeptical about the introduction of wikis, with a concern that unchecked introduction of content will lead to inaccuracies and even lies. Knobel and Lankshear detail the rift between Wikipedia and academia as a general misunderstanding due to cultural and generational gaps. “Wikis, Digital Literacies, and Professional Growth” approached the issue as educating an audience on a new technology (Knobel & Lankshear, 2009). Work with students demonstrated clear advantages wikis brought to the classroom, namely by allowing the teachers themselves to contribute and share their material. The general results found that the overall distrust in the system came from unfamiliarity with the technology. These insights hold true when implementing any unproven technology; FLIP aims to provide easy entry into the system even to those with little technical expertise.

Even the United States Navy has taken an interest in the benefits of crowdsourcing through the most innovative war game ever designed. Merchant

vessels traveling through the Gulf of Aden and The Arabian Sea along the coast of Somalia have faced the threat of pirates for the better part of the last decade. Since 2005 the number and area of reported pirate attacks have steadily increased every year (Law, Hutchins & Brutzman, 2012). This problem is compounded with increasingly limited resources available to police the growing network of shipping lanes at risk. The international community, though vehemently continuing anti-piracy campaigns throughout the region, repeatedly found that “the diversity of solutions is restricted to only a select few who are often like minded.” (Law, Hutchins & Brutzman, 2012). The Office of Naval Research built a system designed to remove any barriers of entry to addressing this problem and allow a completely new segment of the population into the brainstorming process, “Massively Multiplayer Online Wargame Leveraging the Internet” (MMOWGLI) (Dillow, 2011).

Far removed from war video games, MMOWGLI is a wiki where users can post strategies that address complex geo-political issues to advance either the side of the Navy or the pirates. A new move by a player would take one of two forms: to defend the status quo, or innovate a new solution. Other players can then respond either by expanding on the idea, countering it, adapting in a new direction, or exploring it to gather additional information. An idea that elicits a response from another player earns a point for its creator. Players are rewarded handsomely for ideas that lead to chains of responses and further conversation from the crowd. Over 15,000 ideas were posted; each linked to one of 68 action plans towards combating piracy. While the complete results of the game were not posted, only months later the ONR announced a new online war-game on the same MMOWGLI platform. The new

module will focus on increasing the U.S. Navy's warfighter effectiveness by reducing the heavy reliance on a finite, expensive, and unreliable supply of fossil fuels.

Wikis are at heart simply a collaboration medium between peers, inheriting their traits for better or for worse. Just as crowdsourcing accesses a theoretically infinite knowledgebase, it is also open to an infinite amount of possible misunderstandings. Yang, Wu, Lin, and Yang demonstrated that wikis can be applied very effectively to small research groups. These individuals highly educated and experienced in a very specific area, become faster at accumulating and storing collective knowledge. "They not only help users learn new knowledge much faster, but also make better use of the knowledge. More importantly, new (members) can build up fundamental knowledge in the field faster." (p. 349). FLIP is not a pure knowledge management system like a wiki, but can be adapted to act as one when features benefit from user collaboration.

Wikis and Location

User-generated data paired with location tags introduces an entirely new method of sharing. There already exist options for bringing wiki-like geospatial information into a learning environment, albeit most of this is geared toward specialty groups. For example, in "A Geospatal Wiki for m-Learning," Safran and Zaka (2008) describe a specialized Wiki called TUgeoWiki and corresponding mobile Java software which allows users to utilize their current GPS-derived location to create and add to existing Wiki articles. Users could search for Wiki articles associated with their current location and upload photos from their location in order to contribute to

these articles. However, the end result described in their article is one that only serves the very specific purpose of introducing location to Wikipedia's existing structure. FLIP reaches higher. Research on the University of Maryland student population showed this aspect of location-based technologies as a mere fraction of the likely uses students foresaw. The FLIP system strives to create a very simple standard on top of which applications such as this can be easily built. By creating a clear, concise, and simple way of organizing local information, user generated content of all types would flourish.

In their article, Safran and Zaka mention Panoramio, a geo-located photo sharing service that overlays photos onto Google Maps and Google Earth pages. As opposed to being just a photo-sharing service, FLIP provides extended functionality, allowing any kind of file to be uploaded and for location-relevant files to become more obvious to the user.

GeoSpaces, a tool used primarily by United States Department of Defense and National Intelligence Community, is a commercially available geo-spatial "whiteboard" system. The software allows for an enterprise's information to be laid out over a persistent map, with location-specific information placed directly at the location with which it is associated. For example, it has been used to "communicate real-time, spatial, spatial-temporal, and non-spatial information including stakeholder inputs, air and surface vehicle tracks, transportation routes, air corridors, global and regional weather, national and commercial imagery, and other data to the stakeholders' community of interest" (Baraghimian et al. 2001, p. 1679). The article argues that such software allows clients to make informed, rapid decisions based on

location data in Disaster Scenarios. FLIP has a similar functionality and makes the source of information a community.

Team FLIP's research could have wide-ranging effects on a number of fields if it is adopted. In their paper, "Location-aware access to hospital information and services," Rodriguez et al. (2004) describe a system which allows physicians and nurses with a wireless-capable PDA to access a variety of information and services based on their location. For example, with this system, a doctor could digitally access a patient's records if they were proximate to the patient, easily find a colleague by using the colleague's current location, and find the closest medical devices and equipment. The researchers were able to achieve context-aware services by approximating a PDA's location based on which Wi-Fi access points had the strongest signal. The researchers were able to find a PDA's location within a 4m margin of error, which in their implementation was enough to find the nearest patient. However, this was for a very specialized use case. Recent data from Google shows that in North America, their algorithms can predict location with an accuracy of 50m with 80% confidence (Chen 2010).

The accuracy across campus varied dramatically, ranging from 4m to 24000m. If a user were to submit their location within one of the less-accurate locations, the result would be the focal point of the circle created by this radius. With buildings on campus nearly adjacent, the idea of assuming all people within 24000 m to occupy the same position is absolutely absurd. Error increased dramatically when the team considered the risk of being associated with one of any number of overlapping circles of range. This research demonstrated the Internet's complete disconnect with true

location by design. Yet, as discussed, new technologies continually emerge that attempt to gather and use user location with Internet applications.

Social Networks

In the age of information technology, social networks are a common way of information exchange that can be useful in both the social world as well as in more academic environments. Sharing has become a fundamental aspect of working and life. Communities, such as those created by Facebook and Twitter, are a means to increase sharing between people. Recent current events such as the Egyptian overthrow of Mubarak are examples of how sharing through social networks has improved communication in times of unrest, and only increased peoples' freedom of speech.

The role of social networks in an academic environment has always been an interesting balance. A study conducted with 67 students in four classes at two public universities in Taiwan examined the potential usages of online social networking to supplement the traditional classroom experience (Hung, 2010). The study found that social networking is a helpful tool in the classroom, especially in increasing connections and communication between students. Students in the study liked the integration of social networking into their classroom experience. The authors provide recommendations and address concerns regarding the implementation of social networking in the classroom.

Although social networking is generally not associated for use in the educational environment, it is quickly being adapted into classrooms around the

world. In an “Educational use of social networking technology in higher education” (Hung, 2010), researchers found that social networking was actually a helpful tool in the classroom as two public universities in Taiwan. They found that social networking increased connections and communication between students. Students found that social networking was a complement to the in-classroom experience. The authors believe that social networking can be integrated into the classroom as long as the focus lies on the connectivity it provides.

Additionally, a case study of the University of Cape Town’s use of Web 2.0 in supplementing their educational experience examined how Web 2.0 tools such as Facebook could be used as an educational tool. The study followed 200 students and interviewed them about their usage behaviors of Facebook socially and educationally. The study found that it would be beneficial to include Web 2.0 tools into their educational experience because it would “tap into the distinctive proficiencies of their students while ensuring focused learning and positive outcomes” (Bosch, 2009) while increasing networking among the university community. They, however, found drawbacks in the lack of access to the resources and possible disconnect between the older generation and the technology.

Brady et al. (2010) study replacing current traditional course management systems such as Blackboard with social networking sites such as Facebook. The authors argue that social networking sites, specifically Ning in Education in their study, are more personable and easy to use for students. Traditional CMS is outdated with limited features in comparison to social networking websites. However, they found that people are generally unwilling to add another social networking website to

the ones they already use, a huge argument against using anything but the most popular social networking site. Thus, integration of new sites with existing ones is important for new technology adoption.

Of course social networking has benefits beyond the classroom. Chu and Kim (2011) examine the effect of social networking websites such as Facebook and MySpace on electronic word-of-mouth. The authors believe that advertising in social networking websites will become one of the most important strategies for companies. In the United States, advertising spending by companies on social networking websites is expected to increase to \$2.8 billion by 2012. The authors tested the effectiveness of social networking sites in creating electronic word-of-mouth by measuring the tie strength, trust, normative influence, and informational influence. They also measured user opinion seeking, giving, or passing tendencies. The study concluded that social networking sites can increase the strength and effectiveness of a trend when compared to those that were not influenced by them.

Vladar and Fife (2010) discovered that social networks are the only area of mobile communication that saw growth. They identified three major drivers for that growth. First was the improvement of technology, specifically interfaces and processing speeds that have allowed social networking to run more smoothly on mobile technology. Second is the compatibility with existing practices; this means that the mobile technology is supplementing the traditional technology (computers) and furthering the usages of social networking. Third is the value of social networking, which allows people to stay connected in yet another way, and mobile technology, which provides the means for it to happen.

Jeff Beard found that location-based social networking applications, a newer development in social networking, are beginning to increase in popularity (2011). In the Apple App Store, there are over 6,000 location-based applications available. One of the most popular applications Foursquare boasts over 7.5 million users and continues to grow. Although these numbers may seem impressive, they are only a fraction of total smartphone owners. Beard questions whether location-based application growth will continue at its current rate and whether businesses can find a way to properly leverage their usage.

Chapter 3: Analyses of Existing Applications

Digital file sharing alone is by no means a new technology. Over the years many products and services have worked to address file sharing in specific use case scenarios. Specifically, many of use cases we intended to address currently have a variety of existing technologies working towards the same goal. Our research required fully understanding the spectrum of available technology, while FLIP's overall success relied on benchmarking prototypes against the market.

Foursquare

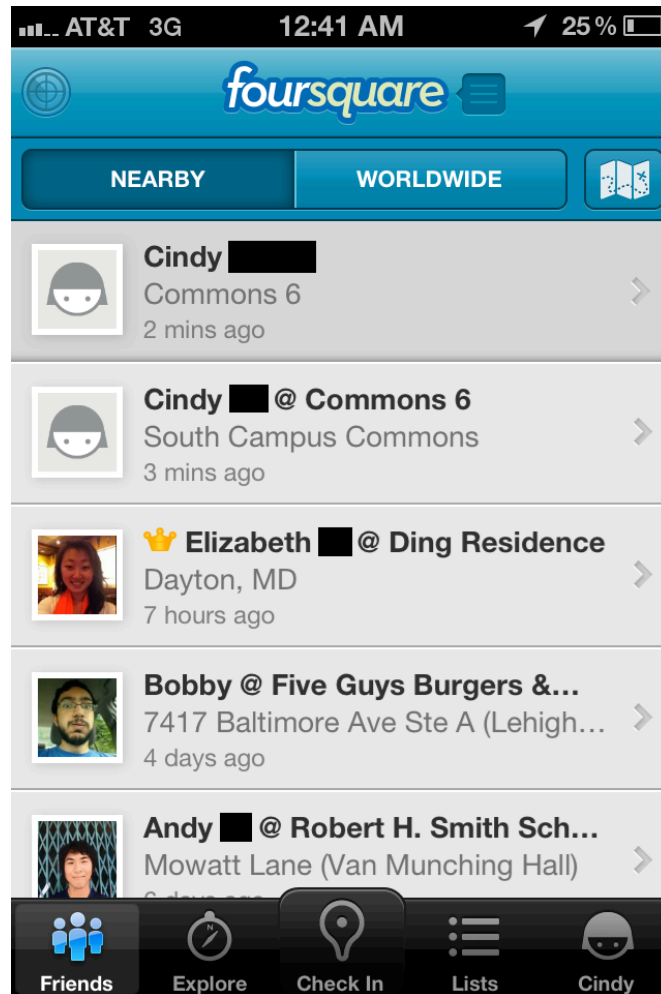
Foursquare is one example of a location-based social network. The site is predominantly made for mobile devices, especially smartphones, and users can “check-in” at a location determined by their GPS. Each check-in by a user is

rewarded with points, which can be accumulated to earn “badges” that symbolize achievements.

Foursquare’s location-based service is accessible to anyone with a mobile device. GPS is determined either by a cellphone’s internal GPS hardware or the location of the network that a device is connected to. This means accuracy widely varies from the average 10-meter accuracy that cellphone GPS hardware have to much larger ranges characteristic of Wi-Fi networks. In addition to a website for browsers, here are applications for the iPhone, Android, BlackBerry, Palm, Ovi and Windows Phones.

The social network’s online website has a simple interface. If you access it from a computer browser, the web application automatically locates you based on your Wi-Fi network’s location. There is a pop-up that asks if you would like to share your locational data with Foursquare, and once that has been accepted, a map interface appears showing local businesses as well as nearby friends. However, the website itself does not allow check-ins as its primary focus is a mobile friend finder. There is a loophole around this by using the foursquare API to create applications that allow check-ins. Nonetheless, you can still see friends’ activity on the website in a live newsfeed format. You can also attach pictures to your check-in if your mobile device takes pictures.

Figure 1: Foursquare app on iPhone



The applications for smartphones are much more robust in features. There are five main tabs: Friends, Explore, Check In, Lists, and personal profile. Checking in is simple, as foursquare automatically uses the internal GPS hardware to locate the mobile device and populates a list of nearby places. If the place that the user is looking for does not appear, he or she can search for specific terms or names. The application shows points and badges earned, as well as a leaderboard where friends are listed in order of highest to lowest points. Additionally, the mobile app allows

push-notification of friend updates, which are called “Pings”. Users can also integrate their Facebook and Twitter accounts so that whenever they update foursquare, it is reflected on Facebook and Twitter posts.

Figure 2: Checking in



Badges are earned based on achievements. For example, the first badge unlocked is the Newbie badge, which is the reward for a user’s first check-in. Badges can be city-specific or earned across many cities. They can also be specific to a certain venue, event or date.

Points are awarded to a user each time he checks in. For example, five points are awarded for each check-in at a new place, one point for check-ins at places he has been before, and bonuses for checking in with the same friend at multiple locations.

Mayorship is another foursquare feature achieved by being the user who has the most check-ins at a certain location than any other user in the last 60 days. You may only check-in once per day per location, so this limits the number of check-ins. Being crowned Mayor means that the user's profile picture and name appears under the description of the location with the Mayor tag.

The use of badges, points, and mayorships is a form of gamification. By rewarding users for using the application, even with virtual awards, the software encourages re-use.

There are also limitations to foursquare. For example, it is only an exchange of text and picture information. Users are unable to use it to send friends files or conveniently link to outside sites. An account is required to view any information available on foursquare, so there is no public data like on Twitter. Users may sign in with their Facebook accounts in addition to using email though.

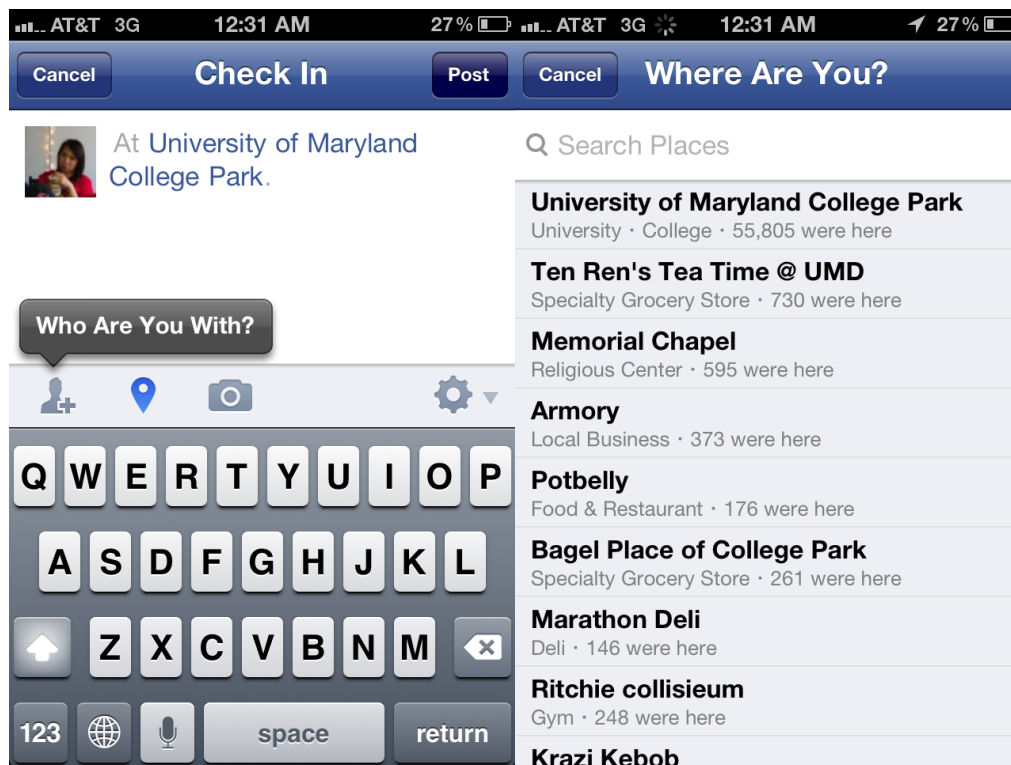
Foursquare is predominantly made to share your location with friends, with the option of tagging friends and adding pictures. It is not made to exchange substantial amounts of data or files. It is limited in that users must tag themselves at a location that has a name, instead of creating a geotag based precisely where the user is located. Users also must use a smartphone to check-in, as check-ins are not allowed on foursquare's website. However, it is a fun way of contributing location tags to the

community. Foursquare gives users an incentive to tag themselves at places they visit and encourages people to share real life location data online.

Facebook

Facebook allows users to share location data with their friends. Their unique advertising point is that users no longer need a smart phone to easily share location. People can easily tag pictures, statuses, and just about anything else they post on Facebook with a location. It is easily customizable as all posts have the option of turning location on or off. There are several components to Facebook's location tags.

Figure 3: Checking in on Facebook



First and foremost, Facebook allows users to check-in at a location or event. This is done through their mobile application for smartphones. On the home page of the app, there is a “check-in” button and selecting it takes users to a list of places and events nearby based on the GPS location determined by the mobile device’s internal hardware. If the user cannot see the place they wish to select, they can search for it. If the place has not been previously located before, the user also has the option of creating a new “place” tag and adding a description. This method of tagging also includes features such as tagging friends with you and including a short description of what you did at the location. Pictures can also be attached to the check-in. Friends can comment on each check-in and “like” them as well. Check-ins, like all other posts, can be deleted from a user’s profile or timeline.

In addition to check-ins, most Facebook actions can be tagged with a location, whether they are added photos, updated statuses or wall posts on friends’ walls. This is enabled by selecting the location button under most posts, which looks like a small balloon marker with a dot in it. Like foursquare, Facebook uses both the internal GPS hardware and network location to target where users are. To remove the location tag, a small “x” button can be clicked.

In addition to checking in, any post can be tagged with locations as well. Posts and check-ins do not show up on the public profile of the location. For example, pictures tagged with the College Park, MD location will not show up on the College Park, Maryland Places profile. The profile shows businesses and buildings in the city of College park, and these places in turn show friends’ check-ins on the profile.

Location tags are not public and users who are not friends cannot see each others' location posts.

Facebook's location system is not meant to distribute large amounts of information. It is not a system meant for people hoping to meet new friends at a location but instead for old friends to share location data with each other. There is no file-sharing capability aside from posting pictures. However, the system does allow for a robust, customizable and secure way of geo-tagging social networking posts.

Twitter

Twitter is a social network designed for the exchange of short, 140-character messages. Unique to Twitter are its enforcement of short messages and its preference for public-facing messaging. Unlike a more monolithic social network such as Facebook, Twitter only specializes in short messages. Also unlike Facebook, Twitter does not have concepts of circles of friends or of networks, instead preferring for users to broadcast their messages into the global Internet. Of particular interest is Twitter's capacity for sharing information associated with a certain topic or location and its ability to encode messages with location data.

Twitter messages - commonly known as tweets - are usually public and are top-level presentations. All tweets are equal and are capable of referring to any other Twitter user or message. If a tweet is to refer only to a provincial topic, then the tweet must include a hashtag denoting said topic. The hash tag is a plain-text marker that must be included in the tweet (Tsur, 2012). For example, tweets concerning a Gemstone presentation might include the hash tag "#gemspresentation". As such, for

a tweet to refer to a local event, it much reduce the size of the message by including the hash tag, and the hash tag must be included in the same wording - consider the difference between "#gemspresentation" and "#gempresentations". As such, while Twitter is appropriate for issues of wide scope, such as presidential debates, it is less suitable for localized communication.

Twitter has a limited capacity for geolocation. Users can set their location as a city, and Twitter will display popular topics in that area. Again, the scope is very wide - the entire range of the Washington, D.C. metropolitan area, for example. Tweets can optionally be marked with specific locations, such as sport stadiums. This allows users to see tweets concerning that location, but is not limited to people at said location. Integration with Foursquare is offered (Laraki, 2010).

Twitter can be accessed via the web or any application using its API. As such, the experience is flexible and can be customized by the user. Besides the web version, common Twitter clients are regular desktop applications and smartphone apps. The primary Twitter web interface makes extensive use of AJAX and is not suitable for screen readers. The simpler mobile interface, however, is appropriate. Given its API exposure, more accessible Twitter clients are available. One example is Easy Chirp, which is "designed to be easier to use and is optimized for disabled users" ("Easy Chirp.") A user account is required. Although Twitter has its own jargon known to intimidate neophytes, the fundamental rules of the system are simple and it has been widely adopted by businesses, other organizations, and individuals.

Twitter has very limited file-sharing capabilities. Links to sites such as Mediafire can be included in tweets, much like how they can be included in email.

Pictures can be embedded in tweets using either Twitter's image service or the independent TwitPic. These images are the only inherent way that Twitter has to share files. Twitter is generally unsuitable for file-sharing, except perhaps for an organization promoting a file that can be downloaded elsewhere.

Remote File Storage Systems

“Cloud storage” and similar buzzwords have exploded onto headlines in the form of new technology start-ups and updates to existing tools. Regarding file sharing, cloud storage allows users to upload their files to a 3rd party business who hosts said file on their servers. This company then provides an interface from which the user can access their files from anywhere with Internet access. This model has become very popular with the increasing prevalence of powerful, mobile devices with limited hard disk space. Commonly space-expensive media such as music or video can be streamed from off-site storage in real-time. A variety of technologies have allowed quick and simple file sharing through cloud storage including Dropbox, Google Docs, and MS Office 365.

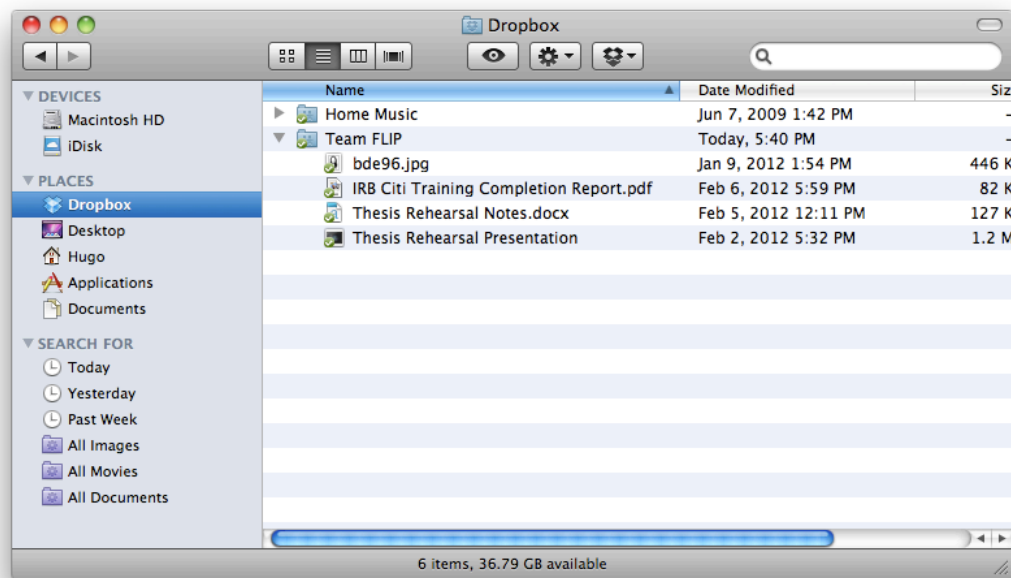
Dropbox

Founded in 2007, Dropbox entered the market as truly one of a kind. Following account creation and installation, the software provides a folder on the user's computer linked to a file hosting service. Any file the user places in the Dropbox folder is copied to the cloud storage and accessible from any web browser.

Users can share these files with anyone through a URL, from which others can download it. Furthermore, any folders created within the main directory can be shared with other users. Then, these collaborators can add files of their own to the folders or edit those posted by others.

Dropbox looks and feels very close to a native application - appearing in the same way that standard folders do on the users system as shown in Figure 4. The file structure exactly mirrors that used by the host operating system.

Figure 4: Dropbox on OSX

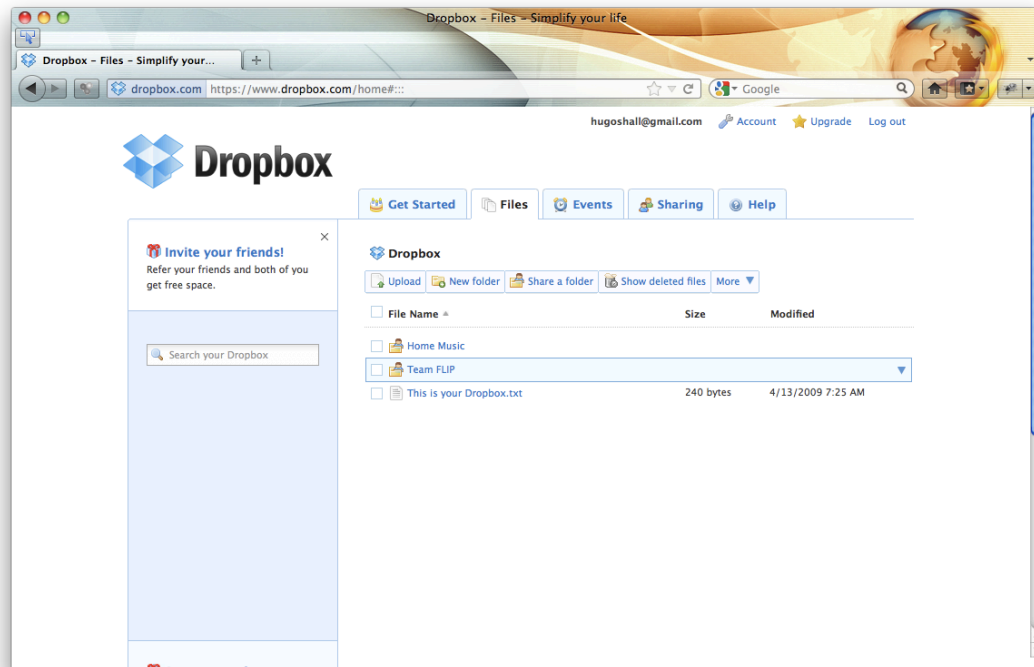


Drag-and-drop functionality coupled with a familiar operating system interface provides an easy learning curve.

File sharing settings must be set through the Dropbox website, which offers another simple and intuitive design. The user's account contains any files or folders

added to the Dropbox as illustrated in Figure 5. A user who has logged in to the website can access their files through any web browser.

Figure 5: Dropbox website

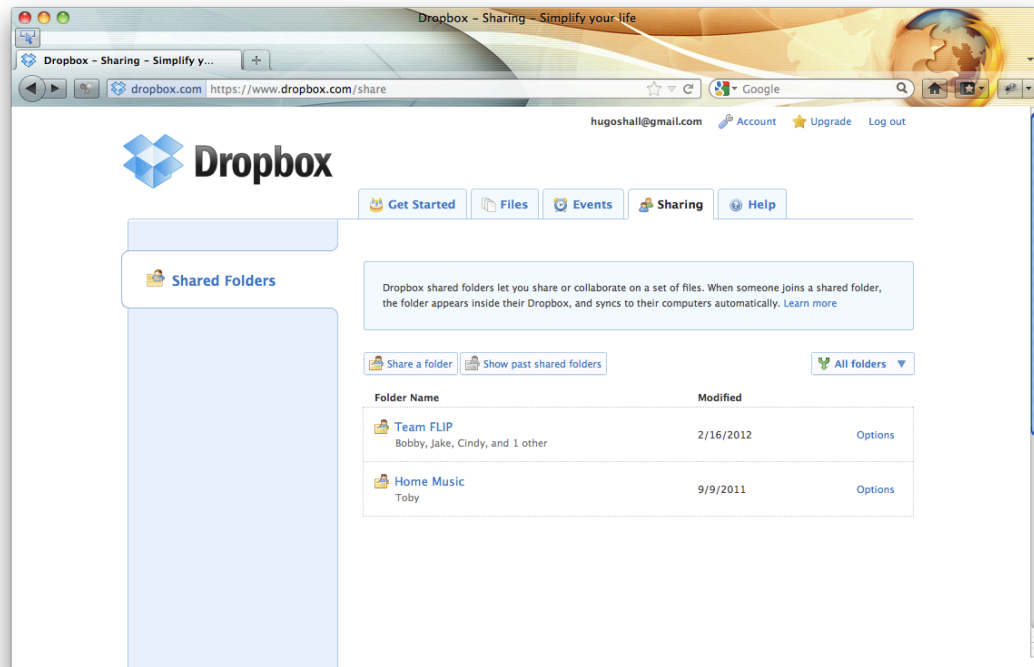


As Dropbox account users are identified by their email address, file sharing functionality has been built on top of that system. Users are able to ‘invite’ other users to the Dropbox through an email invitation. The barriers to entry therefore include those accompanying standard email clients, creation of a Dropbox account, and knowledge of any file recipients’ email addresses.

The technical structure mimics that of a standard hosting service with the addition of the slick front-end shown in Figures 5 and 6. Files are each associated with a unique URL that can trigger their download from any web browser.

Meanwhile, the installed Dropbox software frequently updates any user changes or modifications to the folder on a user's computer.

Figure 6: Sharing folders from Dropbox website



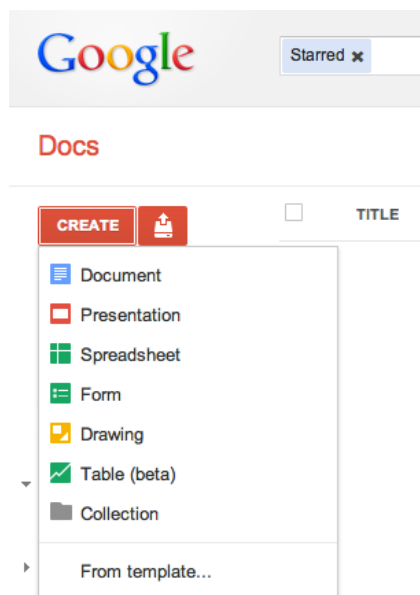
Dropbox does not tailor any features towards the user location; it stays true to standard Internet architecture. It works very well as a much more appealing user interface to existing Internet technologies and capabilities. While users experience a relatively large cost in time and familiarization while setting up their account, frequent file sharing between the same groups of people would bring that cost-per-transfer down over time. Under these circumstances the service can be a very useful tool. However, as Dropbox organizes this sharing by inviting users to the contents of a specific folder, that penalty reappears whenever a new user is added. In addition, this price again occurs when folders need to be rearranged or restructured to match

new requirements. The system also can reach catastrophic failures when groups sharing the same file attempt to collaborate in real time. As edited versions are saved to the same location, multiple viewers editing and saving the same file at the same time can cause serious overwrites and loss of edits depending on the specific circumstances.

Google Docs

Google Docs emerged as a counter to Microsoft Office's ubiquitous technologies. Specifically, it directly addressed the idea of real-time collaboration. Google began by building their own web-based word processor, slide-show creator, and spreadsheet manager that mirrored the popular Microsoft programs Word, PowerPoint, and Excel respectively.

Figure 7: Google Docs home page



Google purposely tailored the Google Docs service to offer the same features in nearly the exact same format as the nearly ubiquitous office tools provided by Microsoft. Unfortunately, Microsoft's programs have evolved into such complex entities that Google has not implemented all of their standard features. While the most commonly used features are fully supported by Google Docs, there are a few more niche components that Google either elected to leave out or were unable to include. The true innovation came from their collaboration features. Similar to Dropbox, users can create files and then invite other users to view and/or edit the one copy stored off-site through email invitations. However, Google completely fixes the collaboration issue. Users can all edit the document at the same time while watching the edits made by one another in real time. Revisions are saved almost instantly so there are no issues of competing edits between users. In addition, all of the documents provide an instant messaging client to foster quick communication between parties. Again, Google Docs gives no consideration to user location as it again remains a tool built on top of standard Internet infrastructure.

Microsoft Office 365

Microsoft has worked to better cater to businesses by combining cloud hosting with their existing software in order to provide easier collaboration and sharing. Their main competitive advantage is the use of the full Microsoft office suite including calendar, email, web conferencing, as well as the programs they have become famous for: Word, Excel, PowerPoint, and many more. Their cloud hosting allows for the community to also access any files from any computer or mobile device. These tools

are geared towards businesses and only given up for a price. Currently Microsoft offers several different pricing options beginning with email and calendar hosting and steadily including various collaborative features and other cloud services. The plans are priced per user per month. While Microsoft Office and Google Docs offer similar solutions, they are marketed towards completely different groups. Microsoft 365 strives to be a turn-key solution to a business's entire IT service needs. Google Docs exists as a free collaborative tool for individuals, but would typically be used in conjunction with other software rather than on its own. DropBox by comparison, offers individuals an easy tool to benefit from cloud storage, however, experiences huge errors when applied to collaboration.

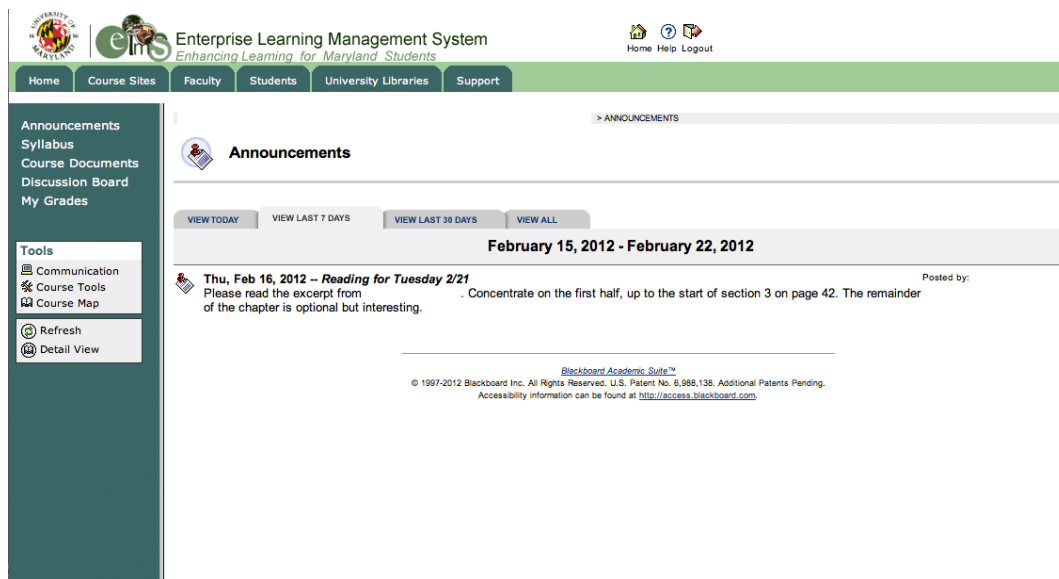
Learning Management Systems

There are a quite few existing websites available as classroom learning management systems (LMS). University of Maryland students are most directly to have contact with Blackboard, rebranded as ELMS at the University of Maryland. Blackboard is the most prevalent learning management system across all US universities, with over 25% of universities using it as an LMS tool in 2010. However, usage has dropped sharply from a high of 40% in 2007 as competitors have slowly taken away its market share (Instructional Technology Council, 2012).

Blackboard as it stands today is an advanced suite of learning tools used to a differing degree depending on the needs of the class and instructor that use it. From the homepage, all of the functions of Blackboard can be accessed. On the navigation bar, users can quickly access the course syllabus, as well as access the other

documents posted by the instructor. For example, instructors may choose to post homework assignments, readings, or lecture slides and notes. Additionally, Blackboard provides a discussion board system, which allows for communication amongst peers and between student and teacher.

Figure 8: Blackboard website

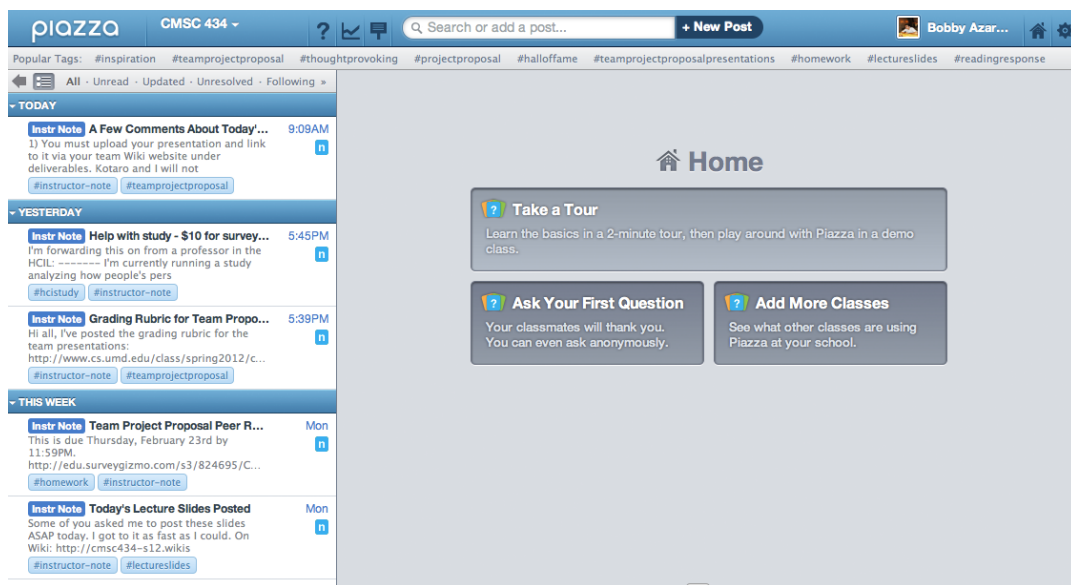


Aside from its features, Blackboard is a plain website. In the version shown on ELMS, it is clear that Blackboard has not been given a design refresh in at least 5 years. The use of framesets across Blackboard's user interface, a practice made obsolete by HTML 5 and strongly discouraged even before its usage, is a testament to its age (W3C, 2011).

Additionally, it seems as if teacher-student communication and student-student communication is not a core feature of Blackboard, as the discussion board feature is not always directly linked to in the navigation bar. In the personal experiences of Team FLIP, the discussion board has been rarely used.

Piazza is a self-described “social Q&A” service created by a former University of Maryland student. Piazza acts much like a traditional online forum, giving people the opportunity to post threaded notes and questions that receive input from classmates. While Blackboard puts the discussion board feature to the side, for Piazza, the discussion board is the single feature of the software. Piazza encourages students to provide help to one another and communicate with the instructors of the course to enrich the classroom experience.

Figure 9: Piazza dashboard



Email

Email as a form of file sharing has become more and more viable due to growing email storage capacities, guaranteed reliability, and low setup cost for the parties exchanging the files. Multiple files can be easily attached to an email message

and sent to as many recipients as required as long as the email addresses of those recipients are known. Over the last 5 years, leading email service providers have started to provide many gigabytes of storage for keeping the files in your inbox for later consumption. Combined with a powerful search engine and folder organization, these attachments can easily be sorted and found later provided the emails they were sent under were identified with the appropriate subject and message.

Reliability is another huge attraction for using email as a form of file sharing. Service providers are pressured to keep their email services available to all users 99.9% of the time, and even very brief outages can be catastrophic to companies like Google, whose Gmail service was down for 2 hours and 30 minutes on February 24, 2009 (Cruz, 2009). The short and long term availability of email service means that files shared through email are guaranteed accessibility for now and future as long as the service is running. Data is also redundantly backed up on servers in the cloud so that users do not need to worry about purchasing their own hardware nor losing their data in the event of a hardware failure.

Email is also convenient to use and easy to set up. With the proliferation of free mail providers, there are no extra fees to pay to use the email service and since email accounts are vastly prevalent throughout the general population, the overhead necessary to both send and receive files is very small. Most people are familiar with checking their own emails and handling the download and upload of attachments, as they are common actions that most people do often. Email can run on even the most basic browsers and more modern email interfaces such as Gmail even carry a simple HTML version for easy access on slow Internet connections or older browsers. One

can share a file with only basic Internet connectivity and the email address of the recipient so there is no need to tell the other party to install extra software to receive the file.

We will now examine three very popular consumer email services; Gmail, Hotmail, Yahoo Mail, in no particular order. All three services have a file attachment size of 25 megabytes, which is plenty for the sharing of documents, photographs, and music files as attachments. However, when attempting to share larger files such as video clips or other unconventional formats, email can fall short in that it will not let you attach files larger than 25 MB. Each service comes with tight integration with its own suite of web applications that forgo this limitation. Hotmail has Microsoft SkyDrive, which is a free 25 GB of personal cloud storage that lets you upload files up to 100 MB for sharing and storage. Gmail has Google Docs that allows files of 10 GB to be stored, and Yahoo has an Attach Large Files application built in that allows for easy and secure sharing of files up to 2 GB. Web apps make it possible to share larger files but tie storage with internal formats which can lead to compatibility issues later.

The primary limitation of file sharing through email is the necessity of an email address. This works fine for contacts that you have already been familiar with or only need the email addresses of a few different people, but does not scale well in sharing files with a large number of people, particularly those whom you do not have the email addresses to. Email has no concern for location as the steps for sharing a file through email does not change with respect to the sender and recipient.

File sharing through email is very simple with low setup because all that is required are free email accounts for the sender and recipient that many people have already. There is no extra software to install with email being able to run on even the most basic browsers that are available on most modern operating systems. Files that are shared can be further stored reliably on the cloud with guaranteed accessibility and fetched for later use. Privacy of the shared files is also kept between you and the recipient because the file is sent as part of the email message as opposed to being publicly uploaded. Many popular email services also come with a rich suite of web applications that further augment and simplify the file sharing process. However, one of the main drawbacks is that the email addresses of the recipients must be known prior to the transaction.

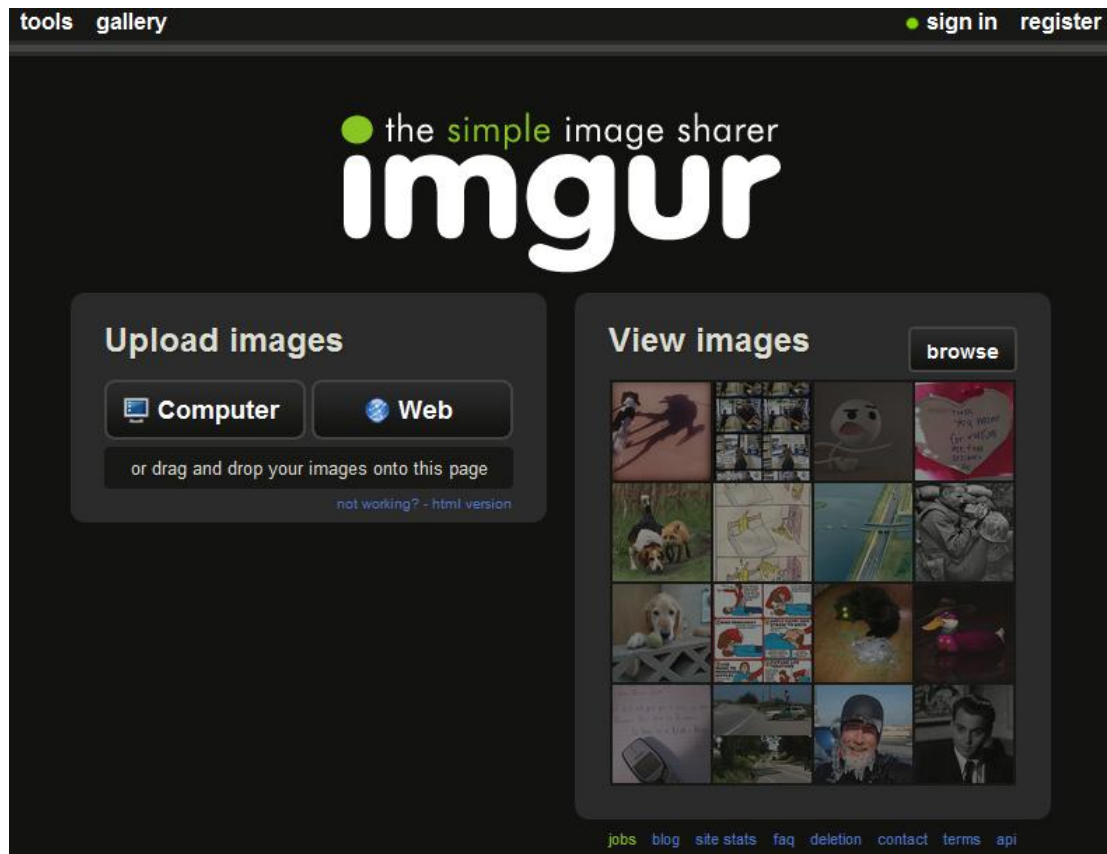
Simple Uploaders

A popular service people use to upload files is simple uploaders. Simple uploaders are websites designed specifically for easing the uploading of files. These simple uploaders provide the server space to host files over the Internet. These websites require users to perform few actions in order to begin the upload process of a file. Simple uploaders often specialize in a specific type of file and may provide the necessary means to play video and audio files through the site without the need to download the file.

The upload process of these websites is designed to be as simple as possible. These websites differ from traditional upload websites such as YouTube, Flickr, and Photobucket by not requiring a user account to upload a file, although the option to

create an account is often available. The front page of each of these websites features a ‘Choose File’ button to allow users easy access to their files. After users select the file from their computer, the user will click the upload button and the upload process begins immediately.

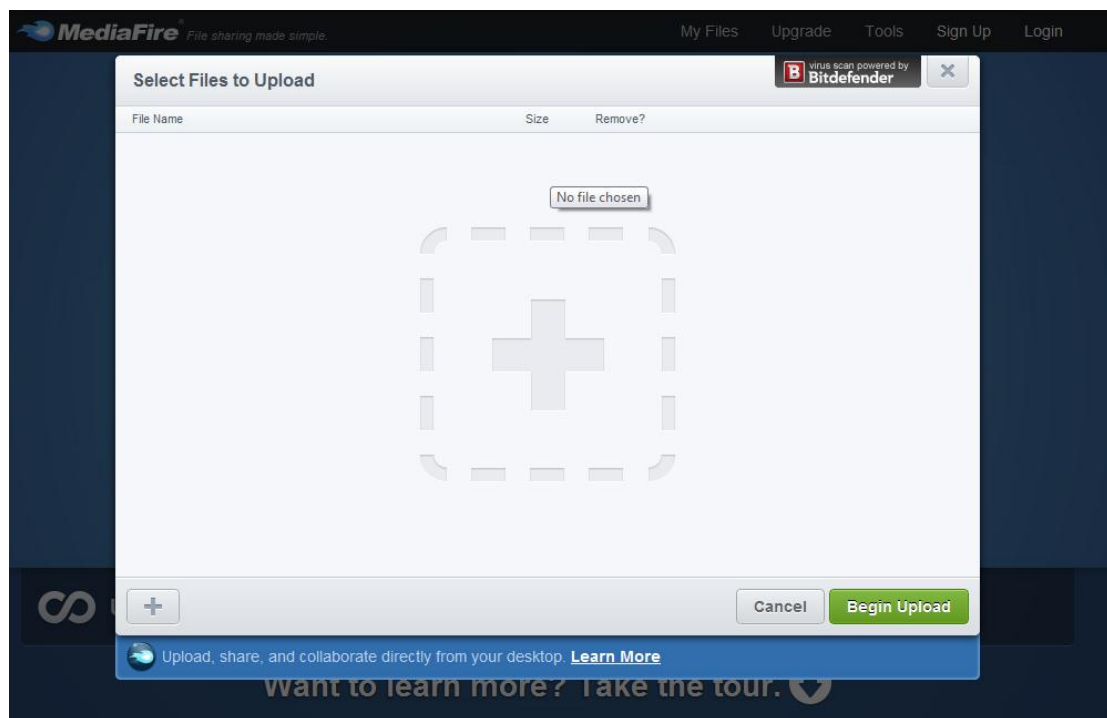
Figure 10: Imgur, a simple uploader for image files



Users then have the option to add details such as a title or tags to the file either while the file is uploading or after the file is finished uploading. A unique link to the file is created and users have the option to share their file using their e-mail or social networks. In addition, unless the user chooses otherwise, the file becomes a part of the immense library collection of files.

Simple uploaders that specialize in picture files include Imgur, Imageshack, and Tinypic. A unique feature of Imgur is the ability to drag-and-drop files from a users computer straight onto its webpage. Simple uploaders that specialize in audio files include SoundCloud, Hulkshare, and Kiwi6. All three services have their own unique embeddable music player that users can use to post their files onto blogs. They also allow users to have the option to allow their music to be downloaded by other users. A simple uploader that allows for any type of file to be uploaded is Mediafire.

Figure 11: Mediafire supports the uploading of any file



Some simple uploaders offer native applications that users can download onto their computer. Imageshack has an application that allows users to upload files in bulk without having to visit their website. SoundCloud offers registered users an iOS and Android application that allows users to upload audio recorded on their phone.

Figure 12: SoundCloud iPhone app



Simple uploaders provide users with a valuable, easy tool to upload files. The limited amount of actions required to upload a file makes simple uploaders the ideal tool to quickly share a file. Users also do not have a big, if any, learning curve to use these websites. These websites provide very straightforward interfaces to their users. Also, users are not required to create another account in order to upload files. With the proliferation of so many services that require accounts and passwords, the ability to accomplish a task without first creating an account is another added level of convenience to users.

However, this also essentially requires the user to give up the rights of their file. Once the file is uploaded to the Internet, there is no guarantee that it will not be downloaded and viewed by anyone with Internet access. On these websites, you can often find multiple copies of the same file because of copycat uploaders. The use of these websites to share with a specific group or network of people is impractical. Some archives can be password protected to protect against this, but this can be easily circumvented.

Furthermore, the legality of simple websites for uploading has been called into question in recent years. While there are many legitimate uses for these websites, copyright infringement is an issue with many of these websites. One of the highest profile cases involves Megaupload. Megaupload was one of the world's largest upload websites that also featured properties such as Megavideo. Megaupload was so popular that a song about the website featured celebrities and artists such as will.i.am, Jamie Foxx, Lil Jon, Kanye West, Kim Kardashian, Floyd Mayweather, Chris Brown, and Serena Williams.

Figure 13: Megaupload Mega Song



Despite the amount of data that did not infringe on copyrights, an even greater amount of data that was uploaded to Megaupload infringed on many copyrights. On January 19, 2012, the Department of Justice seized and shut down Megaupload.com and its properties. The Department of Justice charged Megaupload.com with racketeering, copyright infringement, and money laundering.

Figure 14: FBI warning for Megaupload seizure



Megaupload may be the beginning of more future seizures of websites designed for simple uploading. The United States Congress is considering passing two bills that would increase the Department of Justice's ability to prosecute copyright infringement cases. The 'Stop Online Piracy Act' (SOPA) and the 'PROTECT IP Act' (PIPA) were proposed by members of Congress to fight online copyright infringement and piracy. As governments attempt to crack down on copyright infringement, the freedom of simple uploaders may be restricted significantly.

Bump

Several smartphone applications mimic a direct connection between two local devices through a web application. The most well-known is Bump, which allows two users to exchange contact information by “bumping” their phones together. Users are given the experience of sharing digital information locally, and at an increased convenience.

Figure 15: Bump Transfer Advertising Example



Bump works by tracking each of its users with a web application in real time. The activation of a “bump” triggers the phone to send its location to the web application. At any given time, the web application processes incoming “bumps” by matching pairs by their location and sending each phone’s contact information to the other. Possible conflicts with other nearby users, connection issues, and any general errors are handled with a simple prompt requesting that the user try again. The

application has also been expanded recently to allow users to share online social networking profiles and photos. The photo sharing feature has since become even more popular than the exchange of contact information. Bump's inner workings are completely hidden from the user interface, and really promote the experience over the details.

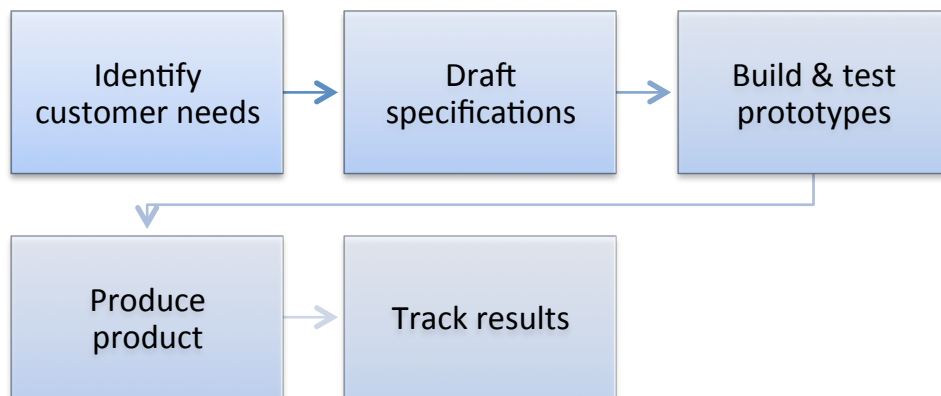
Chapter 4: Methodology

Overview

Team FLIP's research project began with the intention of following the product development process described in *Introduction to Engineering Design* (Calabro, Dally, Fournery, Portmer, & Zhang, 2007). While our research covered groundbreaking new areas in internet technology, a huge portion of it directly relied on the FLIP system. As such we expected the success of our research to be judged largely on the success of our product - the FLIP system. Thus, we planned our early work to follow a standard product development process. The nine-phase methodology is as follows:

1. Identify customer needs.
2. Establish the product specifications.
3. Define alternative concepts for a design that meets the specifications.
4. Select the most suitable concept.
5. Design the subsystems and integrate them.
6. Build and test a prototype and then improve it with modifications.
7. Design and build the tooling for production.
8. Produce and distribute the product.
9. Track the product after release developing an awareness of its strengths and weaknesses.

Early in the product development we became very aware that this generic timeline did not completely fulfill our needs. Software development generally follows a much more iterative process, as changes and additional features are much easier to add to software than a physical product. We quickly altered our original process in order to follow an ‘agile’ development strategy. The main change was the introduction of a cycle between drafting specifications and building/testing prototypes. While we had a very clear overall vision for the final FLIP system, members of the team continued to make improvements to various features and specific details. We found ourselves often refining elements of the FLIP system, testing the results, and repeating as necessary.



1. Identify customer needs.
2. Draft specifications
3. Build and test prototypes (repeat step 2)
4. Produce product
5. Track results

Identify Customer Needs

Who is this customer?

The nature of our position as undergraduates at the University of Maryland presents us a very specific clientele. Over 45,000 students and 9000 staff members spend time nearly every day on a campus of barely 2 square miles. Team FLIP is completely composed of full time students who have spent the last four years living, learning, and interacting with the other members of the student body. This lifestyle gave us a very real perspective on the common motifs and trends facing these people today. In addition, our generation is the first to have grown up with Internet access and lives every day expecting to use the technology. Changes are occurring every day; from short-lived fads to the early signs of the next multi-billion dollar company. All of us specifically remember our earliest Facebook profiles, and have now seen the company valued at over \$100 billion. Suffice it to say, no better user base exists within which to monitor the interest, growth, and value of Internet technologies.

College students utilize and appreciate Internet technologies, however, of far greater importance to our research was what they represented. The Internet was designed to connect communities of people to increase collaboration and productivity. We sought to reach out to these very same customers, those simply looking to connect and share with their peers. The college campus offers this user base but is far from unique in that regard. All people hold circles of contacts with whom they interact regularly. These can include family, friends, work colleagues, or classmates. FLIP's prospective customer truly was, and remains, any Internet user.

Regular Internet users are unique to every other customer in the sense that they include every other customer. People of all types, with all sorts of interests, and from all backgrounds use the Internet to enhance their own unique lives. At the same time all of these users hold their own specific groups of peers. Their groups and interests will vary significantly from user to user, but the commonality of purpose remains. We began the development of the FLIP system with the goal of creating an optimized platform for sharing information between these groups, identifying this specific user as our target audience.

What problem do they have?

We hypothesized early in our research that (Hypothesis 4) current Internet technologies do not take advantage of readily available user-location data, despite the idea that (Hypothesis 5) there is a desire among Internet users to receive more information tailored to their location and the events around them. User surveys distributed by Team FLIP found user response to “Do you see yourself using location based technology to share information in the future?” was yes an overwhelming 93% of the time. Furthermore, when asked “Do you think location-based sharing increases your ability to connect to others near you?” again 93% of those gave positive answer. Furthermore, the question “How often do you use your phone or laptop to find nearby people, events, places, and other information,” earned 85% positive responses from the users, 37.5% of which were marked as “very much” or 5/5.

Product Specifications

After analyzing existing research on topics related to our project, we used Quality Functional Deployment (Calabro et al., 2007) to determine specific objectives we wished to reach. Although all of these objectives may have not been fulfilled, for reasons such as feasibility, we always considered it important to have a best case vision ahead of us. We originally concluded that our product must allow users to connect to each other without using central infrastructure. This means that the complexity and cost of establishing and transferring material should be measurably reduced, or that there are new ways of sharing that were not originally possible with existing means of connectivity. We sought create a new, simple, and secure paradigm for sharing electronic information between geographically co-located parties. This means we would have to both utilize existing hardware and develop new software components that would allow mobile devices to create the connections that we are looking to establish.

We concluded that the program should allow users to create their own networks as well as join the networks of those around them with the ability to share and receive information of any form across these connections. Networks can be broken up into several groups. Furthermore, the application should provide users with the option of revoking rights of access to any data that they have shared with other users. Finally, this application should be independent of any existing commercial products and therefore not bound to any existing device or operating system. This demand may seem unrealistic, but that is only if this is taken as a deliverable goal

rather than an ideological goal. We plan to open source our software to allow others to modify and redistribute the code according to their needs.

Of course, the use of the term “network” is vague. Our software will be able to recognize and create several different types of networks. The first, and possibly simplest, is the “intercom” network type. This network will allow one user to act as an administrator for the group, with the exclusive ability to post files which can be sent among users. This will be useful for presentations, where the presenter may want to share his slide show and related documents for the audience. On the other hand, there are more simple networks with no restrictions, allowing all to share with one another, as well as networks formed among friends. By aiming to allow flexibility in the forms of communication provided by our software, we allow users to create the types of networks that work best for them.

Build and Test Prototype

Alternative Concepts

To solve the issues stated above, several options could have been implemented.

1. To address connection issues, we could create "dongles", such as a USB device or external hardware accessory (Boyle, Huang, Kuijken, Liu, Roedle, Simin, Spits, & Sun, 2007) that attaches to mobile devices, which will allow the devices to connect directly to each other without going through a central infrastructure.
2. However, we ruled the above out because of Wi-Fi Direct, was supposed to be ready by the time we started our research. Secondly, our concept is to develop a software solution to a sharing problem, allowing efficient file transfer between users. A hardware-only solution would not solve the problem of actual file-sharing. We hoped to implement a final solution that is much more streamlined and convenient so that our clients will have more incentive to utilize our product.
3. Developing the software that allows users to connect with each other is another important component of our project. There is the option of developing an application for an existing smartphone system such as the iPhone. This would require that we abide by the distributor's rules of development, which are often very restrictive. Apple has a specific set of guidelines (iPhone OS, 2009) that their developers must follow, and it is uncertain if our project will fall within those parameters.
4. To resolve the aforementioned issue, we could create an entirely new operating system for mobile devices. This requires much more programming than an application, as many routine processes an application must run are coded into the

- operating system. In addition, very few people would be willing to adopt an entirely new operating system that does not already have an established reputation (such as that of the iPhone or Android) making the entire system virtually useless.
5. An addition to the existing TerpNav system developed by previous Gemstone Team FASTR (Cigna et. al 2009). This would resolve the issues of re-coding an entire backend, as well as simplify development.

Out of these possibilities, we originally chose to use Wi-Fi Direct, a technology that was promised to be released by the 2010 by the Wi-Fi Consortium. However, as our team saw in 2010, the standard has been adopted very slowly, having been adopted by Google's Android operating system only as late as November 2011 (Android, 2011). The standard has been left un-implemented in Apple, as they have opted for their proprietary AirDrop technology. Due to this hardware limitation, Team FLIP had to spend even more time re-evaluating the possibilities before us. Since we had no way to realistically use a mobile ad-hoc network to achieve our goals, we had to envision a way to do so through existing technology.

Determining the Superior Concept

In order to achieve all of the goals we had set for ourselves without the need for reliance on hardware that had not even been implemented yet, the team decided to make the transition towards the concept of a simulated geo-aware file sharing protocol. We wanted to focus on designing an application that will use established technology to allow local users to create as well as join networks within a specific

geographic region. We aspired to have a final product designed for any mobile device including but not limited to notebooks, mobile media players, and cell phones.

Since there was never any guarantee that device manufacturers would adopt Wi-Fi Direct or any other wireless technology, it became clear that using existing web solutions was our best bet. The W3C Geolocation API would provide the geolocation technologies that drive our application. Since almost all major browsers in both the desktop and mobile space include support for HTML5 technology (which includes the W3C Geolocation API), there would be no barrier to users except for their use of software that is compatible with our web application.

We ultimately decided to use TerpNav, a component of Team FASTR's research (Cigna et. al, 2009), as a backend for the FLIP system after an evaluation process. For each potential system, we rated the feasibility and the time needed for implementation. TerpNav, which provides a campus pedestrian map and directions, provided pre-existing, tested software that was aware of location. By using the maps, we determined that we could simulate the effect of having local communication without infrastructure.

Creating new software was determined to be too difficult, as it would need both extensive testing and its own mechanism for determining proximity. This could be done via simulation (as with TerpNav) or by using local broadcasting via a technology such as Bluetooth or Wi-Fi Direct. Bluetooth, which has a very short range and is primarily designed to broadcast from one device to another rather than among networks, was quickly eliminated. Wi-Fi Direct seemed promising but was

discarded as it has yet to be fully released and is not yet supported by smartphone and notebook hardware.

TerpNav also provided an existing map interface that could be expanded upon with an alternate local view. The map view seemed useful for testing purposes. A mobile application such as for the iPhone App Store was considered but ruled out, as getting approved by Apple, Google, or another company introduces another layer of complexity.

To assist this decision process, we created in-house prototypes and drafted use cases. One prototype used a web page to allow the sharing of files. By only telling people in one room to access this, we could test the idea of local sharing. To supplement this, we wrote detailed cases about potential uses for the software and designed an interface with a simulated standard usage.

Produce Product

SEAM Software Development

Given that few of Team FLIP's members had extensive experience in Computer Science at the time of development, we contracted out the development of FLIP to several Software Engineering at Maryland (SEAM) teams. The SEAM teams consisted of upper level undergraduate Computer Science students working on software development projects for outside clients as a component of CMSC435, a Computer Science Capstone Course. Team FLIP was the client for five SEAM teams, which developed over the course of the fall semester of 2010.

The five teams that we contracted were split into the main categories we thought our software would have to address:

1. The FLIP Layer team was responsible for extending the existing layer technology as a part of TerpNav so that it could be used by any number of users to create new networks organized by the layers concept.
2. The social networking team was responsible for creating the processes required to allow users to interact with one another through layers and postings on the campus map.
3. The data mash-up team was responsible for creating ways for users to get existing campus data in a map-based interface. They were meant to develop a mechanism that, for example, would be able to see campus bus stops, blue lights, and event information on the map.
4. The routes and regions team aimed to develop another extension to TerpNav that would allow for certain parts of campus to be marked as "avoid zones". If a

region was said to be avoided, the TerpNav technology would route around such a region. For example, if a water main burst and it was reported to TerpNav, the routing system could find a way to avoid the region where it occurred.

5. The Mobile Devices team was responsible for taking the features implemented by the other teams and moving them into an interface accessible to smartphones.

Team FLIP entered in a contract with each of the SEAM teams, which stipulated our required specifications as well as delivery dates. These specifications and contracts have been attached as an appendix.

Unfortunately, only the output of the FLIP Layer team and the Social Networking team were directly included in the application that we have today. All of the other teams' work was either insufficient, or did not fit within the time requirements of Team FLIP's research.

Product Development

Due to the time constraints of a single semester, SEAM teams focused on building only basic infrastructure to enable TerpNav to support later enhancements by FLIP. Further work was done by our team members. Most of the changes were in the interface or to augment the basic layer system implemented by SEAM, but other features like the FlipStream, a version of the website optimized for file sharing and mobile browsers, and a native Android application for mobile users, were built upon the database infrastructure built by SEAM.

Sandbox

Our project was built based upon a previous Gemstone team's project, TerpNav, which is freely available at map.cs.umd.edu. In order to maintain full functionality and availability of TerpNav but still prototype and test our project, we used a sandbox version of TerpNav located at samurai.cs.umd.edu to preview new features without disrupting normal usage of TerpNav. When the sandboxed version moved closer and closer to production quality, we rolled out our features to a clean database cleared of our test values for use in our surveys across University of Maryland students. This site is located at flip.cs.umd.edu.

Login

Due to the privacy and security of file sharing, users now have to log in with any university ID and password through the Central Authentication Service (CAS) provided by the University of Maryland. Users that do not log in are still able to freely use the map as it was with TerpNav, and are presented with basic public layers that may have public events or points of interest on them, but are not able to access the FlipStream that houses the file sharing. A user that has logged in is able to view the custom layers that he/she has joined in addition to the public layers that are available to all users.

Figure 16: Basic layers view seen by guest user

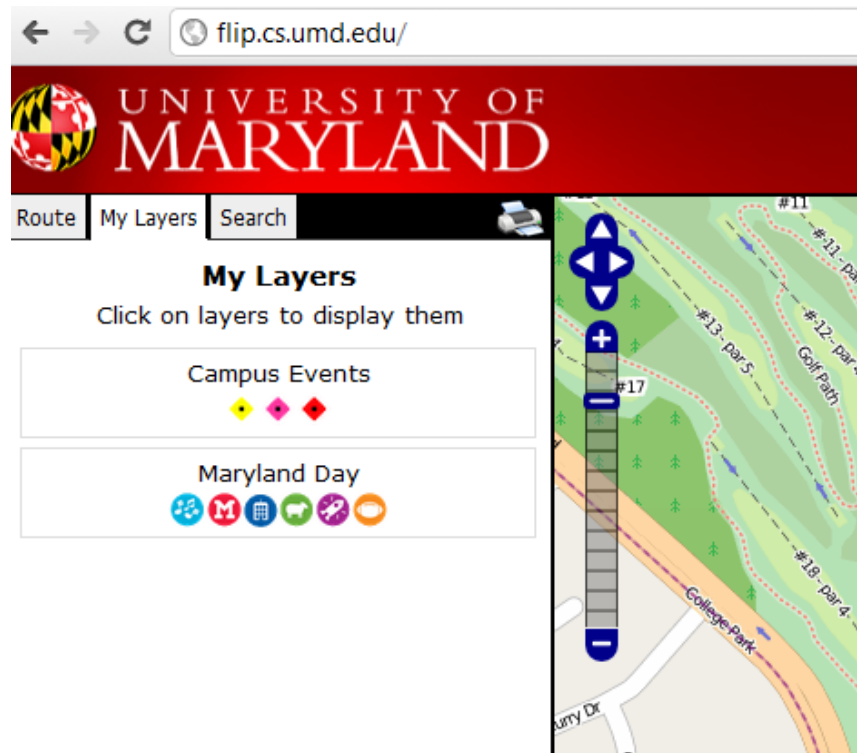
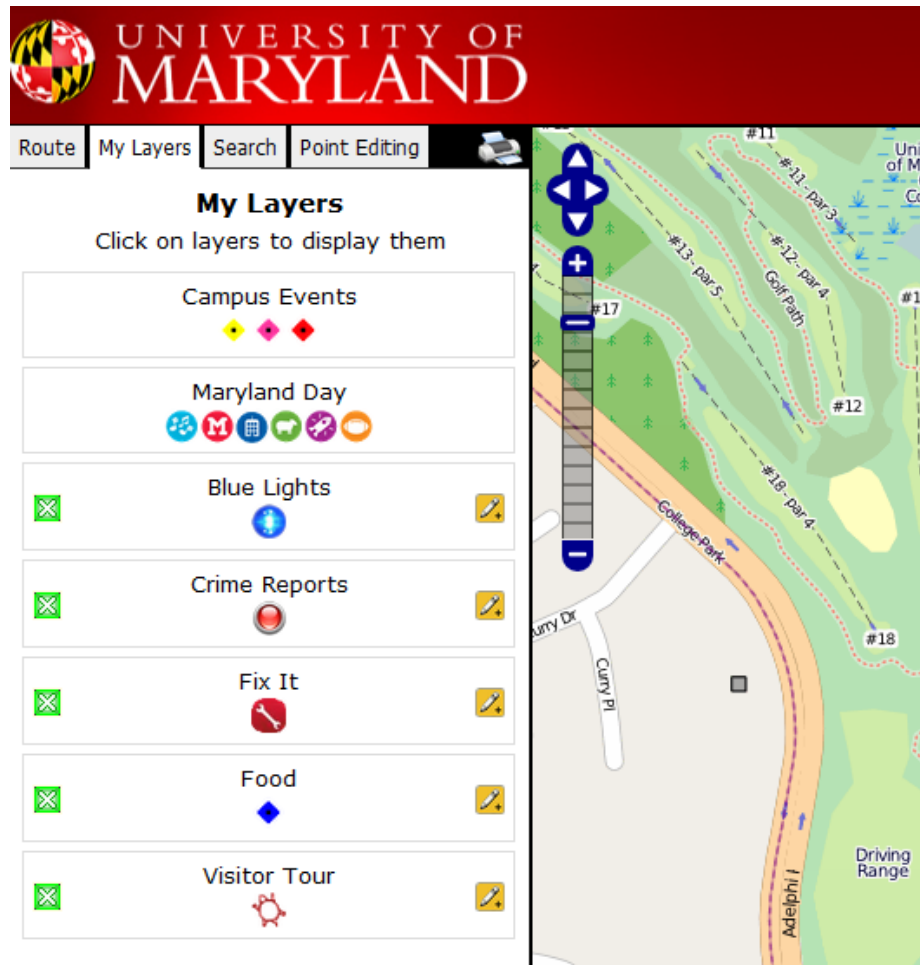


Figure 17: Uniform University CAS login system

A screenshot of the University of Maryland Central Authentication Service (CAS) login page. The page has a red header with the University of Maryland logo and name. Below the header is a section titled 'Central Authentication Service (CAS)'. The main content area is divided into two columns. The left column contains a login form with the title 'Enter your Directory ID and Password'. The form has two input fields: 'Directory ID:' and 'Password:'. Below these fields is a checkbox labeled 'Warn me before logging me into other sites.' and a 'LOGIN' button. The right column contains a security warning: 'For security reasons, please Log Out and Exit your web browser when you are c'. Below this, a red warning states: 'OIT will never ask you to put your password into an e-mail message, I Do not share your password with others!'. At the bottom, there are links for 'Identity Verification' and 'Password Change'.

Figure 18: Customized layer view for logged in user



Layers View

Layers act as organization method to accommodate the different use cases of the FLIP system. For example, you would not want to be sharing files from your classmates or social circle to show up in the same place, so you can put them in different layers that you can make to separate them out. A new user to the FLIP system will only have the public layers shown by default, but can join new layers through the search tab on the top left of the screen.

The search tab shows all layers are viewable by the current user and allows the user to either join a selected layer, or create a new layer. Users can type in the text field to filter the layers displayed in real time. Only layers that have the appropriate permissions that grant the user authorization to view will be shown in the “Search” tab. Once a desired layer is found, the “Add to My Layers” button will add the selected layer to the “My Layers” tab (see Figure 18). A new layer can be created with the “Quick Layer” button that will create a basic layer under the “My Layers” tab in the format “user-id random identifier.” Figure 19 shows a new “My Layers” tab view with the “Flip Presentation” layer added and the newly created “jshao 02180703” layer. The new layers have been highlighted for easier viewing.

Figure 19: Searching and adding layers

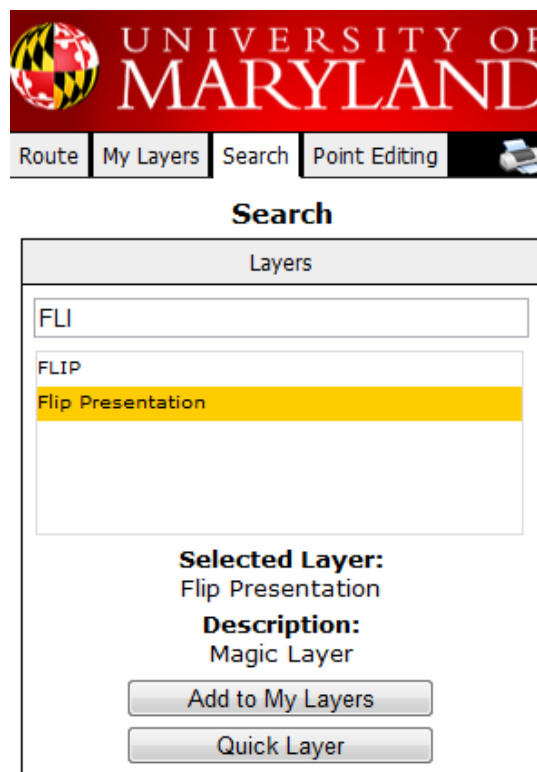
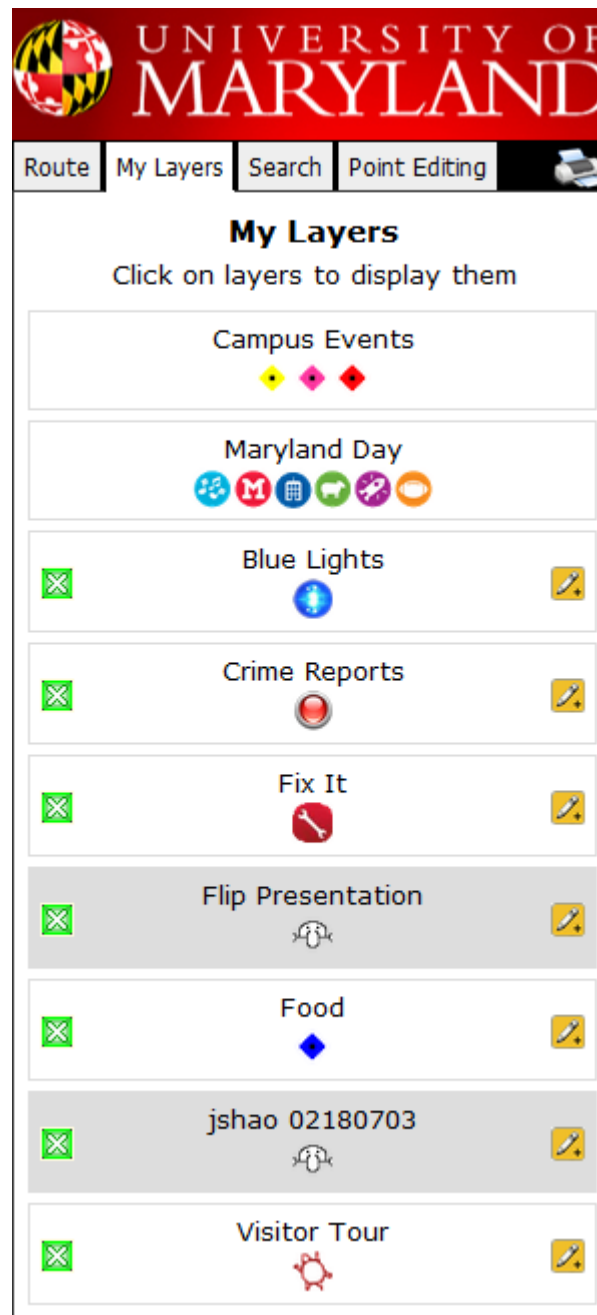


Figure 20: Highlighted layers in layer view



Layers can be highlighted by clicking them under the “My Layers” tab. When highlighted, the points relevant to the layer will be displayed in the map view on the right. Multiple layers can be selected in this way and all points of the selected layers will be shown on the map.

Editing Layers

In the “My Layers” tab view, layers that have been joined or created by the user will have a yellow edit icon on the right of each layer name (See Figure 20). Clicking it will bring up a popup that will give you options to unsubscribe from the layer or edit the layer’s details. If you are an administrator of your layer, there will be options to edit the details of the layer as well as adding authorized users that can view or edit points to the layer. The newly created layer from the quick create button will now be renamed to “Flip Demo” with a new description. A refresh may be necessary for the results to appear in the “My Layers” tab. A layer can also be deleted through this way.

Figure 21: Individual layer button



Figure 22: Editing layers for administrators

jshao 02180703

Unsubscribe

Layer Admin Functions

Layer Name: Flip Demo

Description: This demos editing layers

Logged In Users Can View Points: ☒

Logged In Users Can Add Points: ☒

A comma seperated list of field for additional information associated with each layer point (e.g. files, music)

Attribute Fields: Documents,Video Stream

Icon URL: http://seamster.cs.umd.ec Height: 32 Width: 32

Add Another Icon

Update Layer

Add Layer User

UserName:

Add Layer User

Modify or Remove User

UserName	Layer Name	
Can View Layer & Points	Can Add & Edit Points	Layer Administrator
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
With Selected: Submit Delete		

Delete this layer

Adding a layer user is done through the “Add Layer User” option by filling out the appropriate university ID of the desired user and clicking the corresponding button. A confirmation popup will appear denoting the success of the action. User permissions may be modified after a refresh by selecting the user and the appropriate permissions and clicking the “Submit” button. This feature can be used to allow friends and peers to view and edit an otherwise private layer.

Figure 23: User permissions

Add Layer User

UserName:

Add Layer User

Modify or Remove User

UserName	Layer Name
<input checked="" type="radio"/> testUser	Flip Demo

Can View Layer & Points	Can Add & Edit Points	Layer Administrator
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

With Selected:

A layer that the user does not have sufficient permissions to will only have the unsubscribe button available. The user will be unable to make any changes to the layer's details, delete the layer, or add any more authorized users to the layer. For example, this user does not have administrator privileges to the "Crime Reports" layer, and thus can only choose to unsubscribe from it.

Figure 24: Crime Reports layer edit options

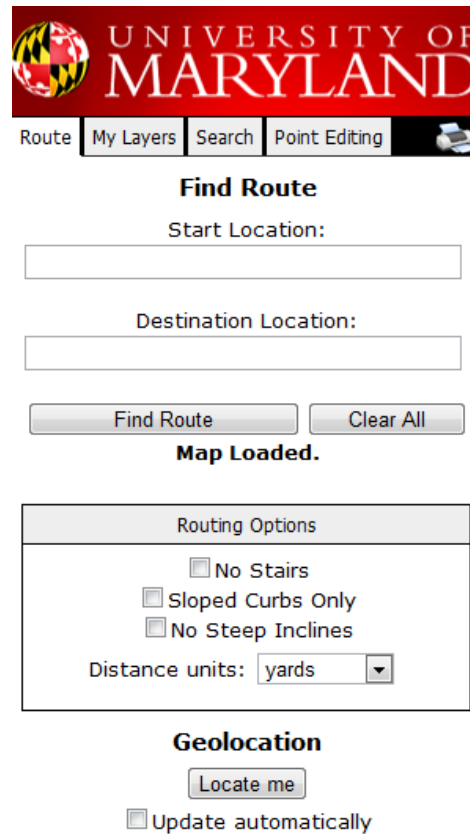
Manage Layer

Crime Reports

Geolocation

FLIP is a location aware application that works best when it knows your current location. However, in order to respect the privacy of our users, the option to set user location is manual with an added option to update automatically if the user is on the move. The option to set your location can be found in the “Route” tab underneath the familiar routing options of TerpNav. When pressed, a short script executes that will call an HTML5 Geolocation API that will use information such as the network adapter’s MAC address in order to estimate the user’s current location. The accuracy of this geolocation call depends on the user’s current network, and is discussed later in the results section.

Figure 25: Route tab with Geolocation option



The screenshot displays the 'Route' tab of a web application. At the top is the University of Maryland logo. Below it is a navigation bar with 'Route' (selected), 'My Layers', 'Search', and 'Point Editing'. The main content area is titled 'Find Route' and contains two text input fields for 'Start Location' and 'Destination Location'. Below these are 'Find Route' and 'Clear All' buttons. A message 'Map Loaded.' is displayed. A 'Routing Options' box contains three checkboxes: 'No Stairs', 'Sloped Curbs Only', and 'No Steep Inclines', along with a 'Distance units' dropdown menu set to 'yards'. Below this is a 'Geolocation' section with a 'Locate me' button and an 'Update automatically' checkbox.

UNIVERSITY OF MARYLAND

Route My Layers Search Point Editing

Find Route

Start Location:

Destination Location:

Find Route Clear All

Map Loaded.

Routing Options

☐ No Stairs

☐ Sloped Curbs Only

☐ No Steep Inclines

Distance units: yards

Geolocation

Locate me

☐ Update automatically

Confirmation of the user's location being correctly set is displayed both as a message under the route search feature as well as on the map itself. A bright purple marker will indicate the user's current location along with an inlay dialogue box.

Figure 26: Confirmation of location set under Route tab



Route | My Layers | Search | Point Editing | 

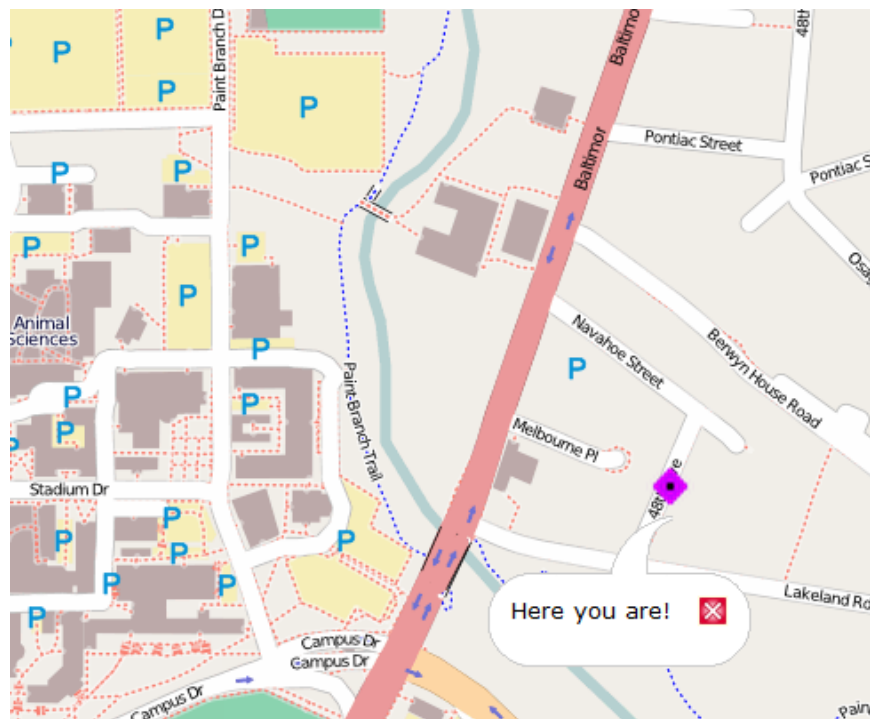
Find Route

Start Location:

Destination Location:

Location set

Figure 27: Confirmation of location set on map



FlipStream

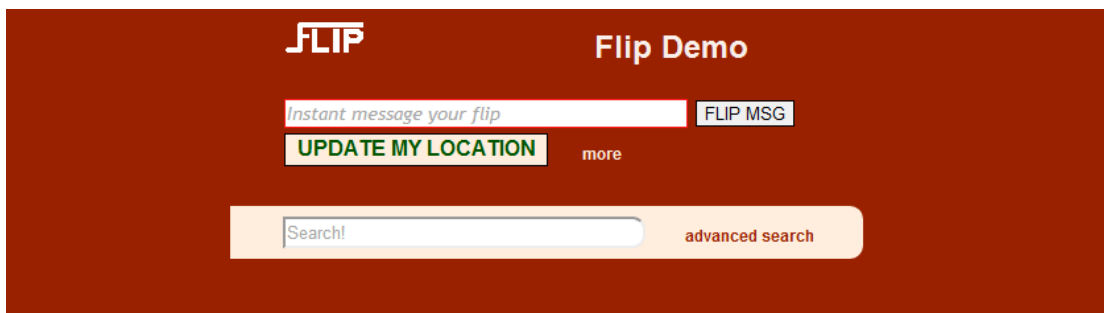
Clicking the green 'X' button on the left side of the layer view will bring the user to the FlipStream of that layer. An alternative way to reach the FlipStream is to access flip.cs.umd.edu on any mobile device. On a mobile browser, users are redirected to the FLIP launch page that is optimized for display on smaller screens instead of having to load the entire TerpNav interface. The layers shown in the FLIP launch mirror the layers shown earlier in the "My Layers" tab. This page allows the user to choose which layer to view the FlipStream for by selecting the desired layer.

Figure 28: Flip Launch



The actual FlipStream is a Twitter-like feed that displays all content shared on that layer that is proximate to your last location update. If no one near you is sharing anything, the stream will be empty, but you are still able to post files or FLIP messages (FM). Many content types can be shared on the FlipStream such as pictures, videos, and documents.

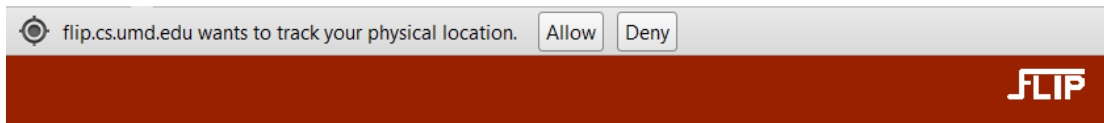
Figure 29: FlipStream



The most prominent button on the FlipStream is the “Update My Location” button. As mentioned above, FLIP works as intended only when it is aware of the user’s physical location. Though there is no way for us to force the user to reveal any data on their physical location, we hope the benefits gained from using our system will be enough to convince users to share their location in order to get the most out of using FLIP. The first time this script is run in the browser session, the browser will prompt for permission to track the user’s physical location data. If this dialogue is allowed, the user’s location data will be used their browser’s geolocation service to estimate an approximate location. Firefox and Google Chrome use Google Location Services (Chen, 2010), while Apple’s Safari uses an undisclosed Apple technology

(About Location Services in OS X Lion, 2011). Denying the dialogue divulges no personal information and has no negative consequences.

Figure 30: Location tracking confirmation message from Google chrome



Once location has been set, the text of the button will change to “Set.”

Figure 31: Location set in FlipStream



Flip Messages

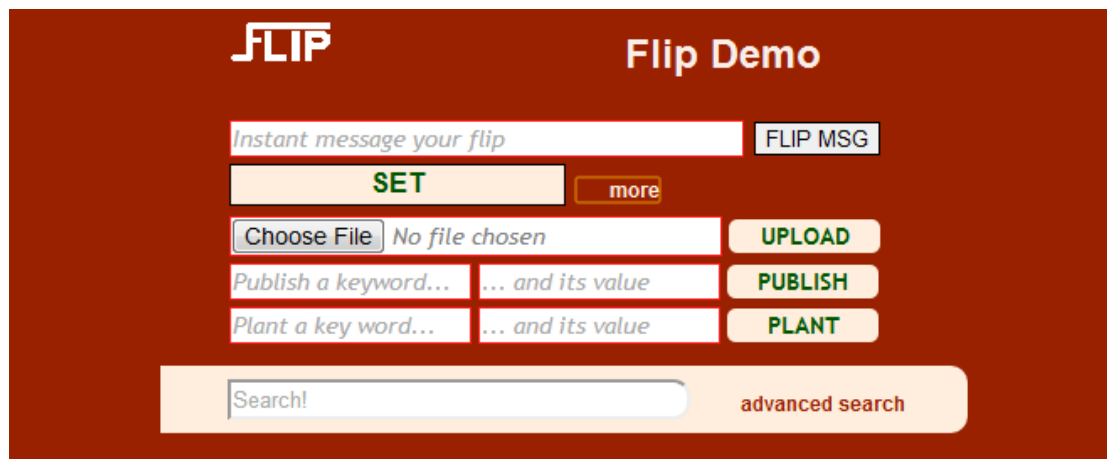
Flip Messages (FMs) are our equivalent to status updates of Facebook, and the tweets of Twitter. Flip Messages are geo-tagged with the user’s currently set location, and are tied to a specific layer. Users are only able to see Flip Messages that are on the current layer and that they are currently proximate to. Flip Messages are usually composed of text only, and are distinct from points that appear on the map interface.

We chose to separate the FlipStream interface from the map because we predicted the amount of usage on the FlipStream would only clutter the map.

File Upload

Along with the ability to post text-only status updates, the FlipStream supports file upload. This, of course is one of the central parts of our research. Users can upload any kind of file (except for a few that we have ruled out as malicious) to the FLIP server. After the file is uploaded, it works much like any other content on the FlipStream. Only users that are proximate to the user that posted the file can see it.

Figure 32: File upload option under "more" expansion



The screenshot displays the FLIP Demo interface. At the top left is the 'FLIP' logo, and at the top right is the text 'Flip Demo'. Below the logo is a text input field with the placeholder 'Instant message your flip' and a 'FLIP MSG' button to its right. Underneath this is a 'SET' button and a 'more' button. The 'more' button is expanded, revealing a file upload section with a 'Choose File' button and the text 'No file chosen', followed by an 'UPLOAD' button. Below the file upload section are two rows of input fields: 'Publish a keyword...' followed by '... and its value' and a 'PUBLISH' button; and 'Plant a key word...' followed by '... and its value' and a 'PLANT' button. At the bottom of the interface is a search bar with the placeholder 'Search!' and an 'advanced search' button to its right.

Publish and Plant

The FlipStream makes a distinction between “published” and “planted” points. Published points follow the user, and are the default for posting Flip Messages

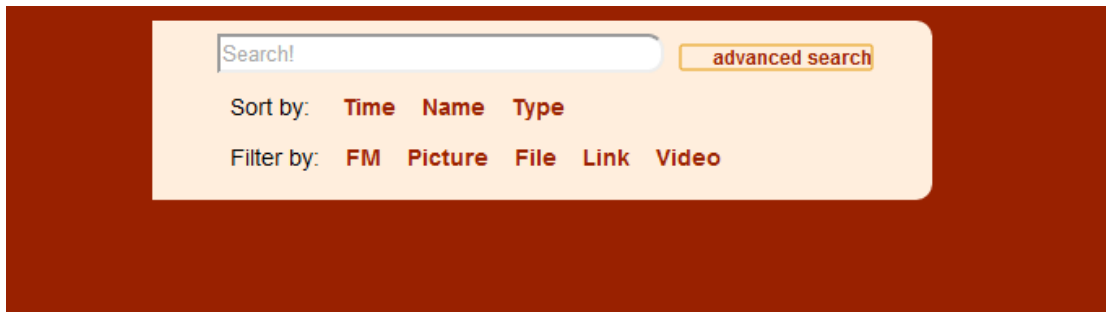
and files. For example, if a user published a Flip Message in the A.V. Williams building, then went to McKeldin Library and updated their location, users on the same layer in the A.V. Williams Building would no longer be able to see those files. On the other hand, if a user wanted to permanently associate a location with a file, they would have to click on “more” and plant their file.

Search and Advanced Search

The FlipStream has a few built-in search and filtering options. If a user wants to quickly find information, they can simply type their query in the search bar. The query occurs instantly, and updates the content as the user types each letter. This makes it easy for users to type in the name of a friend they are looking for or a keyword in a Flip Message.

Additionally, there are advanced search options. These allow users to sort the displayed Flip Messages by time, name, and content type. Users can also filter specific content types, by clicking on the links below the sort buttons. We have provided users with filters for the main content types that FLIP automatically recognizes: Flip Messages, Pictures, Files, Links, and Video.

Figure 33: Advance search options



Content Types

As mentioned above, FLIP supports five main content types out of the box. What this means is that if a user posts a Flip Message with a link to something with one of these types, it will automatically be embedded in the page. So, if a user posts a link to a picture, the picture will appear embedded in the FlipStream, instead of just appearing as a link. If a user posts a link to a video upload site, such as YouTube, the video will automatically be embedded and marked with content type video. All items on the FlipStream are marked by their content type by an icon on the top left. All of the content type icons are shown in Figure 33.

Figure 34: Content types (Pictures, FMs, Planted points, Links, Videos, and Files) from left to right



New FLIP Stream User Interface

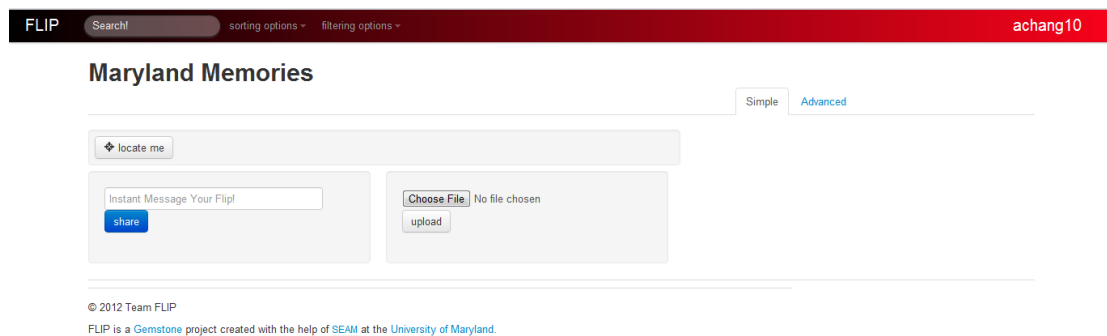
We decided that the FLIP Stream user interface was unsatisfactory to our goals. A goal when designing the new user interface of the FLIP Stream was simplicity while keeping the aforementioned features. A key strength that we identified of many existing services was a slick user interface. We strived for FLIP Stream to be more user-friendly and aesthetically appealing.

Instead of designing an entirely new user interface from scratch, we chose to find design templates that were suitable to our needs. We ultimately decided on using the Twitter Bootstrap template for FLIP stream. Twitter Bootstrap is an open source interface toolkit that was originally developed by Twitter. The primary advantages of Twitter Bootstrap were simplicity and easy customization. The FLIP stream is not intended to be a complex file sharing interface. The goal of the FLIP stream is to make sharing as easy and quick as possible while making the learning curve as minimal as possible. Twitter Bootstrap's clean, simplistic layout was analogous to those goals. Another advantage of Twitter Bootstrap is its full adaptivity, which allowed our developers to avoid re-designing multiple layouts.

The FLIP stream is designed to provide easy access to all the features of the FLIP stream. The default front page of the FLIP stream includes the three features we felt users would use most often. The 'locate now' button allows users to locate themselves to enable location-based sharing. The FLIP message and upload file buttons are the two sharing features that users will usually use. However, we provided access to other features in the 'Advanced Features' tab.

We also integrated the search bar into the top bar of the FLIP stream. This is similar to many social networking sites like Facebook and Twitter. We also felt that users would want to be able to sort and filter posts. Users can sort by name, type, and time and filter by file type (FLIP message, picture, video, audio). The search function is dynamic and automatically filters posts as the keyword becomes more precise.

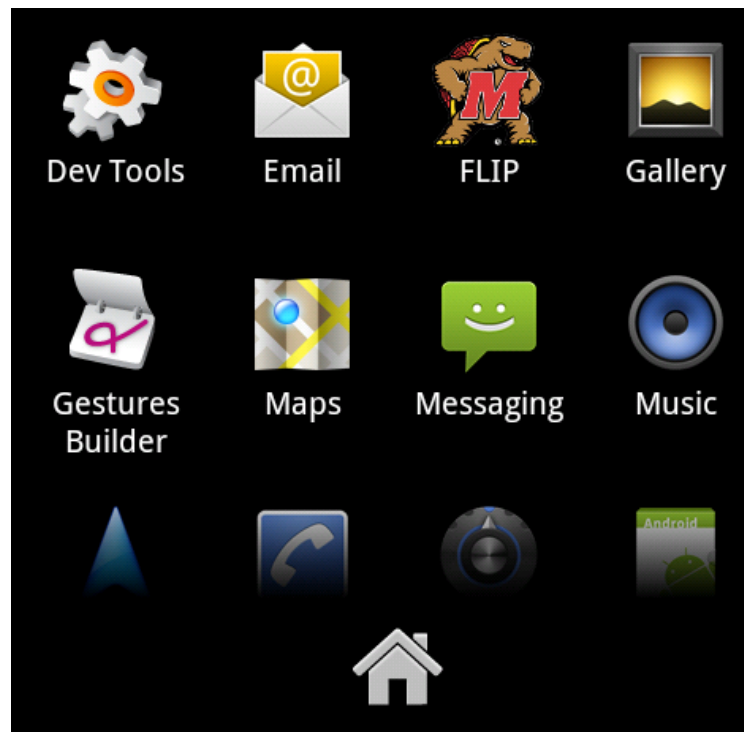
Figure 35: FLIP Stream's new user interface



Android Application

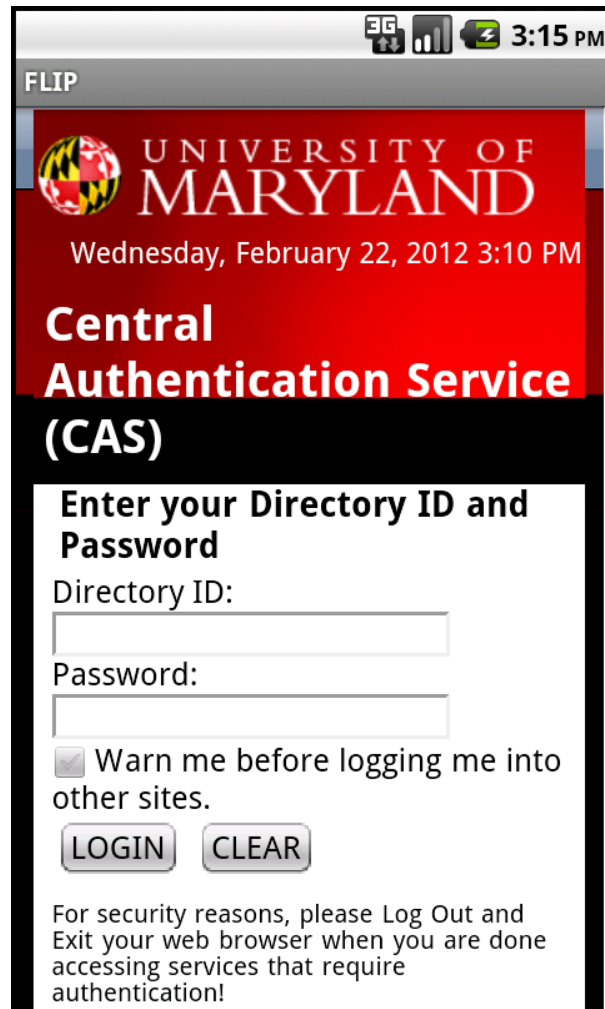
A native Android app written for target platform version 2.2 was made to take advantage of GPS hardware on mobile devices that greatly improved location accuracy. With the prevalence of smartphones and tablets, we knew many users might try accessing FLIP from a mobile device, and this native app was made to neatly wrap up the main features of FLIP so users do not have to go through a mobile browser. Android was chosen for its low development cost and low barrier to entry into the marketplace.

Figure 36: FLIP app installed on an Android 2.2 device



Much like the desktop versions of FLIP, the Android app also takes the user to a CAS login screen where a valid university directory ID and password are expected as soon as the app is started.

Figure 37: Logging into FLIP through Android



FLIP

UNIVERSITY OF MARYLAND

Wednesday, February 22, 2012 3:10 PM

Central Authentication Service (CAS)

Enter your Directory ID and Password

Directory ID:

Password:

☒ Warn me before logging me into other sites.

For security reasons, please Log Out and Exit your web browser when you are done accessing services that require authentication!

Once logged in, users will be able to see a list view with all the layers that they are currently subscribed to. Once again, the most prominent button is the “Update Location” button at the top of the screen that will use the phone’s Location Services to obtain an approximate location and to send it to FLIP. If a GPS signal is available, the phone will first attempt to determine a location using GPS, but will fall back to using Wi-Fi triangulation. Correct acquisition of location will display a Toast notification of the new latitude and longitude coordinates. If both GPS and Wi-Fi are

not enabled, the phone will display a Toast notification indicating that Location Services are not enabled.

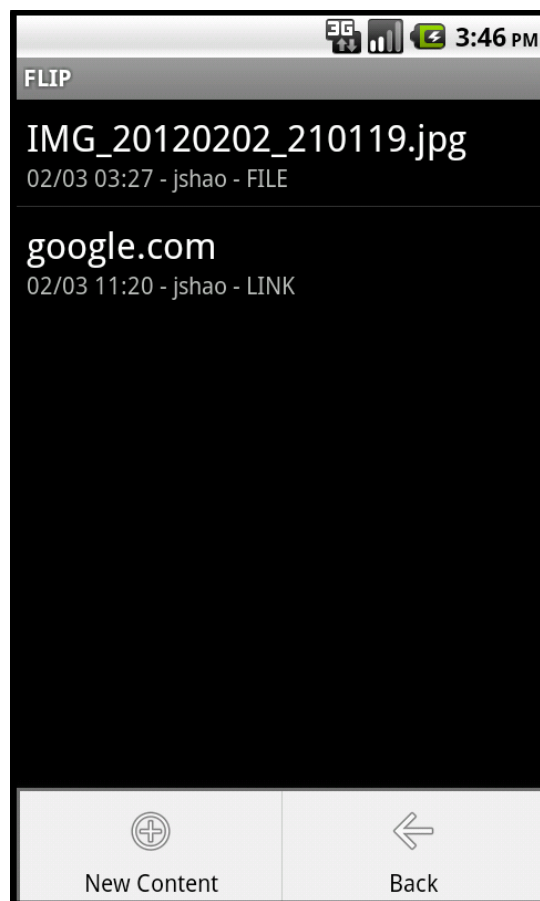
Clicking the “Menu” hard key on the Android device will bring up a contextual menu at the bottom of the screen (See Figure 35). “Join Layer” allows the user to subscribe to other layers, “Map View” allows the user to view points that are proximate to them on a map of the campus, and “Logout” forces the user to login again through CAS after bringing the user to a CAS logout screen. Clicking any of the layers in the list view will bring the user to a new list view with FLIP content for that layer.

Figure 38: Android after logging in with menu expanded at bottom of screen



The FLIP content page for each individual layer will only display content in the layer that is proximate to the user. Pressing the “Menu” hard key on the phone will again bring up a menu with the “New Content” and “Back” options (See Figure 36). “New Content” will allow the user to upload files from the phone or add new links and FMs. The “Back” key will bring the user back to the main view of the app similar to the “Back” hard key of the phone. Clicking the content in the list view will open them in an in-app browser for viewing.

Figure 39: Android content view for layer with menu expanded at bottom of screen



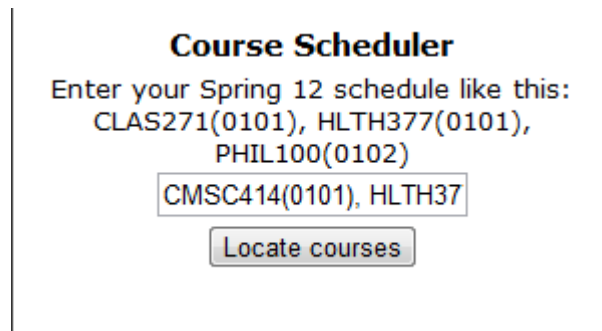
Secondary Features

At the end of development, we had a product that simplified the sharing of files between users who were proximate to each other, but also developed secondary features that further realized team FASTR's vision of community-sustainable mapping. The layer-centric groundwork is ideal for obtaining crowd sourced data for common interests. These secondary features augmented the geo-awareness and social aspects of our system, and include a course scheduler for creating layers with the locations and times of the user's schedule and the ability to have crowdsourced community-sustainable layers. The layers created by these features can be shared with and edited by the public or with select users. A brief description of these features will be given.

Course Scheduler

The course scheduler for the FLIP system is located below the Geolocation feature and automatically generates a layer filled with information such as building, room number, and times of the courses. This feature is not only helpful for new students who are not sure where buildings are located, but can be used for social purposes as well. Layers can be shared with friends and permissions can be granted so that others can edit and add points to the schedule layer such as times for lunch dates and other appointments.

Figure 40: Course Scheduler under the Route tab



Course Scheduler

Enter your Spring 12 schedule like this:
CLAS271(0101), HLTH377(0101),
PHIL100(0102)

CMSC414(0101), HLTH37

Locate courses

In this example schedule, CMSC414 and HLTH377 are entered in the format “CMSC414(0101), HLTH377(0101)” similar to the provided sample. Courses entered should have a section number in parenthesis and should be separated by commas. When “Locate courses” is clicked, a layer is automatically created for the user and displayed in the “My Layers” tab of the interface. The layer name will have the format “username Schedule timestamp,” which can be edited by the edit layer functions. Once the layer has been selected in the “My Layers” tab, classes will be mapped on the map view. Figure 39 correctly shows CMSC414 at CSI and HLTH377 at the School of Public Health. Clicking each point will bring up a popup with information on classroom, time, and course name.

Figure 41: Newly created schedule layer

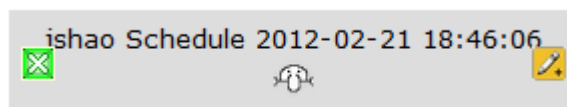
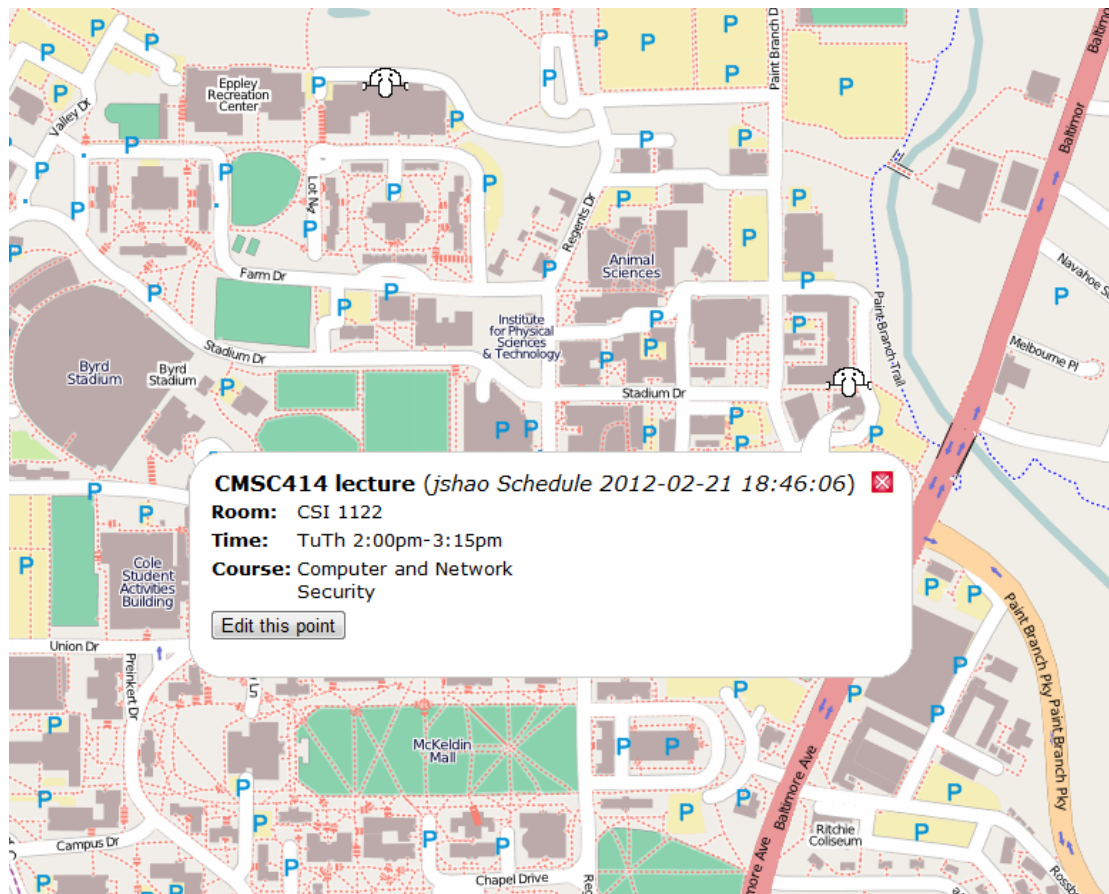


Figure 42: Schedule layer shown on map



Crowdsourcing

The ability to have the users of the FLIP system crowd source information about the University of Maryland is an extremely efficient way to accumulate data for relevant topics. For example, a public layer could be created titled “Bike Racks” where all users could add points on the layer denoting the location of bike racks on campus. Similar to Wikis, as more and more users input the locations of bike racks they know about, a more and more complete picture of the locations will be available to all the users. There is no limit on the variety of ideas that can be crowd sourced, with applications ranging from academic courses to social gatherings to practical

details about our campus. Crowd sourcing on TerpNav is made possible by the layer organization of FLIP along with privacy options that allow the public or specific users to view/edit the layers.

Chapter 5: Tracking the Product

As we developed our new technology, it was imperative that we make adjustments while testing the different features. First, we conducted a click analysis to evaluate how FLIP performed in comparison to other popular file-sharing websites. We then gauged public interest through user surveys after providing them with videos of simulated situations in which FLIP could be used.

Click Analysis

After creating a working final version of FLIP, we decided to run the program through a performance test to determine the user experience efficiency of the program. The efficiency of the user experience is important in determining the adaptability of a program. A program that has a higher learning curve and frustrates user is less likely to be adapted by the users. Convenience and efficiency are key measures of performance.

We ran FLIP and other technologies that already exist on the market through a rigorous user experience test to determine the competitiveness of our product on a technological level. The primary goal of this testing was to identify any lag in user experience and subsequently correct them in order to determine the competitiveness of FLIP to existing technologies. Although we were confident of the product we created, we decided that internal testing was essential in order to evaluate and further improve the user experience before releasing it to the public for usage.

Deciding on the Best Test

There were many tests that we considered to make this quantitative analysis. Since the user experience depends on the technological experience of the user, we first had to decide on a variable that would standardize a user experience as much as possible. We found that various measures were not suitable for us to use in our testing due to various factors.

There are several variables that could be used to make this analysis. We looked into clicks, total time, and keystrokes as a measurement of performance. After running the time test on various programs, we believed that it was an unreliable measurement that we should not use. The time performance of a program can be affected by many different factors. One of the factors that would cause variations in performance are the number of other passive or active programs running affects the amount of resources available for a program to use.

Another factor is the variations in download and upload speeds between any given moments in time. At any point, there can be several computers connected to a network router. Each router has a capacity of bandwidth that it can give to connected computers. If many computers are connected, there is a limited amount of bandwidth that a single computer can receive. Since available bandwidth correlates with download and upload speed, it would subsequently affect time.

We also explored the reliability of keystrokes as a form of measurement of the convenience of user convenience. We believed that keystrokes were a more consistent measure of the user experience than time. However, we still found inconsistencies that made performance comparison unfeasible. The different login requirements for

various services and a lack of a reliable way to standardize these accounts created wild variations in keystrokes. For example, services such as Facebook require a full e-mail while other services such as Twitter only require a username. There are also password requirements such as capital letters, numbers, and special characters that make keystrokes a poor measurement for comparison. Furthermore, the typing proficiency of the user affects the importance of keystrokes as an indicator of performance. A person who types 60 characters a minute would be much more affected by two extra keystrokes than someone who types 120 characters a minute.

The measurement that we ultimately decided to use in order to measure the efficiency of the user experience of FLIP and the other programs was click count. We decided that clicks were the minimum required actions that a user must perform to complete a task. Clicks are the digital equivalent of steps, and unlike the above metrics, they are completely independent of time. Users must complete each step before advancing to the next step. Steps that involves a 'click' include 'upload file,' 'send,' and 'login.'

Click Testing

As mentioned earlier, once we had a working version of FLIP, we began our click testing. In order to begin our testing, we first compiled a list of popular services that allow users to share data, files, or information similar to FLIP. The five types of data that we focused on were: documents/files, pictures, videos, music, and text/notes. These websites ranged from social networks to simple file uploaders. We then set out

to test each service from a ‘cold start’ (the user is not previously logged in) to having a file be shared onto the Internet.

After testing all of the websites thoroughly and achieving the absolute minimum number of clicks, we found the mean and median of each file type. We then compared FLIP to the mean and median. We found that FLIP lagged behind the average user experience of other technologies. As seen in Table 1, FLIP averaged 10 clicks over all of the files. However, all other existing technologies besides torrents had a better streamlined user experience. Only torrents had a user experience that averaged over 10 clicks. We believed that FLIP’s user experience was not competitive to the technologies we tested. After an extensive re-evaluation of the user experience, we identified some steps that could be eliminated in order to streamline FLIP’s experience.

Exhibit 1: Minimum share clicks before modifying FLIP

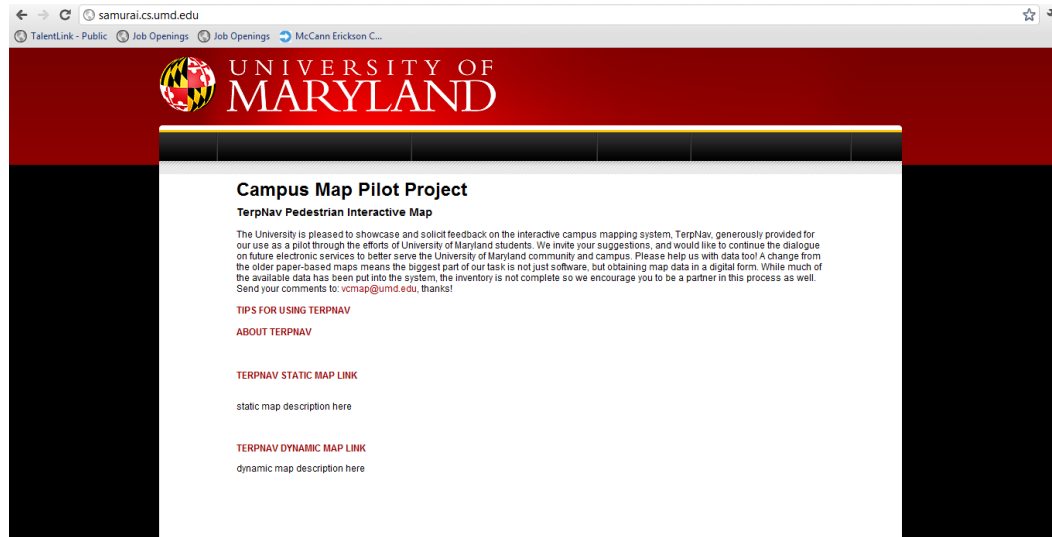
	Doc	Photo	Video	Audio	Links/Text
FLIP	10	10	10	10	9
Gmail	8	8	8	8	8
Yahoo! Mail	8	8	8	8	8
Hotmail	8	8	8	8	8
Facebook	6	6	6		3
Hulkshare				4	
Torrent (Demonoid)	14	14	14	14	14
Soundcloud				6	

Google+		5	5	5	5
Twitter					3
Dropbox	2	2	2	2	
Imgur		3			
Mediafire	3	3	3	3	3
Youtube			7		
Imageshack		4	4		4
Tinypic		4	5		
Average	7.375	6.25	6.666667	6.8	6.5

The first step that we eliminated was a ‘Welcome’ front page before access to FLIP. In the previous iteration of FLIP, users were introduced with a ‘Welcome’ page with extensive information about the project and a short text tutorial. We decided that this was unnecessary to keep in FLIP’s experience. While this information could be useful to a first-time user, we believe that most users would not read the information every time they accessed FLIP. We decided that it was more necessary to allow users quick access to the actual program then to provide them background on the program. When examining existing technologies, we found that these ‘welcome’ pages did not exist on their websites. For example, Facebook and Twitter allow users to login from the front page and instead have supplemental links on the page that allows users to read about the program at the users’ discretion. Although we could not embed the login link onto the map because of technology limitations of the university login authentication service, we decided that it was necessary for login to be the first click for users. Therefore, we found the ‘Welcome’ front page an unnecessary step and

eliminated it from the user experience. Currently when users access FLIP, the first thing they see is the map and a link to login.

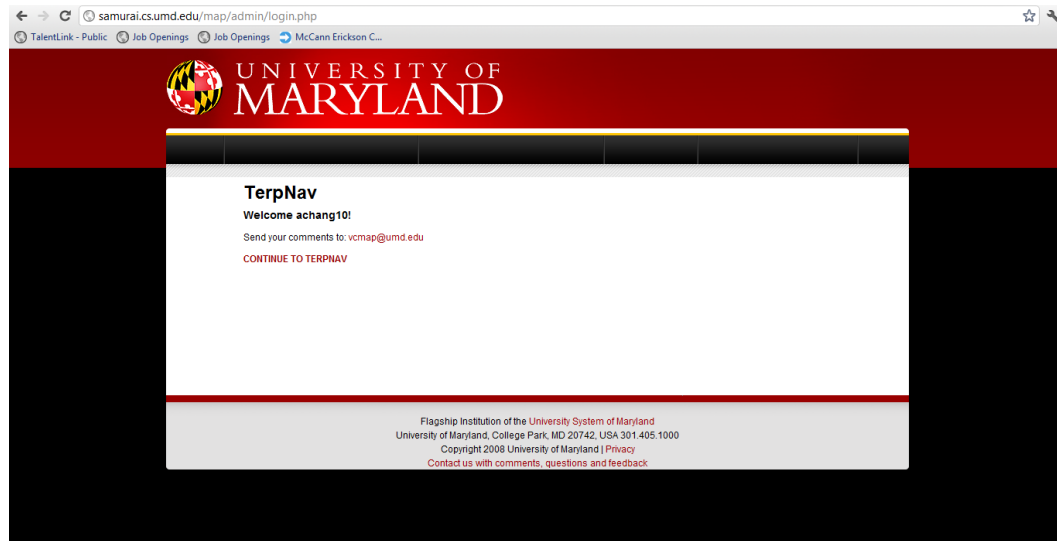
Figure 43: Cover page from flip.cs.umd.edu (<http://samurai.cs.umd.edu>, 2/20/12)



The next click that we found that could be eliminated was an authentication approval page. After users logged in, users would be sent to a page that would say “Welcome, [username]” and a link to continue to FLIP. We decided that it was unnecessary for users to have to be assured that their login was successful. If the login was unsuccessful, they would be forced to try again. Again, we looked at the experience of competitors for guidance on this issue. We found that this feature did not exist in the user experience of technologies. Therefore, we eliminated this buffer page between the login and the FLIP program. Currently after logging in, users will be automatically re-directed back to FLIP.

Figure 44: Login authentication page from flip.cs.umd.edu

(<http://samurai.cs.umd.edu>, 2/20/12)



The third click we managed to eliminate was a re-shuffling of the FLIP interface. When users logged in, the first tab that they were shown was the tab labeled ‘Route.’ While this was the primary feature of the previous version of FLIP, we decided that it had become a secondary feature in the newer versions of FLIP. We decided that the ‘My Layers’ tab should be the default tab that is shown to the user after they login because we believe it would be the most commonly used tab by FLIP users. In order to provide easy access to their layers, users should not have to make the extra click of having to access those layers. Therefore, we decided to make the default display tab to be ‘My Layers’ instead of ‘Route,’ which eliminated another click from FLIP’s performance.

Figure 45: ‘Find route’ tab originally displayed first

(<http://samurai.cs.umd.edu>, 2/20/12)

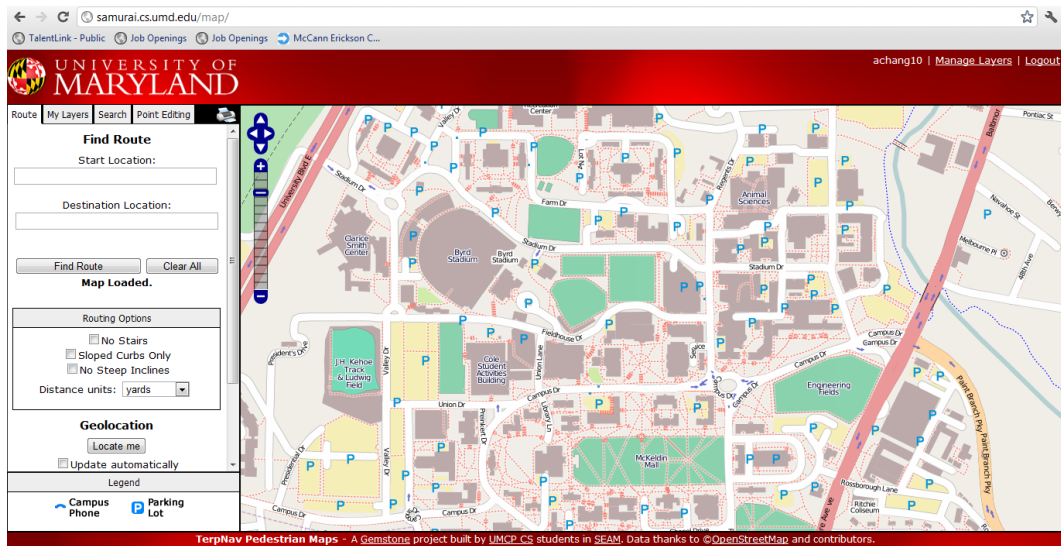
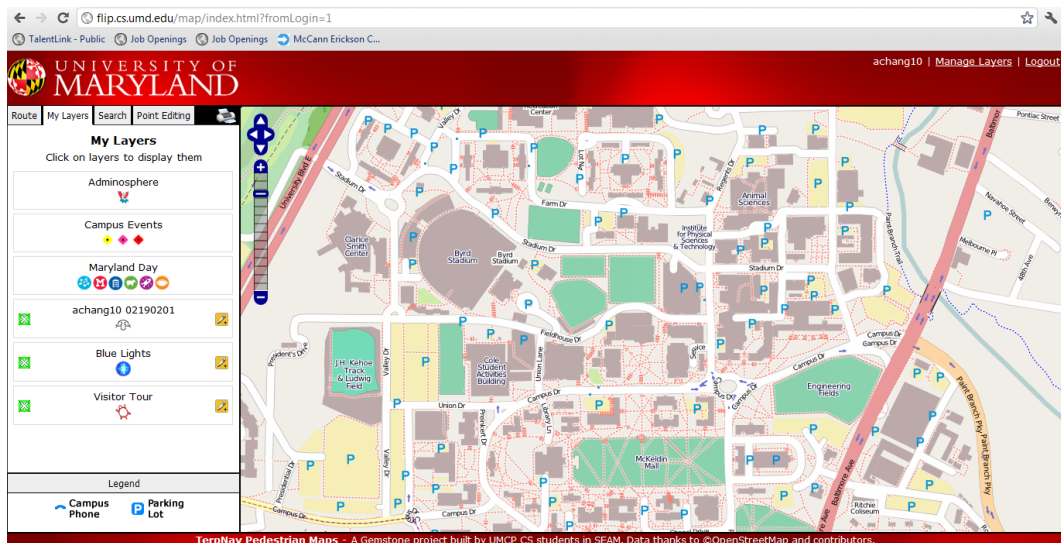


Figure 46: Currently, ‘My Layers’ tab is displayed first

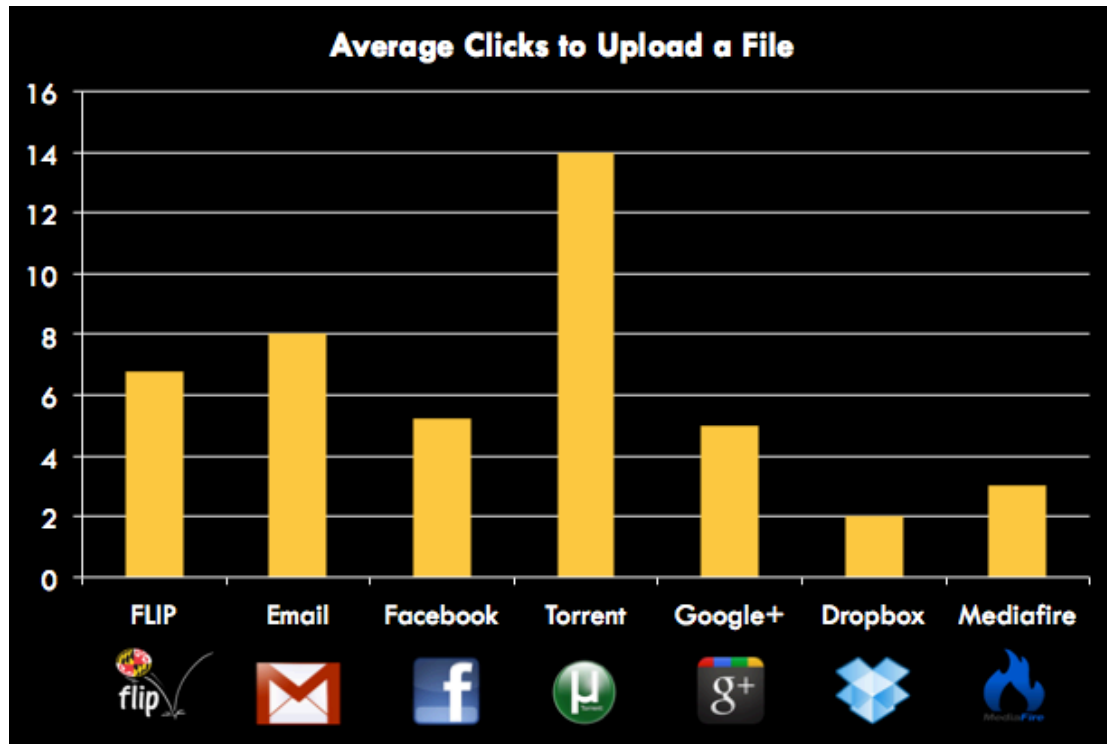
(<http://flip.cs.umd.edu>, 2/20/12)



After making these changes to FLIP, we re-tested FLIP to ensure that three clicks had indeed been eliminated from the process. We confirmed that FLIP did improve by three clicks by removing these three steps from the FLIP user experience. We edited our data (Exhibit 2) to reflect the changes that we made to the program.

This graph shows the average number of clicks it takes to upload a file regardless of file type for the listed services.

Exhibit 2: Minimum share clicks with edits made to FLIP



Our initial testing only tested the upload user experience across the services. We knew that it was necessary to narrow the scope of our testing even further. Although some services had a significant advantage in the minimum number of clicks to a pure upload or share, we decided that the services should be standardized even further.

When using services such as FLIP and e-mail, users are sharing with a specified group of users. Some uploaders such as YouTube simply upload files onto

the World Wide Web. In order for that file to be shared with a specific group of people, further steps or clicks must be taken. We believed that it was necessary to factor these clicks in our evaluation. The scope of our research is to make sharing with a group in a geo-located area more efficient, not the sharing of files to the general public. Therefore, we decided to re-test every service that simply uploaded a file onto the Internet by also determining the number of clicks required for a user to share the link with specific users.

To justify for this additional interaction, we added the number of clicks it would take to use each site's native, embedded sharing features (such as using email, Facebook or twitter) to send links to someone. This significantly increased the number of clicks it took, as you can see on this graph.

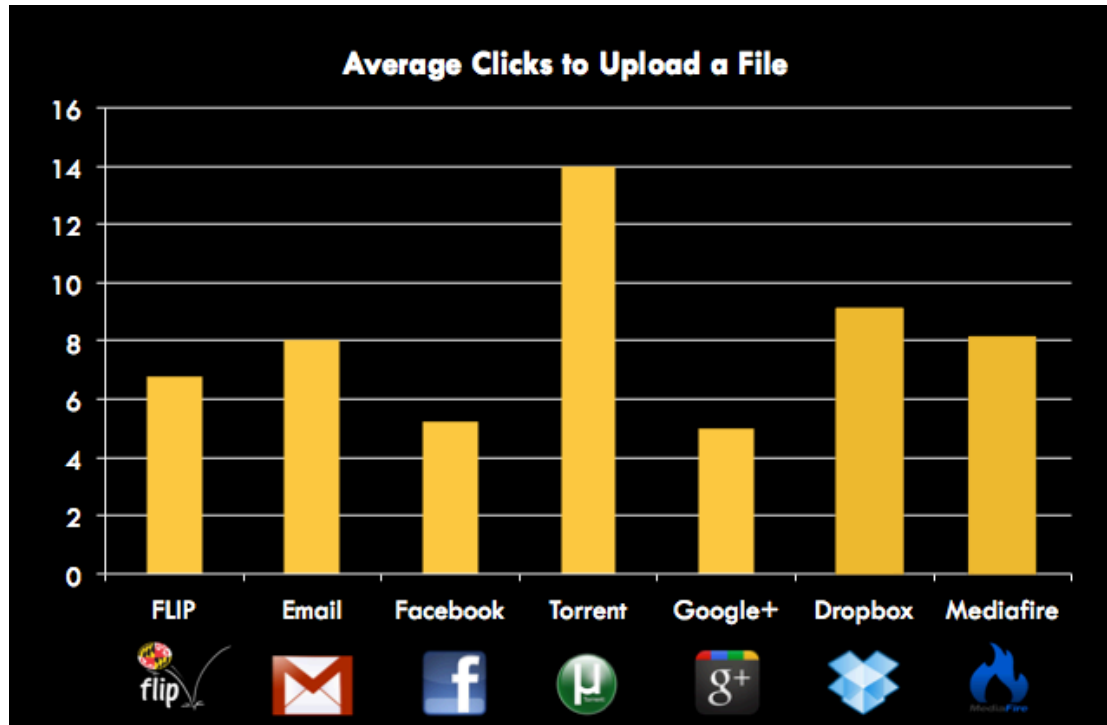
We found that there was a significant increase in clicks by websites that specialized in uploading after sharing clicks were taken into (Exhibit 3). While Dropbox was the clear leader in the first round of testing, when adding Dropbox's e-mail based sharing clicks, Dropbox increases dramatically to nine clicks. This shows that Dropbox's core competency is personal sharing and may not be viewed as a convenient file sharing service compared to others. Furthermore, when adding the sharing clicks to other services such as YouTube and Mediafire, their clicks increased anywhere between one to five clicks.

Exhibit 3: Minimum clicks after embedded sharing clicks are added

	Doc	Photo	Video	Audio	Links/Text
FLIP	7	7	7	7	6
Gmail	8	8	8	8	8
Yahoo! Mail	8	8	8	8	8
Hotmail	8	8	8	8	8
Facebook	6	6	6		4
Hulkshare				7	
Torrent (Demonoid)	14	14	14	14	14
Soundcloud				6	
Google+		5	5	5	5
Twitter					3
Dropbox	9	9	9	9	
Imgur		7			
Mediafire	8	8	8	8	8
Youtube			7		
Imageshack		7	7		7
Tinypic		5	6		
Average	8.5	7.666667	7.75	8	7.1

Several services excel at providing an upload service, however, many have yet to refine the targeted sharing aspect of their services. Exhibit 4 shows the new average number of clicks after these additions.

Exhibit 4: Minimum share clicks plus additional clicks for Dropbox and Mediafire



Conclusions from testing

This testing served as a proof of concept and validation of the FLIP service. When creating a new product, the developers must take into account how their product performs in comparison to competitors. By creating a product that is more inconvenient to use than existing product, developers risk alienating users. It is important for new products to be able to perform as well as existing competitors. Our click comparisons show that FLIP performs just along the average compared to many of these services.

During testing, we ran into several hurdles or limitations of many services including FLIP. Many of these websites serve a core competency in the digital

information market. They all serve a specific niche in the market and satisfy that niche very well. For example, websites specializing in uploading have the most streamlined user experience to upload files. However, once share clicks were factored in, their user experience lagged. While some people upload videos with the goal of being viral, that is not necessarily the goal of every user.

Also, we found that many of the services required users to set up an account before being provided access to upload services. If a user is looking for a one-time use of an upload service, they may find the user account creation process to be a chore when also considering the need to verify many accounts. FLIP is built directly into the university database. The user credentials are the same identities as other university services such as Testudo (testudo.umd.edu) and Blackboard. All university members have a university directory login upon registering with the university. FLIP can be seen as added value in terms of the breadth of access a university login provides.

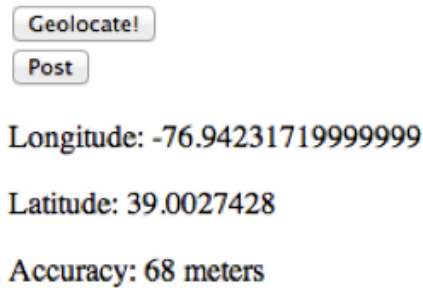
We also found several limitations of file transfer services. These limitations ranged from file sizes to sharing limitations. Yahoo! and Google mail all limit their maximum file size to 25MB while Hotmail limits files to 10 MB. These file limits mean that many video files cannot be sent via e-mail. Dropbox allows users to use their service for free with a maximum of 2 GB. Users that would like to use more storage have to pay a monthly fee. Furthermore, the sharing capabilities of many of the sites were limited to global sharing without additional measures taken in order to restrict the privacy of a file.

Wi-Fi Location Precision Analysis

As a result of FLIP's reliance on technologies like Google Geolocation Services, there is a definite margin of error for each user's geolocation look-up on FLIP. Google Geolocation Services, which is used by Google Chrome and Firefox, is used in situations where an exact GPS coordinate is not available. While most smartphones currently have GPS units inside them, allowing for a sensing of location as accurate as 10m, Google Geolocation Services is often much less accurate. Google Geolocation Services depends on three primary pieces of information to estimate user location (a) the computer's IP address (b) information about nearby wireless access points, and (c) a random client identifier, assigned by Google, that is erased every two weeks (Mozilla 2012).

Since Google Geolocation Services and its ilk are nothing more than a heuristic, Team FLIP thought it would be important to put the precision of their heuristic to the test. Specifically, we wanted to get a look at how good geolocation estimates are on campus. To do this, we went across campus with a laptop and tested the Google Geolocation Service with a simple purpose-built application, shown in Figure 44.

Figure 47: Our testing application showed the estimated coordinates as well as the range of error.



The screenshot shows a web application interface with two buttons at the top: "Geolocate!" and "Post". Below the buttons, the following text is displayed:

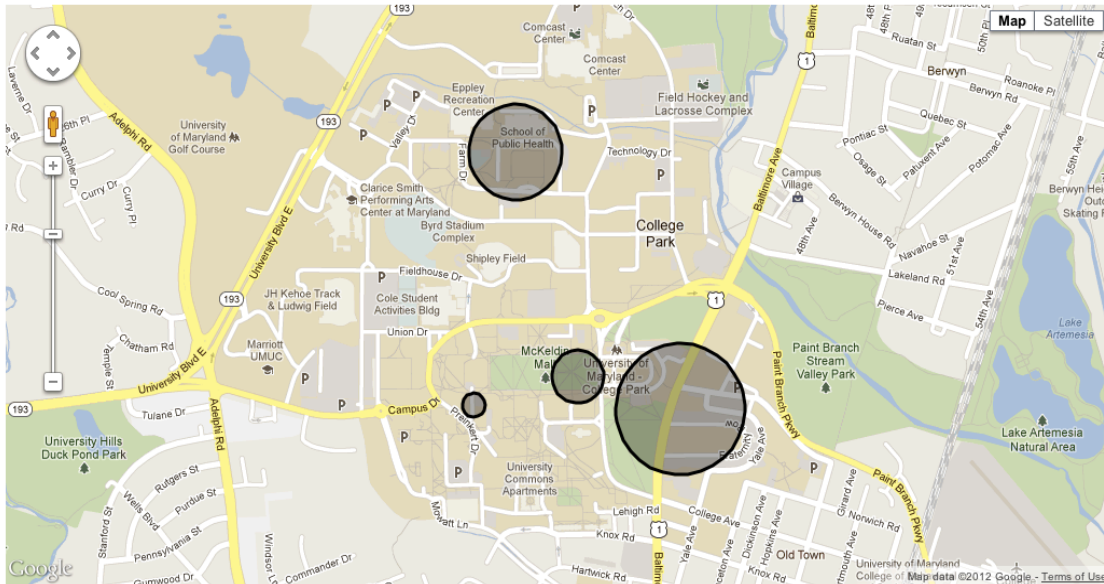
Longitude: -76.94231719999999
Latitude: 39.0027428
Accuracy: 68 meters

Using the over 100 points of data generated from this application, we created a map using Google Maps API which showed just how precise geolocation can get on campus. This map is shown in Figure 45.

To visualize the precision reading, we plotted each point on a map. Each of these points is represented by a circle, and each circle equates to one measurement. The radius of the circle shows the error radius of the reading.

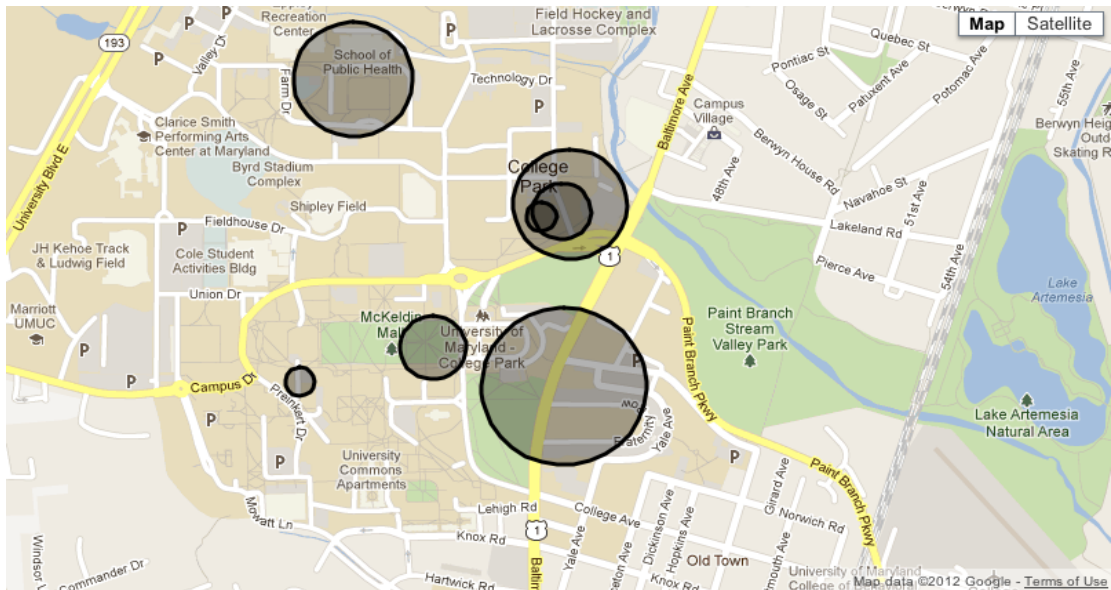
To clarify, when we took this measurement, the app located us to be at the center of the circle. However in reality, we could have been anywhere within its circumference.

Figure 48: Wi-Fi Precision Accuracy Results (small vs. large radii)



We also recorded changes in both precision and accuracy, which produced stacked circles. There is a difference between precision and accuracy: in this case, *precision* would describe the length of the error radius from our actual point of measurement, and *accuracy* would describe the consistency of our detected position and error radii when taken multiple times from the same point. The stacked circles show this variation of error radii.

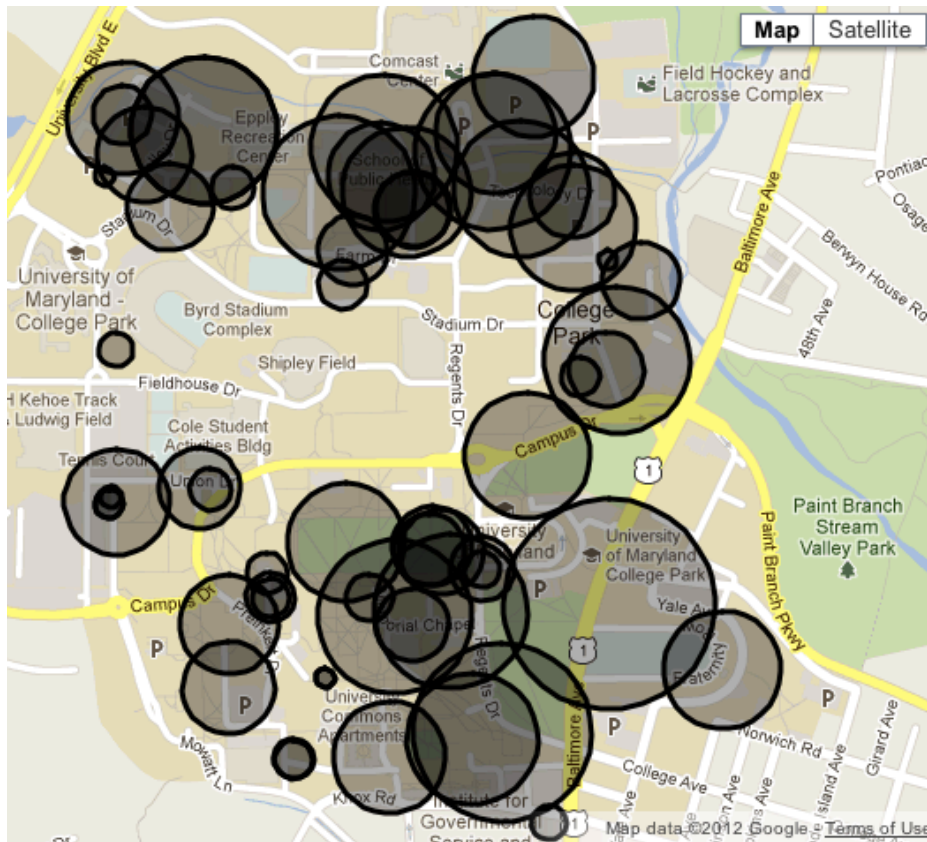
Figure 49: Wi-Fi Precision Accuracy Results (stacked measurements)



We found that location predictions were most accurate inside buildings.

Location predictions were the least accurate near Route 1, as well as on McKeldin mall. The following map shows all test points plotted.

Figure 50: Wi-Fi Precision Accuracy Results (all measurements plotted)



Chapter 6: Surveys

In order to gauge public interest in our project, Team FLIP administered a survey to students in the University of Maryland community. Furthermore, the questions we asked address one of our research questions: How will FLIP technology affect communication in class, in the workplace, and in social situations? This survey reveals how users compare FLIP to existing file-sharing technologies such as Dropbox, file-hosting sites, and email exchange. Additionally, this survey shows users' affinity for using location-based technologies such as Foursquare and how much they plan on adapting more in the future.

In order to survey human subjects, we needed approval from the Institutional Review Board (from hereon referred to as IRB). In February of 2012, the IRB approved our application and we were able to move forward with our final assessment of user interest and evaluation (see Appendix C for the complete IRB application submission). We hosted the survey using Google Docs and its form-making feature. The advantage of using this software is that every answer is already recorded in spreadsheet form, which can then be downloaded as a Microsoft Excel spreadsheet. This helped us greatly when it came to analyzing data and creating graphs. To attract participants, we first set up a Facebook event and invited University of Maryland students to partake in the survey. Students were asked to view instructional videos on how to use the FLIP application. Then, they could complete the survey based on their previous knowledge and use of location-based and file-sharing technologies in addition to newly acquired knowledge from watching the FLIP tutorial videos.

Participants

Our Facebook event directed people to the FLIP web application. Upon logging in, the users saw some example use cases of the FLIP software as shown through tutorial videos. Users were then allowed to explore the FLIP website, and use and evaluate in at their leisure. After using the website for any amount of time that they like, the user completed the survey that was linked from the Facebook event. At the end of the survey, they were asked to read and sign a consent form, and to enter their email address (optionally) if they wished to receive payment in return for taking the survey. Those who filled out the survey had the chance to receive one (1) of 30 prizes of \$10 cash. This was determined by a random raffle. In order to qualify for the survey, the participant had to be a student at the University of Maryland and also have a working university log-in ID for the Centralized Authentication Service (CAS) at UMD. There were no other criteria in selecting the participants, and participation in the survey was completely voluntary.

Survey Interface

The survey was hosted on Google Docs using their form creator. The beginning of the survey requested that users watch tutorial videos on the FLIP application at www.youtube.com/teamflipvideos. Then, the user was asked to answer seven questions and an optional comments section on FLIP and location-based and file-sharing technologies. In order to be entered in the random raffle for the thirty \$10

cash prizes, participants were asked to enter in an email address as contact information, but this was also optional so participants could refrain from giving any personal information if they wished. Participants were also asked to type in an electronic signature to confirm that they agree to the consent form that they are linked to in the survey. Any emails or personally identifiable information were taken out for data analysis as to not create bias when analyzing results.

Questions

We analyzed public interest through user surveys after providing them with videos of simulated situations in which FLIP could be used. We simulated our product's application in the following case scenarios:

- Colleges and co-workers who gather for a meeting or study session should be free to immediately share documents and notes in real time, without email transmission or the overhead of uploading/downloading files to/from a server.
- Friends socializing with one another should be able to collectively listen to or view media entertainment (rather than individually experience multiple copies of the same media, as is now the trend with iPods and other portable media players).
- Restaurants and markets should be able to directly share additional information about products or wares, beyond just the product itself. Customers should also be able to establish serendipitous sharing with one another simply based on being in the store together.

- Crowd-sourcing of knowledge should be able to locate problem areas on campus that need fixing. For example, if a user sees a pothole, he should be able to label the location of the problem on a map and provide a description of the issue for others to see.
- A student who uploads his course schedule to a map layer and is able to see the geographical location of each class.
- Users can upload events to a calendar layer, depicting when and where each one is.

Ideally, we would select participants that fit each of these groups and then instruct them on how to use FLIP using step-by-step directions pertaining to the subject. However, due to limited resources and time, we provided participants with tutorial videos about the FLIP application and its uses. Then, they were asked to fill out a survey asking them about their daily use of location-based technology and how FLIP compared to those other technologies.

Survey questions addressed a number of topics: the user's familiarity with location-based technologies like Foursquare and Facebook Places, how FLIP performed in ease of use in comparison with other file-sharing technologies, and how FLIP changes users' perception and use of the University of Maryland's campus map TerpNav. There were 11 questions in total. (See Appendix C for a complete list of survey questions. The questions were submitted with the IRB application.)

We used questions with scaled answers for six of our questions to offer users a flexible range of answers based on the intensity level that they feel about the subject.

Five of our questions addressed how convenient it was to use FLIP for file transfers in comparison to other technologies. These multiple-choice questions had three answers each of “more convenient”, “about equal”, and “less convenient”. These were then converted to numeric values in the data analysis part, where more convenient = 1, about equal = 0, and less convenient = -1.

Team FLIP sent out Facebook event invites on February 8, 2012 when the IRB application was approved. The survey link remained open until February 27, 2012. In this time, we received 30 survey responses from various students in the University of Maryland community.

Survey Procedure

We asked participants to view our instructional videos from our team’s YouTube channel, then use Flip and answer several questions about their experience. Each survey participant received the following instructions:

“This is a survey about our Gemstone team project.

Please click on this link <http://ter.ps/ce> and view the videos through the link provided at the top of the survey. Then check out the second link provided, use our application for a few minutes, and answer the survey questions as honestly as possible.

Don't forget to put in your email address at the end of the survey if you wish to receive ten dollars for your participation.

Thank you!”

We made the instructions as clear as possible while trying to give them little prior knowledge about the system. This way, the participants had to figure out how to use Flip just as would someone who discovered it on their own, which gave us honest and useful feedback. Most of the questions had multiple-choice ordinal responses, i.e. opinions scaled from 1-5.

We also asked the participants to compare our system with preexisting file-sharing applications, such as Dropbox. The answers available for these were “More Convenient,” “Less Convenient,” or “About Equal.” In order to more conveniently graph these nominal results, we assigned the numbers 1, -1, and 0 to each response, respectively. This approach gave us a better visual representation of how other applications compared to ours.

The subjects were also given a comments section to provide additional feedback outside of our questions. However, only six of our participants chose to use the comments section, so we were unable to use this particular part of the survey to draw user patterns from the results.

Results and Discussion

The first question on our survey was “Do you see yourself using location based technology to share information in the future?” Since location based file sharing is relatively unused, we used this question to get feedback on our overall goal and second research question (“how can location-based social networking affect communication within classrooms, in the workplace, and in social settings?”)

Figure 51: Survey Question 1

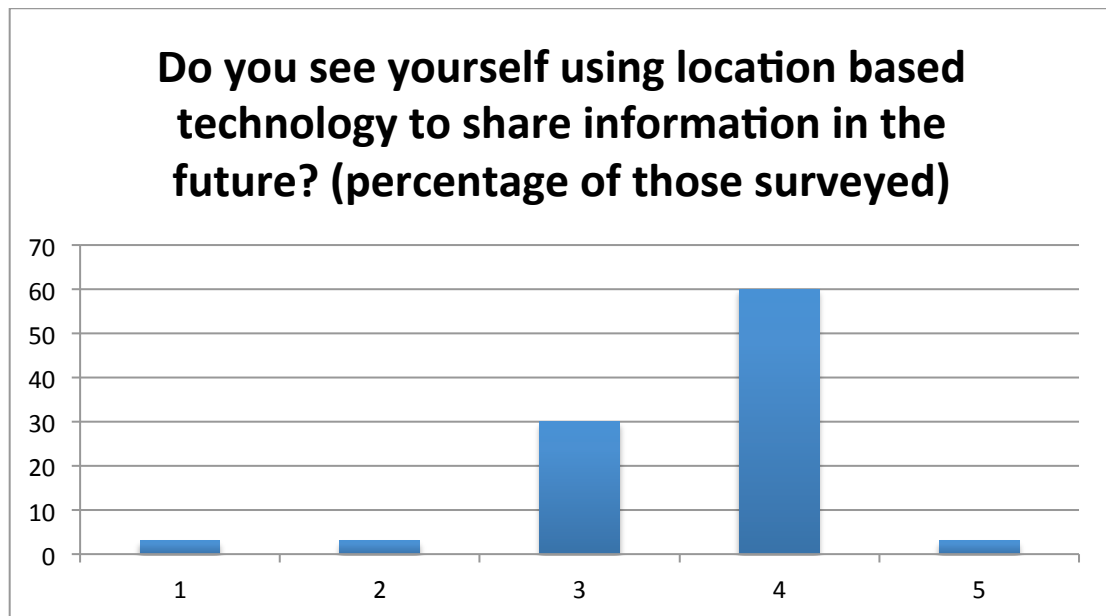
Do you see yourself using location based technology to share information in the future? *

1 2 3 4 5

Never ☐ ☐ ☐ ☐ ☐ All the time

As seen in Exhibit 4, 63 percent of responses were either a 4 or a 5, indicating that the respondents would use technology like this in the future. Currently, not very many other services offer file sharing based on location, so the results of this question demonstrate interest toward this approach. The answer of a 4 or a 5 could be interpreted in several ways. Either the users that answered this way already use a service like ours and see themselves continuing to do so, or our survey has introduced them to something they haven't seen but would like to use again. Either way, positive answers to this question indicate that this survey was relevant to our particular group of respondents.

Exhibit 5: Future use of location-based technology



Our second question, “Do you use ‘check-in’ services like Facebook Places and Foursquare?” pertained to the social networking aspect of Flip. We decided to mention other common social networking websites that mainly focus on the location of the user, which gives us an idea of the prevalence and the need for a service like this.

Figure 52: Survey Question 2

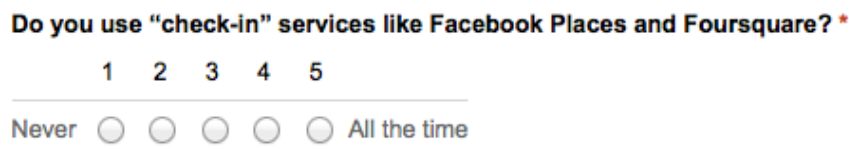
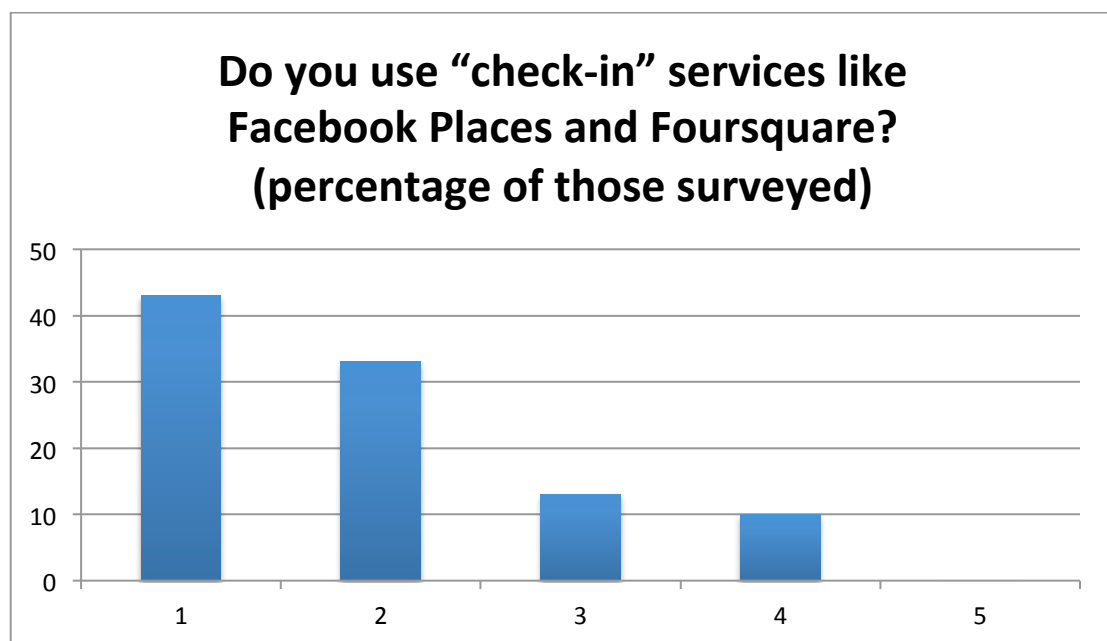


Exhibit 5 shows that the answers to this question were over 70% 1’s and 2’s. Although most of the respondents said they could see themselves using a location-

based application in the future, the majority of them did not use location-based apps regularly at the time of the survey. This pattern offers some clarification for the responses to the first question – it seems that respondents were introduced to a concept that they would like to continue using, which pertains to our research question, “to what extent will users be willing to adopt location based applications, particularly ones used for file sharing?” Flip both identifies and addresses the need for such applications.

Exhibit 6: Use of check-in services



The third question on the survey has to do with the functionality of the concept of location-based sharing. The question and answers seem straightforward, but connecting users digitally to one another when they are close in the physical world is a main staple of our project, so we felt that this was an important question.

In addition, the answers to this particular question would give us an idea of how well our product actually works (or appears to work, according to new users). If the product was not effective, then we would not get a positive answer to the question of whether FLIP increases users' ability to connect to those around them.

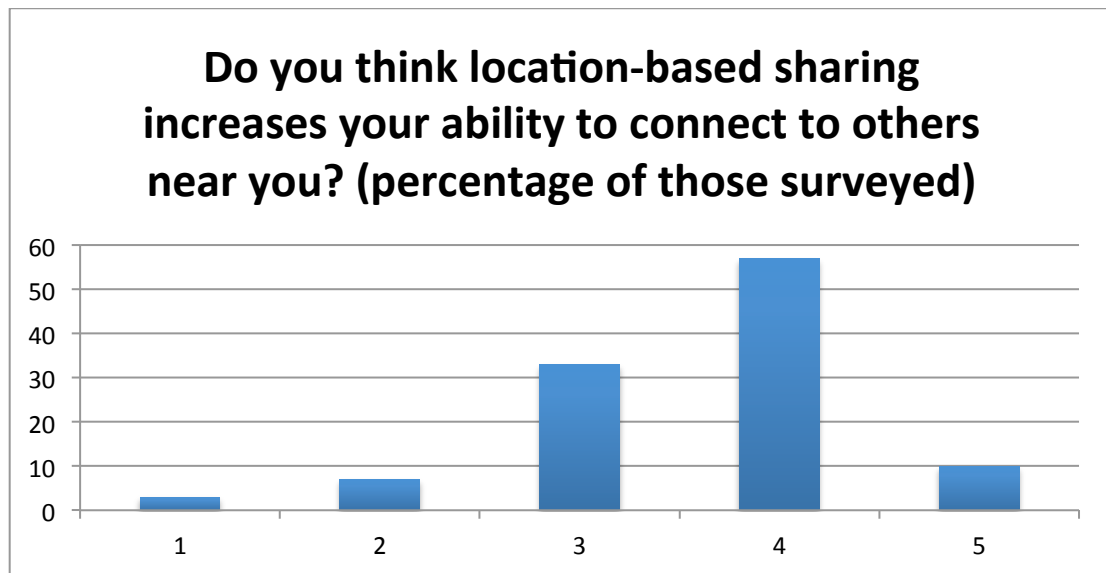
Figure 53: Survey Question 3

Do you think location-based sharing increases your ability to connect to others near you? *

	1	2	3	4	5	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

Based on the answers to this question, our respondents leaned toward location-based sharing technology as a catalyst for connecting with others around them. One of the goals of our project was to make file sharing as easy to do digitally as to hand someone next to you a piece of paper. Such a strong response – more than half of the answers were greater than a 3 on the scale – indicates to us that our technology can help people interact face to face with one another in a streamlined and convenient way.

Exhibit 7: Ability to connect to others nearby



The next question was directed at students, and addressed the “starting with the University of Maryland” part of our first research question (How can we create a social networking system that allows users to connect to each other within a geographic area: starting with the University of Maryland?) TerpNav, the University of Maryland map application introduced by a previous Gemstone team, is mostly relevant to students trying to get to their classes. Since our system is based on the TerpNav platform, we wanted to find out if users looked at our additions as an improvement.

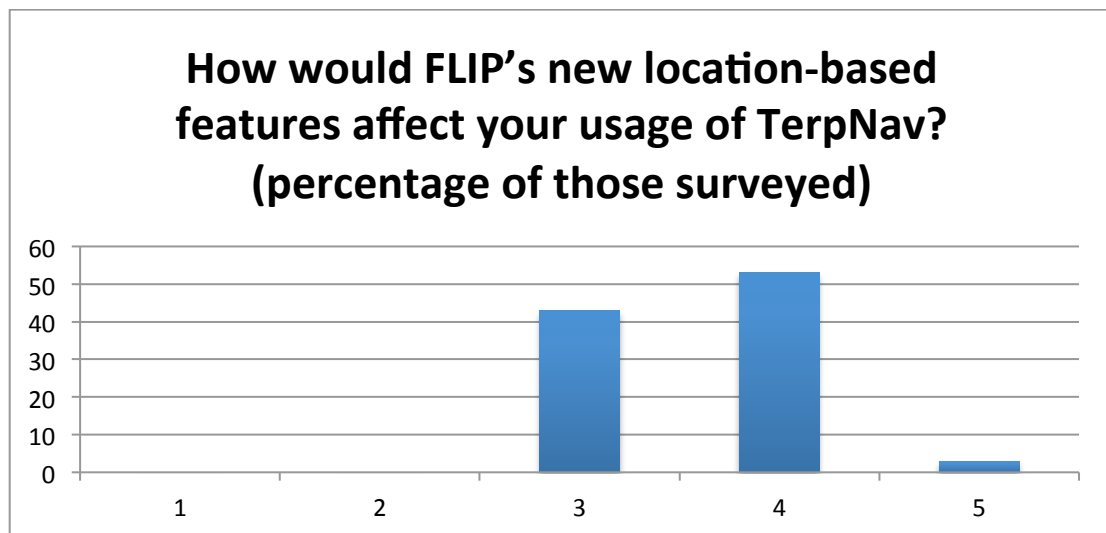
Figure 54: Survey Question 4

How would FLIP's new location-based features affect your usage of TerpNav? *



For these results, we did not expect to see many 1's or 2's, because our program does not discourage the use of TerpNav. Conversely, we didn't expect a vast increase in TerpNav use either – we hypothesized that our main contribution to the use of TerpNav would be raised awareness of the website. A result of 3.56 proved our hypothesis and demonstrated that our program also raised user awareness of TerpNav, since any value above 3 indicates a positive increase in usage of TerpNav.

Exhibit 8: Usage of TerpNav



Our next question was added to the survey in order to find out whether enough students used mobile technology to make a mobile-based sharing application

worthwhile. By asking them about how often they use their mobile Internet to interact with their surroundings, we directed the question specifically toward the features characteristic to our application. Since we all usually interact on a college campus, we hypothesized that most people probably had wireless Internet access and used it daily.

Figure 55: Survey Question 5

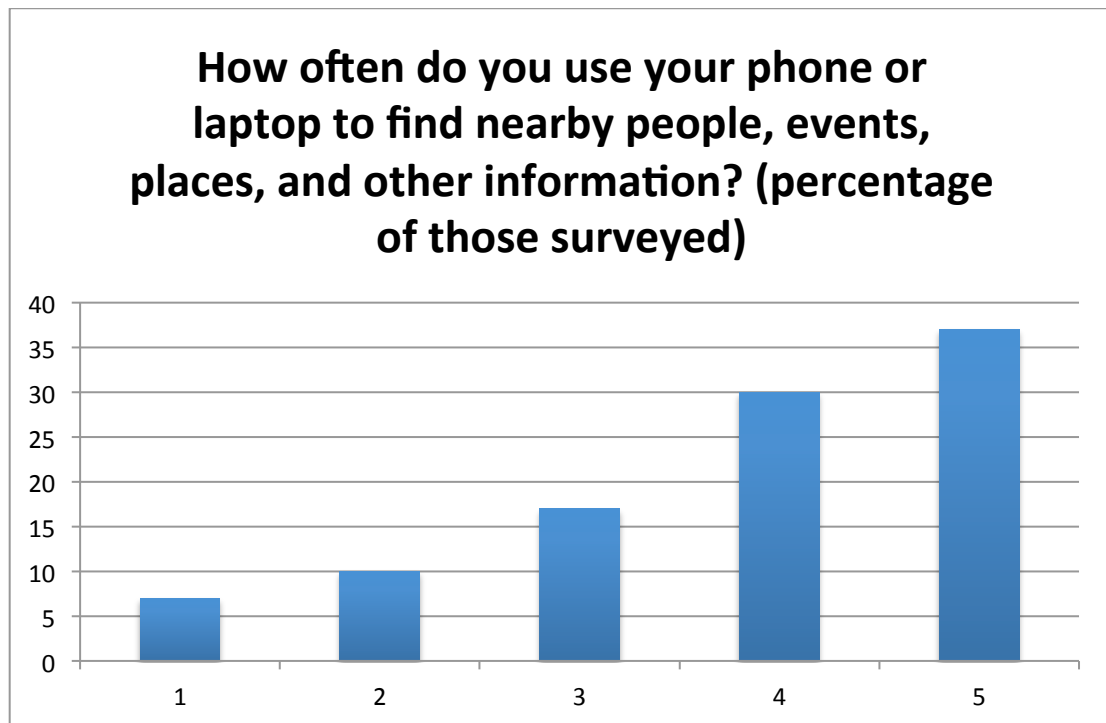
How often do you use your phone or laptop to find nearby people, events, places, and other information? *

1 2 3 4 5

Never ☐ ☐ ☐ ☐ ☐ All the time

The results are scaled pretty evenly for this question. The least frequent response was “1,” and the rest of the responses increased steadily until “5,” which was the highest. Over 65 percent of our respondents answered a 4 or a 5 that they use their mobile Internet to find out about events or things nearby on campus. This was very encouraging for us as far as the relevance of our project. Although people were not using Facebook Places or Foursquare to reveal their location or share their own data with others on a social network, they were still using sites to find out about events near them. This led us to believe that people care about security, and would rather take information from their surroundings than give it out. Flip solves the problem of anonymity, since a sense of security is established when the two file exchangers meet face to face.

Exhibit 9: Finding nearby people, events, places and other information



Our next question was meant to draw the users attention to the other aspect of our program, the map layers. We used these layers so that users, mainly on the computer, could see where they are located on a live, interactive map. This map also shows points of interest, filtered by different layers.

We thought this would be a very useful and informative feature for our users, so we estimated that the average response would be much higher than 3, which is the neutral answer. However, the average turned out to be 3.1, only minutely above the neutral answer. This let us know that new users, at least, were not as interested in this aspect of the project.

Figure 56: Survey Question 6

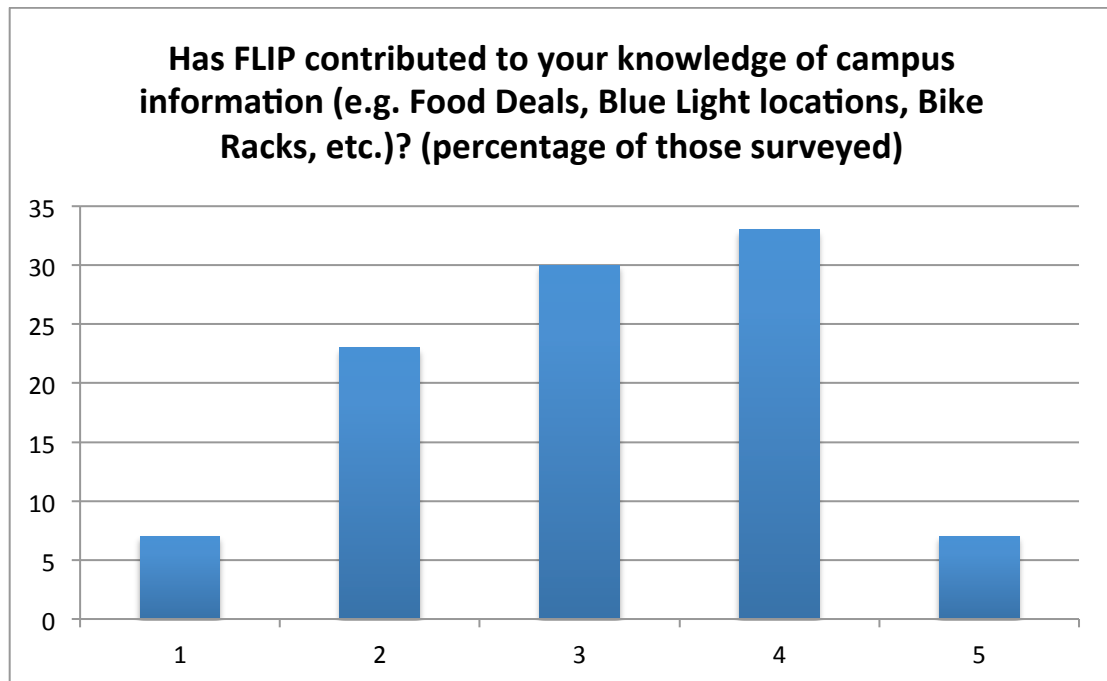
Has FLIP contributed to your knowledge of campus information (e.g. Food Deals, Blue Light locations, Bike Racks, etc.)? *

1 2 3 4 5

Not at all ☐ ☐ ☐ ☐ ☐ Very much

The most common answer to this question was a “4” on the scale, and though 33% of those surveyed gave this response, interest was still not as high as we thought it would be. We tweaked the interface in accordance with these answers, but because of these results focused more of our time and energy on the file sharing aspect of our project.

Exhibit 10: Contribution to knowledge of campus information



Our final question asked users to rate the convenience of using FLIP compared to other technologies. The answers were qualitative and we assigned numerical values to each answer. Less convenient was assigned a value of -1, about equal a value of 0, and more convenient a value of 1.

Figure 57: Survey Question 7

How would you rate the convenience of using FLIP to share files COMPARED to the following technologies: *

Watch the FlipStream video at <http://www.youtube.com/user/TeamFlipVideos>

	Less convenient	About equal	More convenient	n/a
Using flash drives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dropbox	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Email	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Uploading to hosting websites (e.g. MegaUpload, MediaFire, HulkShare, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other software like Mojo, AirDrop	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

To visualize the percentages of user answers, we created pie charts for each individual technology comparison.

Exhibit 11: FLIP convenience compared to flash drives

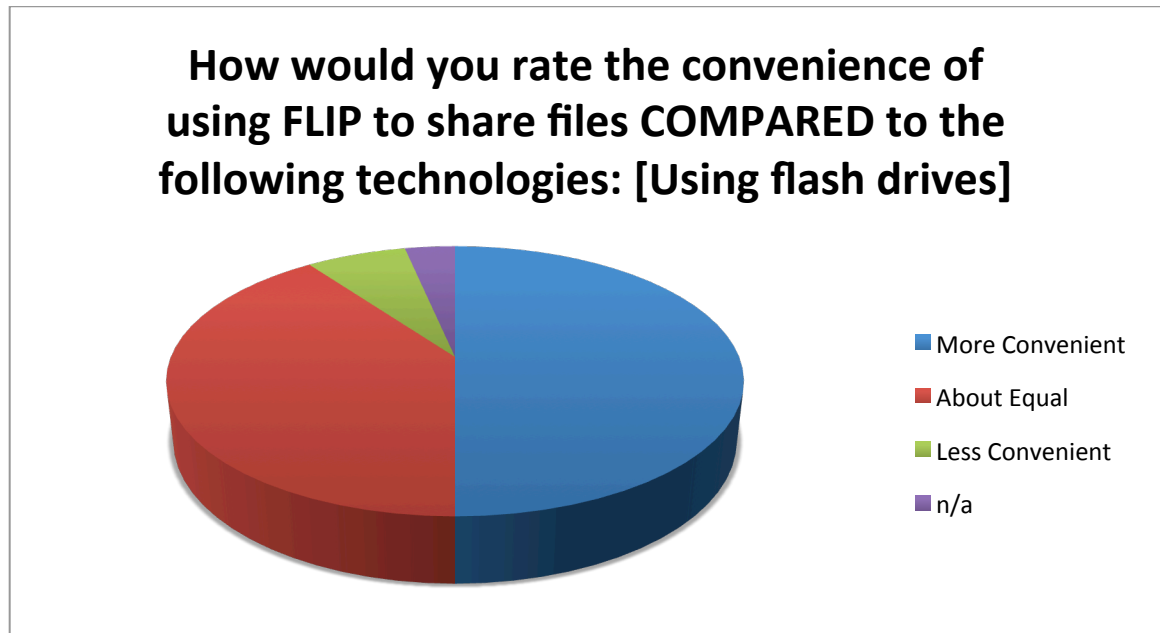


Exhibit 12: FLIP convenience compared to Dropbox

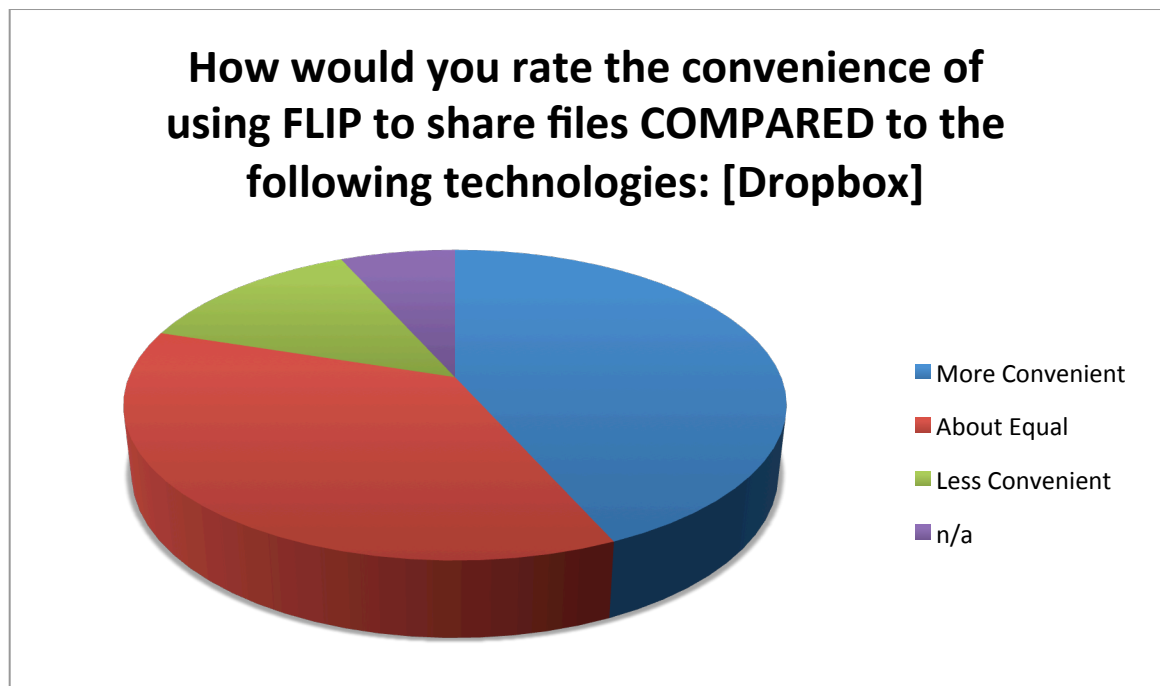


Exhibit 13: FLIP convenience compared to email

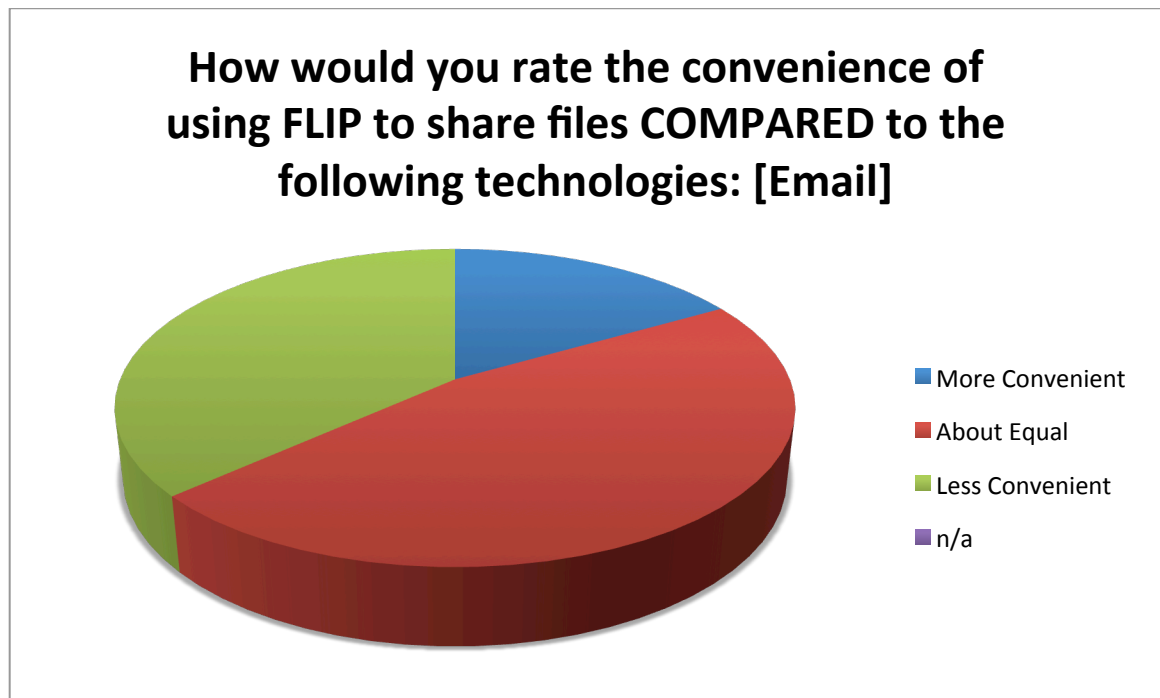


Exhibit 14: FLIP convenience compared to hosting websites

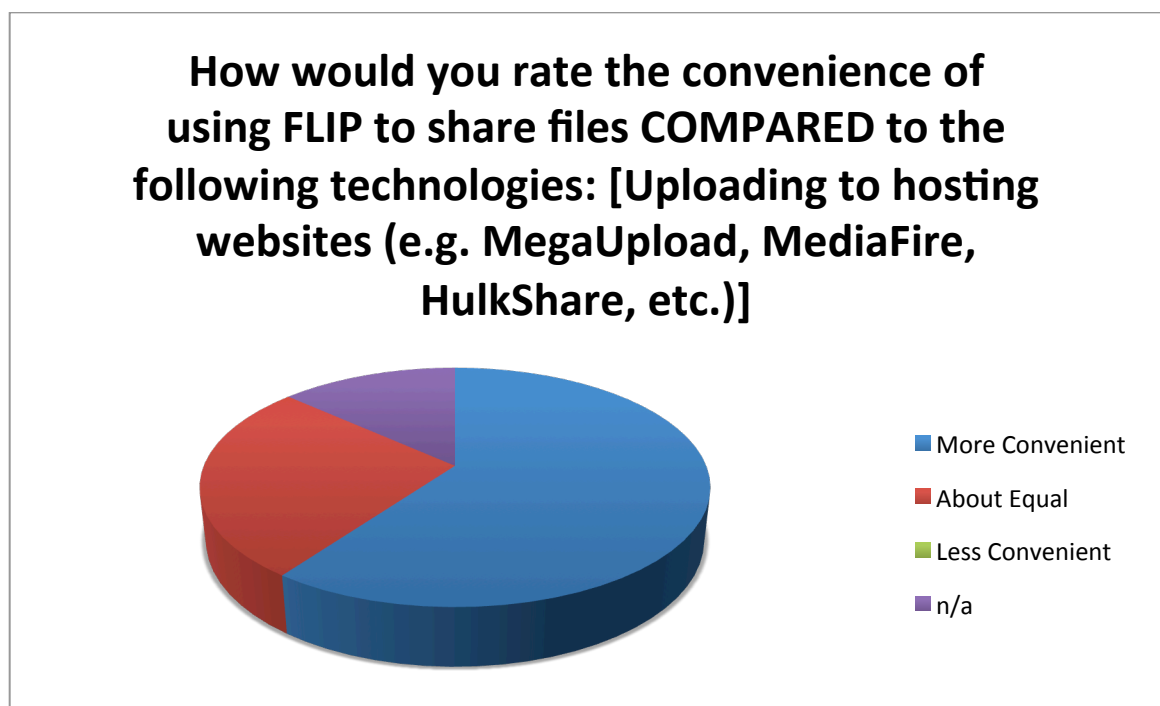


Exhibit 15: FLIP convenience compared to other technologies (Mojo, AirDrop)

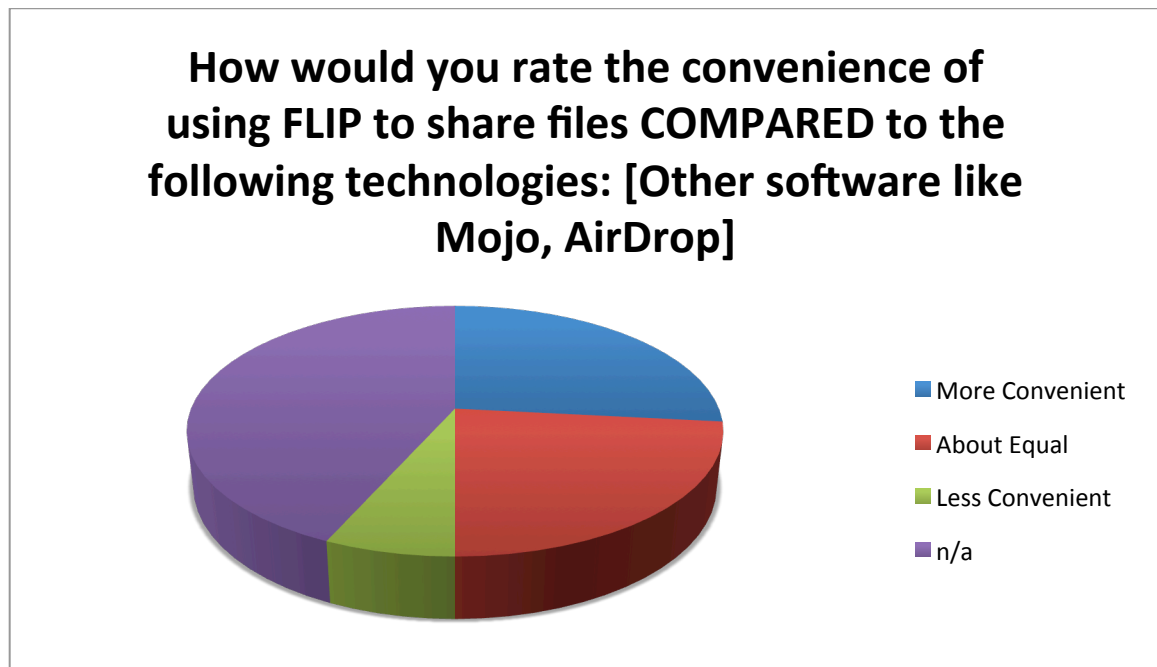


Exhibit 16: Average user responses in comparing FLIP with other technologies

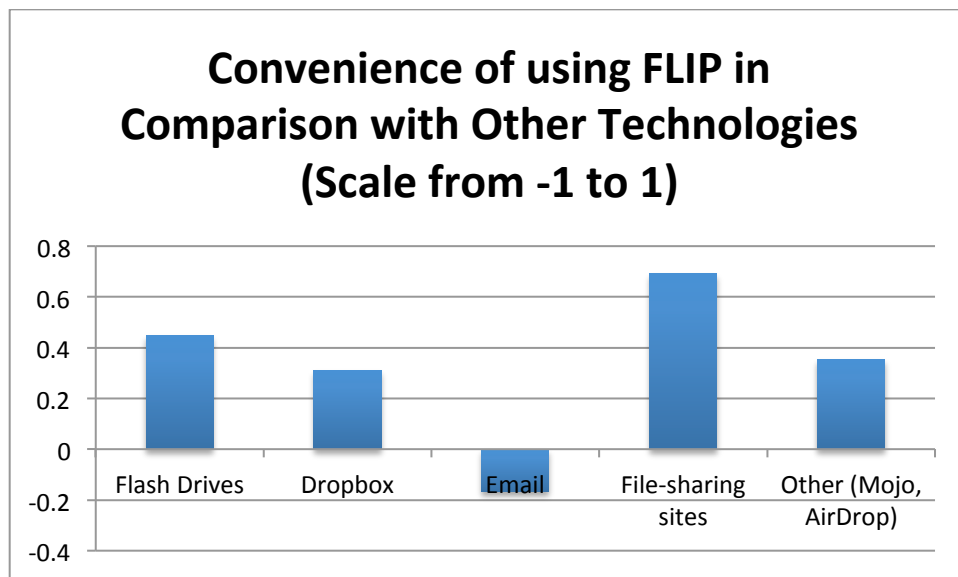


Exhibit 17: Numeric averages of user responses in FLIP comparison

Flash Drives	0.448
Dropbox	0.310
Email	-0.167
File-sharing sites	0.692
Other (Mojo, AirDrop)	0.353

After transforming the qualitative answers of “more convenient” to a numerical value of 1, “about equal” to 0, and “less convenient” to -1, we took the average of all given answers for the different categories of flash drives, Dropbox, email, file-sharing sites like MediaFire, and others (e.g. Mojo, AirDrop). In comparison, FLIP performed better than four of the five categories with the exception of email. On average, users thought FLIP was more convenient to use than flash drives, Dropbox, file-sharing sites, and the other technologies category. Out of all the categories, users thought FLIP was greatly more convenient than file-sharing sites. Furthermore, Table 17 below shows the percentages of the different answers for each technology. The generally positive reaction that users had to FLIP technology alludes to their willingness to adopt new location-based applications, particularly file sharing. Not everyone was familiar with all the technologies listed. Some participants chose the “not applicable” option, most notably 13 out of 30 participants chose n/a for the Other (Mojo, AirDrop) category.

Exhibit 18: Percentages of user responses in Survey Question 7

	Flash Drives	Dropbox	Email	File-Sharing Sites	Other (Mojo, AirDrop)
more convenient	51.72%	46.43%	16.67%	69.23%	47.06%
about equal	41.38%	39.29%	46.67%	30.77%	41.18%
less convenient	6.90%	14.29%	36.67%	0.00%	11.76%

Survey Comments

Our open-ended comments section allowed participants to give qualitative feedback about FLIP. Here are some of the responses:

“The two things I like most are being able to type in your classes and seeing where they are all located. Also being able to see deals at food places is very convenient.”

“Very cool idea. I think the practicality of receiving information about UMD that they wouldn't know otherwise, combined with the enhanced navigational tools, will get students to use the site. However I think that it will take a while, maybe a long while, for students to starting using it for sharing a lot of things. Overall very good though, I think this tool has a lot of merit and seems well thought through.”

“FLIP can be very useful, especially if your entire group of friends has it. I can see it as a great way to meet people in the future.”

To these participants, FLIP's technology is something that they had not previously seen. Furthermore, they found the features of the FLIP application useful, particularly the community sharing aspect. Nonetheless, some users addressed that there was a lack of awareness of FLIP and it would be a good idea to attain more users to make the application even more beneficial to their daily lives.

Survey Conclusions

The survey's results indicate that participants generally had a positive view of location-based applications. Many had already adopted technologies such as Foursquare or Facebook's Check-In feature. The survey indicated that a majority of users predict that they would be using location-based applications more in future, and that these features will increase their ability to interact with others who are physically proximate to them. The survey determined that many users already search for information relative to them based on location, and that FLIP has helped them obtain this information in one convenient online location.

In comparison to other technologies, FLIP is perceived to be more convenient to use than Dropbox, flash drives, file-hosting sites, and other alternatives (Mojo, AirDrop) when used to share files between people who are proximate to each other. The only alternative that was perceived as more convenient was email, and this may be due to the subjects' familiarity with email compared to Dropbox, AirDrop and similar. Email is convenient if users already have each others' email addresses, or if they are sending files to a limited number of people. However, if it was a one-to-many exchange, it would be more difficult and time-consuming to send files via email

than with FLIP. It is our hope that one day FLIP will be as familiar to Internet users as email and just as easy to use.

Chapter 7: Discussion

Team FLIP's research reveals many implications for both file sharing and location-based technology. These implications include what effect location-based file and information sharing has on communities of proximate users. Furthermore, it reveals the direction that new technology and web applications should stride towards.

Primarily, both our literature research on related technologies and user interest in the FLIP application has shown that there is currently no convenient and efficient method of exchanging files and information with those who are proximate to each other, with the predominant categorizing characteristic being the geolocational tags on the data.

So far, sharing files between two users who are physically close to each other geographically is the same as sharing files between two users who are physically far apart. For example, if a user in the Stamp Student Union at the University of Maryland wishes to send a file to someone who is in the same room as him via the Internet, he uses the same technology (such as email and file-hosting sites) as if he were to send the file to someone in California. The idea is that people who are physically nearby one another have already verified each others' identities. Why do they need to verify this data again in another form on the Internet? File sharing should be as simple as handing another user a physical document, without the hassle of log-ins, typing in email addresses, or uploading to host sites which then give a unique URL to send to the other person.

FLIP solves this issue by creating identity through location. With FLIP, users can join a network cloud that consists only of the people around them. They can then easily share information and files over this local network, even though the exchange technically takes place over broad Internet servers. The security and exclusivity of files comes from the geolocation tag on each piece of data, and the data moves with the user, ensuring that pieces of information are not simply left in a network somewhere unrelated to the user. In addition to security, FLIP's method of information sharing provides users with relevant data. Because information is coming directly from those who are proximate to each user in location, data is more likely to be appropriate or interesting to the reader.

FLIP's target audience is the University of Maryland community, and it is our aim to provide this community with an efficient and easy way of sharing information. Because FLIP is accessible by any University of Maryland faculty, staff or student, this target has been met. FLIP wants to keep the application secure and protect UMD members from outside threats such as spam or viruses, and thus is restricting access currently to only users with a campus log-in ID.

We believe that FLIP has the potential to change the way people interact with others nearby online. In our analysis, we found that other file-sharing services rely on a core competency, whether it is direct exchange of files, or creating public URL links to uploads. These services specialize in providing a specific service and doing it well. However, they ultimately depend on each other for their survival. The quickest file-upload applications still needed e-mail or social networks to share their links. We envision that FLIP will be another medium, a location-based medium, that social

networking and file sharing can occur on. We believe that we have succeeded in creating that product.

Though our product is currently modeled for use on the University of Maryland campus, there is no limitation that restricts it from being used in any other geographical area. The FLIP application can easily be added to other open-source map-based applications, and FlipStream (the file sharing feature of FLIP) can be implemented without a GIS (geographical information system). This means that it is a standalone product that allows users to share with others in geographical proximity without having to view a map.

FLIP is a product that can always be further developed and refined by future members of the University of Maryland. We have created a framework for a social network that is built upon the existing skeleton of the university ID login. We believe that future features that could be added to FLIP include embedded audio and video player, the ability to identify friends more easily, and access-revocation rights. Increased security of files is a constant issue in file sharing, and it is imperative that FLIP works to address upcoming challenges.

Limitations

One of the main limitations of the FLIP system is the lack of GPS hardware on computers and laptops. Our application relies on accurate GPS positioning in order to properly track and allow users to share files with one another. According to our geo-accuracy study, location data from a Wi-Fi network is very volatile. The accuracy could range from a few meters to over hundreds of meters, depending on how large the network is. However, GPS hardware in mobile devices is accurate to about 10

meters, so using this accuracy would be much more effective in FLIP's applications than using laptops or computers connected to Wi-Fi.

Furthermore, FLIP could have benefited greatly from simply having more time. The SEAM class is only one semester long and in order for us to properly collaborate in production of an application with them, it would have been much more productive if we had worked with the teams for one year. A product development cycle is hurried at best during the four months that a class is in session. As a result of the short amount of collaboration time, there were many unfinished tasks and wasted prototypes of useful features.

Lastly, due to the small number of students taking the survey, the impact of FLIP on the entire University of Maryland campus cannot be determined. So far, it seems that students are generally interested in FLIP technology. However, this is not statistically representative of the entire UMD population. In order to further our study, we would need to survey many more users and ask demographically categorical questions to better understand our target audience. Team FLIP needs to advertise the application to the campus to gain awareness of its use and features, and then proceed with a more detailed study on how users interact with each other using FLIP.

Chapter 8: Conclusion

Team FLIP saw the need for a location-based file sharing system after noticing the gross inefficiency of sharing files between people proximate to each other geographically. We then researched many methods of potentially solving this issue, from using Bluetooth to ad hoc Wi-Fi networks. However in the end, our research determined that our resources were best used to simulate an ad hoc system over the Internet, with the help of the TerpNav system as our base. We then implemented a geographical information system that allowed us to create and manage layers of user-contributed information on the TerpNav map. Additionally, we created another feature that allowed users to share information, particularly files, over these layers with others who are geographically co-located.

Conclusions to Hypotheses

After our product development and survey phases, we concluded that in general, our hypotheses were correct.

Hypothesis 1 states that peer-to-peer file sharing is something that Internet users are both interested in and engage in. We were able to confirm this through our literature review after studying several cases when peer-to-peer file sharing was something that users looked favorably upon and enjoyed using.

Hypotheses 2 stated that the use of location-based technology is prevalent among Internet users today. Our survey confirmed this hypothesis to a limited extend. All 30 participants had heard of Facebook Check-In and Foursquare, with many of

them using the technology. Furthermore, many of them had also used other locational technology to find people, events, places, and other information close to their geographical location.

Hypothesis 3 states that geo-centric users would benefit from a file sharing system built to take advantage of their shared location. In our survey, users reacted positively to the FLIP application and its location-based features. Many of them expressed enthusiasm at seeing information on campus that was relevant to them because of the location of the data. For example, participants mentioned that being able to see where food deals were on campus was beneficial because it was relevant to where they lived. Additionally, in the comparison part of the survey, FLIP was found to be more convenient to use than many of the technologies mentioned above. This suggests that the location-based features of FLIP made file exchange easier for Internet users.

Hypothesis 4 states that current Internet technologies for file sharing do not take advantage of readily available user location data. This was proven in our study of current file-sharing systems. Location information is readily available to most websites and application. It is simple to use Google's location services as we did it easily with FLIP. Gathering location tags is easy but through our study of email, file-sharing sites like MediaFire and other alternatives, none of these systems used location as a constraint or definer of file exchange. They did not even allow users the option of tagging their files and information with a location.

Hypothesis 5 states that there is a desire among Internet users to receive more information tailored to their location and the events around them. This was clearly

evident in our user survey. Participants were very interested in people, places, events, and information geographically near them. Furthermore, they answered that they would be likely to use location-based technologies in the future to acquire more knowledge and data relevant to their location.

Recommendations

Though Team FLIP was able to create a location-based file sharing system for the members of the University of Maryland community in the short time span of our project, there are many features and improvements that we hope to make.

Primarily, in order to attract more users to use the FLIP application, a better interface design would be helpful. Currently, users have expressed consternation and confusion over the current interface, and developing a more intuitive user interface would help make FLIP a seamless application. Although an integrated tutorial was tested, it was ultimately scrapped due to internal concerns of its usefulness. A better designed tutorial and interface would benefit users greatly.

Security is another concern. Currently, users can post anything and everything they want. In the future, filters to prevent inappropriate content, spam, viruses and other files of negative impact should be implemented.

Further research is definitely a priority in determining FLIP's impact on the University of Maryland community. Due to time constraints, FLIP was only able to survey 30 students in the community. A better survey released to more participants would help guide Team FLIP in making improvements to the application. It would also be a good way to gauge public interest and preferences in what they hope to see

from a location-based web application. A broad-scale survey including questions about technology and demographic information of the participant would be useful in determining needs of different groups. It would be good practice to invite a wide range of users in age, gender, race, socioeconomic status, and other factors that would affect their use of online location services.

Furthermore, once there are more users using FLIP, tracking actions would reveal intentions of use and patterns of interaction. This data is important in shaping new features as well as revealing what people actually use FLIP for and if these intentions match our expectations.

Privacy controls would also be something that FLIP considers in the future. Currently, the settings for layer control are limited and users cannot dictate who can view, edit, or delete layers easily. It is not a straightforward process to change these settings, so work on this weakness is recommended if FLIP is to reach broad commercial use.

Finally, technological advances permitting, Team FLIP would like to move its application from being Internet-based to what we originally intended: onto an decentralized ad-hoc network. Using this system, users would be able to connect directly to one another without going through a centralized server. Their mobile devices would have a direct connection and it is through these connections that location-based file sharing would work. Further studies with multi-hop node connectivity would need to be conducted in order to find a system that supports the interaction that the FLIP application implements.

In order for FLIP to become a widely-used product, there are many improvements that can be made. The key is to constantly receive feedback from users in the form of action-tracking as well as surveys in order to tailor our product to their needs. Data collection is one area that can be greatly increased and Team FLIP hopes to continue developing its application while gathering elucidating results.

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Appendix A: SEAM Documentation

SEAM FLIP Proposal

Thu, Nov 11, 2010

FLIP Updates + Pursuing an Agreement

Hello Team FLIP and Dr. Purtilo,

Since we last spoke with you, our engineering team has been working hard on early prototypes and thorough documentation of FLIP. The programs are still in early stages, but we have learned enough from starting them to write a few documents describing how we think FLIP should work. This is where you come in: we need your input to make sure that we're on the right track.

I've attached a document that describes our vision for FLIP. We are open to changing this document to align with your ideas. Our goal is to have the the FLIP team, Dr. Purtilo, and our engineering team agree to a final, master document that describes the functionality of FLIP to the satisfaction of all parties. This document will serve as a contract around which we will design our software.

Here is our proposed schedule for getting this done in a timely fashion:

11/11 (Thursday): Dr. Purtilo and the FLIP Team receive initial documentation.

11/15 (Monday): FLIP Engineering Team members be available to attend the weekly meeting in AV Williams to answer any questions or concerns. We should try to solidify as much of the document as possible at this meeting.

11/16 (Tuesday): The FLIP Engineering Team will make the appropriate changes and send out a new version of the document via e-mail.

11/18 (Thursday): The document is fine-tuned if necessary, and all parties sign off on the final document.

If this schedule doesn't allow you enough time to review the documents we provide, please let us know and we'll adjust accordingly. We are pursuing an agreement aggressively to afford us more development time as the semester comes to a close. After all parties have signed off on a final document, we will stay in contact with you about our progress.

Please review the attached document over the next few days. We'll see you on Monday.

Best, The FLIP Engineering Team: Ben Cwik, Rayhan Hasan, Ben Kirzhner, Martin Petrov

[TODO: pdf here]

FLIP Proposal

Revision 2010-11-11

Ben Cwik, Ben Kirzhner, Rayhan Hasan, Martin Petrov

Introduction

This document is an overview of a proposed implementation for File Location In Proximity (FLIP), a system enabling users to share files and other information across various devices. The intended audience for this document is Dr. Purtilo, the FLIP Gemstone Team, and any groups in CMSC435 that will need to implement FLIP functionality in their deliverables.

General Description

FLIP enables users to share files and other information based on their physical proximity to one another. Physical proximity may be calculated in a variety of ways, including GPS and wireless network-based look-up. Our proposed implementation of FLIP consists of three parts: a server-based protocol specification (FLIP/P), a production-ready server, and a reference client. FLIP clients can exist as standalone servers.

FLIP/P is purposefully feature-agnostic. Features such as file transfer and text chat may be implementable over FLIP/P, but the protocol is not tied to any particular feature. There are a few constraints on FLIP. Our definition of FLIP/P must allow for reasonable privacy. In addition, it will be difficult to verify GPS data from clients, so this information will need to be taken at face value.

Definitions

FLIP: File Lending In Proximity. This term generalizes the whole system, which consists of the FLIP Protocol (FLIP/P), the FLIP Server, and FLIP client(s).

- FLIP/P: The FLIP Protocol.
- FLIP Server: The centralized server that all FLIP clients connect to. There is one FLIP Server.
- FLIP client: Connects to the FLIP Server. Unprivileged users will interface with FLIP exclusively through FLIP clients. There may be many FLIP clients, however in practical use (such as TerpNav) there will exist one client.
- Users: Represents users using the FLIP protocol. A user may be used to spawn a session or create an event. A user is identified by a username and domain.
- Sessions: Sessions represent an instance of a user signed in through some client. For example, a user might log in from both a smartphone and a laptop, each of which would be represented by a session. Each session maintains a position. Sessions may also customize their visibility options on various visibility layers.
- Events: Events are used when persistent notifications are required. An event has a position, as well as a start and end time. Proximity may thus be triggered on events.
- Proximity: Two entities are proximate on a visibility layer if the distance between the entities' active sessions are less than or equal to the minimum of the two entities' specified visibility radii.
- Visibility Layers: An application may define multiple visibility layers. Users may subscribe to said visibility layers. User sessions and events may toggle visibility on a visibility layer; visibility on at least one visibility layer is required for proximity. A layer is associated with the domain that creates it and only users on that domain may access it.

Requirements

1. Overview

- a. FLIP consists of a centralized server and any number of clients (generally one) connecting to the server.
- b. A client can report the location of a user to the server.
- c. The server and client will support a list of features. A feature is an extension to the core protocol which adds support for additional request types.

File Lending In Proximity Protocol (FLIP/P)

- . We will design FLIP/P as a client/server protocol for exposing clients to one another based on proximity.
- a. The core protocol will handle creation and deletion of visibility layers, users, events, and sessions.
- b. The protocol will support a geolocation feature.
 - i. The geolocation feature will allow the user to specify their current location. The location mechanisms must be extensible in future versions of the protocol, but multiple location mechanisms need not be supported in the initial protocol implementation.
 - ii. Visibility to other clients can be toggled by the user.
 - iii. A client will be able to set a region of interest.
 - iv. A client may restrict their visibility by distance.
 - v. A client may request a list of other, visible clients in the region of interest.
 - vi. The client may update their current location and request that the visible client list be updated.
- c. The protocol will support a file lending feature.
 - . The file lending feature will allow the client to associate small tokens of structured data with a user.
 - i. The client may request a map of proximate sessions to visible tokens.
 - ii. The client may set access restrictions on individual tokens.
 - iii. The FLIP protocol will explicitly limit tokens to a small size which we expect to be approximately 4KB. This is to minimize traffic to and from the FLIP Server.

Server Implementation

- . We will implement the components of the FLIP Server to satisfy all specified requirements of FLIP/P.
- a. The FLIP Server will match clients based on their geolocation as determined by client and server-side connection information.

Reference Client Implementation

- . We will implement a FLIP client as a reference implementation for other teams. The client will itself be a web server.
- a. We will implement support for a status feature and a file transferring feature within the client as sample lending functionality.

- . The text feature will allow a user to set a personal status message. A user will then be able to see the status messages of all users within proximity.
- i. The file transferring feature will allow a user to upload files to the client.

Engineering Risks

1. Server Implementation

- a. Development Time: It may not be feasible to write a robust and secure implementation of the FLIP server within the allotted time frame. We will start early on this and make goals along the way to stay on track.
- b. Scalability: Given the amount of time we have to write a working FLIP implementation, it may unreasonable to expect this program to be written in such a way that it will scale to having very high numbers of simultaneous users.
- c. Request Filtering: We should expect that some users may want to abuse the proximity system by spamming other clients with automatic requests for information, or may try to distribute harmful software. This could potentially be prevented by either limiting client bandwidth or forcing clients to sign in to the service.

FLIP/P Design

- . API Timeliness: Our plan to implement FLIP involves creating a server implementation and a sample API. To create a deliverable by the end of the semester, we will need to interface with teams working on Social Networking and PDA support. This requires that we have a simple client implementation ready with enough time for the Social Networking and PDA teams to use it as a reference.
- a. Flawed Design: Requirements for FLIP/P may change after its API is exposed.

Reference Client Implementation

- . Inconsistent Implementation: Differences between the reference implementation and FLIP/P can lead to inconsistent code from the PDA team.

4. Client Hardware Support

- . A way of obtaining GPS information may not be available on all platforms, and when present it may lack sufficient precision.
 - i. iOS, for example, started making their geolocation API available from mobile Safari with the 3.0 firmware; before this it required a full fledged native application.
- a. Internet connectivity and bandwidth requirements limit the effectiveness of the client-server model.

- b. Closed APIs: whilst most smartphones feature wifi, bluetooth, and infrared connectivity, these are often not available to app developers due to security concerns. Accessing the network and bluetooth stacks requires a jailbroken iPhone; this limits the number of alternatives to GPS, should that prove to be an unreliable location mechanism.

Social Networking Proposal

Ray Douglass

Sebastian Gomez

Jeff Gunzelman

Mike Kuenzel

Glenn Stephenson

Tobin Valenstein

Mike Wendt

Hyunsoo Kim

Andrew Skoda

Introduction:

We propose the implementation of several social networking principles and practices to the preexisting TerpNav project in both core functions and interface improvements. Our goal is to enable TerpNav users to interact with each other through shared information via FLIP layers.

Abstractly we have the idea of multiple user-defined layers that superimpose information onto the TerpNav campus map. Data and annotations attached to these layers

can be hidden or visible to provide information control, and reduce clutter and information overload. Users can mark a point of interest on layers that they have permission to do so. Layers will have access restrictions; a user will have a combination of read and write privileges, including not being able to view the layer at all. Our main goals are to implement layer access restrictions, support user data through the use of the database and API for access, create a user interface to organize layers, and modify the existing TerpNav database to support these features.

Terminology:

Point of Interest - A geographical point on the map defined by a user that contains annotations and information about the point. This would be displayed as a pop-up in the same way locations already appear in TerpNav.

Layer - A collection of points of interest that are superimposed onto the map. Users can subscribe to layers and toggle their visibility from within a tab on the main page of the interface.

CAS - Central Authentication Service

FLIP - File Lending In Proximity

Core Functionality:

The core functions we are proposing are split into two categories: changes/additions to the front-end user interface and changes/additions to the existing TerpNav database.

User Interface:

The major addition to the interface is a new tab alongside the currently existing three (“Route”, “Map Layers”, “Search,”) that will provide the ability for the user to search through available layers. This tab will be available to all users; however, the number of layers visible to the user will depend on which layers the user has access to. This search will be auto-completed after two characters have been entered, allowing the user to easily browse through layers without knowing specifically what they are looking for. Once a layer is selected in the search box the user can click the add button to add the layer to “Map Layers” tab.

The other major addition is the interface through which users can annotate the layers they are subscribed to. The user can right-click a point in the map, and select the option: “Annotate Layer.” This leads to a pop-up window where the user sees a drop-down menu with the user’s layers. If the user has access to annotate a layer he or she can select it from the drop-down menu. The drop-down menu only contains layers the user is currently subscribed to and has permission to annotate. Below the drop-down menu is a dialog box that allows the user to add whatever information is deemed necessary to describe the point of interest. The ability to annotate will be available no matter which layers are currently turned on.

There are several other minor tweaks that need to be added to the interface as well. Under the preexisting “Map Layers” each layer will have a red “X” that can be clicked to remove the layer from the tab. Additionally a “Login” link that redirects through CAS needs to be added. The attached presentation contains mock-ups of all of these changes and should give a rough idea of what they look like.

Databases and User Information:

All user authentication will be done through CAS. Once a user has been approved and directed back by CAS they will have access to their customized TerpNav portal. The first time this occurs, the user's directory ID will be stored into a PostgreSQL database along with a default list of layers and default access privileges to these layers. We will provide an API for retrieval of this information. This API allows access to the layers a given user is currently subscribed to in addition to their access privileges. Users are identified by their directory IDs, as provided by the University which restricts the use of the layers to University students, faculty, and affiliates. The API will provide all key information related to users such as: layer subscriptions, layer ownership, access restrictions, and the basic user information.

When a user subscribes to a layer, his user id is added to that layer's membership set.

When a user unsubscribe from a layer, his id is removed from the set. This set is maintained within the TerpNav server within the currently existing database. If a user cannot be automatically geolocated through their connection, they will be able to specify their current position by right clicking on the map and selecting "My Location" from the drop-down menu. This data could be used by FLIP for use in geolocation services.

The following is an E-R Diagram (Entity Relationship) representing our changes to the database.

[FIGURE BILL.1]

Schedule

Our implementation plan according to this document is as follows:

Before beginning on any endeavors we will take time to familiarize the group with the

project and the current resources available to facilitate communication across task groups.

The group will then split into three groups.

Group A will then be tasked with designing the user information API and relevant user account properties within the system. This group will eventually be charged with implementing the API once it is in agreement with other planned tasks.

Group B will be tasked with designing the new functions needed to store user information and layer information. This includes and is limited to user id, layer membership sets, access permissions, and layer ownership.

Group C will be tasked with creating the core changes to the user interface and providing the front-end needs to the user, including the two main additions discussed earlier: annotations and the layer search tab. After all these groups have found a clear focused solution that works across the board we will implement and release our solution for further testing.

Risks & Dependencies

Our largest risk comes from our dependencies on other groups implementations. With a small time frame left we are relying heavily on the effective and timely implementation of both the Data Mashup and FLIP layers projects. Also since our implementation is so heavily dependent on the other groups design process any changes would cause major problems in our implementation which could lead to loss of functionality. We will need to work closely with Data Mashup and FLIP layers to emphasize communication of changes so that we are able to quickly adapt our solution to match their changes. Within our own project we run the risk of a dependency between

our user information database and the layer information stored elsewhere via Data Mashup/FLIP if we do not carefully define what data needs to be stored where.

FLIP Use Cases correspondence

FLIP core functionalities and a use case

From: Cindy Weng - Nov 16, 2010

To: Rayhan Hasan, Team FLIP, Jim Purtilo

Hi Rayhan,

Please forward this email to your team, since I realized that I don't have all their email addresses. Anyhow, this is what we came up with after our meeting today:

Core functionalities:

- Create layer(s)
 - be able to set proximity
 - a "chatroom"-like feature where users can share text
 - BE ABLE TO SHARE FILES OVER LAYERS
 - a "quick layer" button with 1-click creation and 1-click join (for convenience and sheer awesome speed)
 - what would be the default layer settings? (help us please SEAM)
- Layers are only visible to users proximate to each other
- Modify layer(s), which should include but not be limited to
 - Increase or decrease the scale of proximity
- The ability to "see" and "unsee" layers (already kind of there in Terpnav right now)
- Ability to support multiple layers
- User definitions
 - "signature"/username/password?
 - Differentiate between admins and participants of layers

- Notifications
 - how users will know when a new layer/file//data has been added to FLIP
- Delete layer(s)

Use case:

- An office setting
 - a presenter wants to share a file with his audience right away
 - he hits the "quick layer" button and somehow, users in the room will be able to receive a notification that the layer has been formed
 - they will then be able to join the layer, and see a file that has been shared across the layer, and download/access that file, all because they are proximate to the speaker

Something to worry about later (or maybe now?):

- How do we pick certain people to join a layer if there are hundreds within proximity?" For example, how would we send an invite to only a select few friends in a lecture of 200 people who are all proximate? How do they learn about/see my layer and know to join it?

We'll give you more use cases soon, but please let us know if you have any questions/comments/suggestions!

Cheers,

Cindy

From: Rayhan Hasan - Nov 17, 2010

To: Team FLIP, Jim Purtilo, SEAM Group 4

Hello Team FLIP,

We've been working on modifying the proposal submitted to you on Nov 11 to reflect changes from Monday's meeting. We wanted to clear some changes with you, briefly:

Requirement 2.c.ii is "*Visibility to other clients can be toggled by the user*". During the meeting, we discussed whether or not users should be able to see the contents of a layer without joining the layer (the ability to "peek"). I believe we decided that users would need to be a member of a layer to view its contents (no "peeking" allowed). If this is the case, then this requirement should be removed. Please correct me if I'm wrong.

Requirement 2.c.iii ("*A client will be able to set a region of interest.*") will be removed. It was not worded clearly, and its intended meaning duplicates

Requirement 2.c.iv.

As per our meeting, **Requirement 2.c.iv** ("*A client may restrict their visibility by distance*") will be removed.

The contents of our proposal and your submitted documents must be aligned before

we move forward. We need to iron out any inconsistencies across documents. We look forward to receiving the rest of your use-cases, but in the meantime, we have some questions for you regarding your most recent e-mail:

1. "Be able to set proximity"

Does this mean setting the proximity at the user level or at the server level? At our meeting on Monday, I believe that we decided to have the definition of "proximity" set by the server, on a per-layer basis. Please verify.

2. a "chatroom"-like feature where users can share text

Our proposal currently contains the ability for a user to set a "status" message in text, viewable by proximate users. How would a "chatroom" work? Is everyone on a layer able to talk? Is it only between two people, or is it something else entirely?

How critical is this feature? The addition of a chatroom may significantly extend development time. I'll have to meet with the other engineers to discuss the additional time and resources necessary to implement such a feature.

3. "Layers are only visible to users proximate to each other"

It's unclear to me what this means. The wording of this seems to imply that if a user is not proximal to any other users, then no layer is visible to them. Please clarify.

4. "The ability to "see" and "unsee" layers (already kind of there in Terpnav right

now)"

Would the action of hiding layers in this way have any effect on a user's membership to a layer? In other words, is this a feature to keep users organized while allowing them to be members of many FLIP layers, or does this action remove their membership?

5. *"User definitions: "signature"/username/password"*

What is the "signature" part of this?

Please get back to us as soon as possible, and include any further questions you may have. Also, please remember to "reply-all", so that future messages will be sent to our engineering e-mail list.

Thanks,

The FLIP Engineering Team

From: Hugo Hall - Nov 17, 2010

To: SEAM Group 4, Team FLIP, Jim Purtilo

Rayhan, you brought up some great concerns in your email, and we apologize for any confusion caused by our previous email. We tried to answer your concerns in as simple a way as possible, so as to avoid any further confusion and keep our specifications consistent and on track for success.

1) The “proximity” would be set at the server level in the sense that it is being decided by the geolocation services available. However, this is an option we would like the user to specify while creating a layer.

2) The language we used, “chatroom”, may have been a poor choice of words. What we meant by this section is just what you said in your proposal. Users should be able to share a “status” with other users, nothing more advanced than that. What we did mean, however, is that information could be accessed independently of the map. This feature enables users to not only see the newly created statuses as “points” on a map, but also as little statuses on an interface much like the Facebook news feed. This would be useful in a situation where so many statuses are being updated in such close proximity that it would be difficult to narrow down which point a status is coming from.

3) Ideally the user who created the layer “sets” the proximity of the layer in its inception. The layer is then only visible to users within this set distance from the layer’s point of origin (with the possibility of creating invisible layers that are only accessible by some sort of invitation). We do not expect these hosts to be very dynamic, users hosting small layers will most likely be physically interacting with the others while sharing, while users hosting larger layers are unlikely to leave such an area. For example, someone in an office meeting using FLIP would not leave the network until it had served its effective purpose. Also, a layer controlled by a larger

figure such as the University of Maryland would be hosted from a stationary point.

In other words, this feature is unchanged from our discussion on Monday. Layers should only be visible to users which fall in their radius.

4) Ideally, users should be able to still be a member of a layer while not actually having it be displayed on their screens. A user could have multiple layers on their stack of current layers but decide that they want to narrow down the layers seen on their map for a moment, they wouldn't need to remove it from their stack to "unsee" it. This is essentially separating the action of "being a member" and "seeing" a layer. Think of it as having the ability to "peek" at a layer you are already a member of. This does not contradict our agreement on **Requirement 2.c.ii**, as far as we can see.

TerpNav currently works somewhat like this, except all layers are always "joined".

5) The signature is a term to describe a small amount of information attributable to a layer. When viewing layers available, a user would want some information about them before deciding whether or not to join them. Being able to view the entire contents of the layer would be overwhelming, however a few minor details such as a name, host's name, and perhaps a short description, would do the job well. The combination of these details would form a layer's signature, visible (perhaps upon clicking or some other user action) to any user to whom the layer is visible.

If we ever referred to a user's signature it was intended to be synonymous with their username.

We are currently working on test-cases to prove the intended functionality of the FLIP system. These will essentially be story-boarded steps the user takes during what we imagine as a typical use-case scenario. These should help in the development process to give the engineering team a look at what we expect that a user should be seeing when FLIP is actually out in the field.

Regards,

Team FLIP

From: Rayhan Hasan - Nov 21, 2010

To: Team FLIP, Jim Purtilo, SEAM Group 4

Hi Team FLIP,

Thanks for your quick response on Wednesday, and for thoroughly answering our questions. We are continuing to develop the protocol, as well as server and client applications. Right now, we are basing our work on the proposal we have sent to you.

We'd like to come to a final agreement on the engineering team's deliverables for FLIP by the evening of **Wednesday, Nov 24**. The final agreement will consist of two

parts: an approved proposal document, and an approved list of use-cases. Once finished, all parties will sign off on it.

If we aim to come to an agreement by Nov 24, then we will need your use-cases as soon as possible. We'd like to have a day to discuss the feasibility of your use-cases with you, and adjust them as necessary. This means that we would need them by the evening of **Monday, Nov 22** (tomorrow).

The engineering team's goal is to build demo applications that show off as much of the the features of the FLIP Protocol as possible. The longer it takes us to come to an agreement, the less feature-rich we will be able to make our demo applications.

Please let us know if your team has any qualms about this timetable.

FLIP Use Cases - Engineering Feasibility Assessment

This document is the FLIP Engineering Team's assessment of the use cases submitted by the FLIP Gemstone Team on Nov. 22, 2010.

BACKGROUND: The FLIP Engineering team, as tasked, is responsible for the design and development of the FLIP Protocol and server, which is the “engine” of FLIP.

Pending discussion with Dr. Purtilo, we can not guarantee more than server

implementation of any feature. We will, however, develop a proof-of-concept client application. This application will be minimally polished, and will exist only to visibly demonstrate the FLIP server's capabilities.

The text that follows is the document submitted by the FLIP Gemstone Team on Nov 22, annotated by the FLIP Engineering team. Text written in Arial (such as this text) is from the original FLIP Use cases document. Text written in Courier New (such as the text in this paragraph) was written by the FLIP Engineering team. Paragraphs will be annotated with one of the following "categories", describing the engineering team's opinion on the feasibility of each feature:

Category 1: This feature will be feasible to implement by the end of the semester.

Category 2: This feature will be possible to implement using the FLIP Protocol, but its code cannot be written and tested by the end of the semester.

Category 3: This feature will be difficult to implement using our protocol as it stands.

Home View:

The user's main screen space is divided between several spaces of information depending on the current view.

Upon start-up of the FLIP program (following the form of user authentication realized by SEAM-Social

Networking), what the user sees is mostly comprised of a map with points representing other users nearby. The map rendering we see as a piece of the work from SEAM-TerpNav.

Exactly how our demo application will interact with TerpNav is still uncertain. We will keep the FLIP Gemstone Team updated regarding map specifics.

A separate area holds a list of available networks (available determined both by proximity and privilege), from which they can join available networks or leave ones of which they are already a part. The networks' signatures can also be viewed from this list. Finally, somewhere must exist the prompt for a user to create their own layer (to be discussed later). These three features comprise the "Home" view. The purpose of the home view is to grant the user a sense of his surroundings, from which they can then narrow their interactions to those within the networks in which they are interested

Layer View:

A user will then, through the available networks list, join a specific network. The current view will update to now show the map of the user's proximate area populated with points designating the other members of this layer. The 'Home' view must

remain available in the sense that the user can return to it should they wish to see it again. This feature mirrors the current TerpNav interface, where one can toggle between layer views through a set of tabs, however, FLIP limits the ability to view to members of the layer. Unlike the TerpNav interface, FLIP users will not be able view multiple layers overlayed on the current view*. It is crucial that the FLIP program differentiate between a client belonging to a layer and currently viewing it's contents, to enable users to be members of multiple layers simultaneously.

A layer view will also include a newsfeed displaying activity within the layer, with each activity including the username of the hosting user and the file lended. Should the file fall under the limit of a token size (which we expect to only take the form of a short amount of text, or "personal status message") the text will be displayed directly. If the file is larger such that the token is actually associated with larger structured data, the file's name will appear. From this activity the user will be able to download that file to their mobile device

Engineers: We understand that the important interface elements for a "home" view would be a visual indication of nearby users, and a list of layers. We will work to include these, but they may not be laid out in the manner that you've prescribed. When developing user-facing software, it's difficult to predict what the most effective interface will look like ahead of time. We will try a few different ways of laying out interface elements.

In addition, the "newsfeed" feature may not be a wise choice. Users may shy away

from pulling files from other users if they feel like they are being watched.

The user will also have the option to contribute to the layer in the form of a personal status message or another file. The former would prompt a text input box the into which user would type directly, and the later a means to locate the file on the user's device. Other users on the layer would then be able to access this information through their respective newsfeeds just as earlier described. Contributions can also take the form of a location on the map, possibly signifying an event. An event's signature would include information such as location, time, and description.

Multiple Layers:

The user will then return to the "Home" view and join a separate layer from the list of available layers. They will now be able to switch their current view between the three views of each layer and home, maintaining the layer view functions described earlier on both views. Each layer view contains an entirely separate newsfeed.

Category 1: This feature will be feasible to implement by the end of the semester.

Privileges:

The following features are not required in a final product, however they should be considered in the program's construction such that they can be implemented later. The core functionality grants every user on the layer all possible privileges, however, several use cases would benefit from limiting these for some users. Layers should be

able to be invisible on users' home views, necessitating some form of 'invite' from a layer admin. The right to join a layer is always associated with the right to view it's content, however the right to contribute to that content should be revocable. Also, once a user leaves a layer the default response should be that any information they shared on that layer remains, however, it should be possible to change this response and make this information now unavailable.

Category 1: This feature will be feasible to implement by the end of the semester.

Global Layers:

A global layer holds an infinite proximity such that all users can join. However, upon joining the layer only provides events within a set proximity. This creates the conditions for the Home view as well as several commercial use-cases. The Home (global) layer is available to anyone to join, however it only provides information relevant to the users proximity.

Similarly, a global layer such as "Food Deals" could exist. Any user could join from any location, but would only know of events, users (restaurants in this sense), and events going on within proximity. We feel this concept aides in the creation of the Home View (which users are forced to join upon startup) as well as consolidates the commercial applications of FLIP.

Category 1: This feature will be feasible to implement by the end of the semester.

Layer Creation

The user can create their own layer from a prompt on the Home view. The user specifies various features of the layer such as proximity from their current position (at the time of origin) in which the layer is available, the layer members' privileges, and the details that comprise the layer's signature such as its name and a short description.

Category 1: This feature will be feasible to implement by the end of the semester.

Misc.

A search feature to find a specific network without scrolling through the possibly many available is not required but its inclusion could be needed in future.

Category 2: This will not be difficult to implement in a future iteration, but time constraints may prevent us from implementing this feature.

*The ability to overlay layers dramatically complicates the notifications section as now should it update to hold two layers? Should it resort all events to keep the chronological order? Much easier and more practical to keep them separate.

FLIP Use Cases

An office setting

- a presenter wants to share a file with his audience right away
- he hits the "quick layer" button and a notification is sent to everyone within a specified proximity.
 - "quick layer" feature follows the creation process as a normal layer, however the characteristics that are normally user-specified such as proximity and member privileges are filled in with pre-set choices. We see the practical choices being a public layer (all parties nearby can join and publish material) and a proximity of around 50m.
- they will then be able to join the layer, see a file that has been shared across the layer, and download/access that file

Office Setting - Category 2 (with caveats): "Quick layer" creation is possible, but the FLIP Protocol does not currently support automatic notifications to other users. This could be added in a later version of the protocol.

Our demo application will support the creation of a "quick layer", but may require other users to refresh their layer lists manually to be see new layers. As the protocol is currently written, *all* clients could periodically poll *all* layers, but this is extremely wasteful of bandwidth and server resources. It is unadvised to go this route.

A lecture setting

- Professor can use FLIP to create a classroom layer, accessible only by the professor and the relevant students, controlled by professor
- Students can contribute by turning in assignments or showing that they are present for attendance purposes (submit server)
- Students can also ask questions anonymously, which helps in a big lecture hall
- Professors also would have the ability to distribute assignments without using a lot of paper, monitor the class's questions better, take attendance more efficiently
 - Availability of presentations on mobile devices will improve visibility

Lecture Setting - Access Control - **Category 2:** Creating customizable layer access control is possible, but would require additional development on the client end. This cannot be done by the end of the semester.

Lecture Setting - Asking/Answering Questions - **Category 3:** This feature is beyond the scope of the FLIP Protocol. A separate, entirely different protocol would need to be designed for this feature.

Lecture Setting - Distributing Documents - **Category 1:** This feature will be possible to develop by the end of the semester.

- Customer service setting
 - retail store, customer can join store's customer service layer
 - customer then can post questions or concerns on layer
 - employees of the store (that are qualified to answer the question) can see this specific customer's location and find them to assist them
 - GPS may not be accurate enough to find exact location of the asker in a small store so alternative may be pinging the customer to come to the front desk when there is a free employee to assist them

Customer Service - Concerns or Questions - **Category 2:** This feature will not be possible to develop by the end of the semester. This use case breaks from

our current model in two significant ways:

1. There is nothing currently in the protocol regarding "posting questions" or "raising concerns". The FLIP Engineering team was not made aware of this feature until this week. Implementing this feature would require significant re-working of our current model.

2. "Pinging" a user: The FLIP Protocol is currently written as a "pull" protocol. This saves bandwidth and processing, but means that all interactions are initiated from the client side. This means that "pinging" the user is infeasible without using immense amounts of bandwidth to have every client check in with the server. Given more development time, the protocol could be expanded to support "push" notifications such as this one, but we do not have enough time to develop this.

- Campus events
 - hosts of events can post locations and times on relevant public layers
 - Examples of event layers: Athletics, academic events, student groups, etc.
 - event host's contact information can be made available
 - alternatively, details for events could be requested within the FLIP client to protect privacy (maybe offer a choice between the two for people posting events)
 - clicking on an event when viewing the layer should give you directions from your current location to the event in question

Campus Events - **Category 2:** The FLIP Protocol currently has elements in place for

handling events, but the user interface side of this would take significant time and resources. This feature will not be possible to develop by the end of the semester.

- Crime
 - police department can post crime alerts on a layer in addition to the mass emails
 - crime layer should be publicly visible but only editable by police department

Engineers: **Category 2:** This feature will possible to implement using the FLIP Protocol, but its code cannot be written and tested by the end of the semester.

- Automatic file lending (maybe?)
 - student walking through campus listening to an mp3 file on their mobile device can allow people within proximity to listen to that file
 - file should be accessible only by people in proximity, and only while they are in proximity
 - is it possible to create a layer in which users can view files that other users in the layer are currently viewing?

Engineers: **Category 3:** This is not possible via streaming, as it raises bandwidth issues. Additionally, it raises legal issues regarding sharing copyrighted media.

- First Look Fair / Career Fairs
 - People running booths at a career fair can post their company information on a career fair layer, what kind of positions are available, and other relevant information
 - people attending the career fair can make their resume available on the layer, so that there is less paper and every employer in the room has easy access to an electronic copy

Engineers: **Category 1:** This feature will be feasible to implement by the end of the semester.

- Deals Layer
 - companies near campus can post ads on a specified advertisement layer
 - these posts would probably be treated like events, where the time of the event is the time that the deal is available and the location is the store location
 - ideally, advertisements would only be allowed on designated ad layers
 - some kind of program or mods (actual people) that enforce this rule
 - special accounts for advertisers so that ads will be non-intrusive

Engineers: **Category 2:** This feature will possible to implement using the FLIP Protocol, but its code cannot be written and tested by the end of the semester.

- Fraternity/sorority recruitment
 - similar to career fair use case scenario

- fraternities/sororities can broadcast information about their group on a recruitment layer that all users can view (what kind of person they are looking for, requirements, etc)
- layer should be available whenever groups are recruiting
- layer should probably not be restricted by geography (maybe entire city of college park) but should be restricted to students at the university
 - can be used for all recruitment, campus groups, etc.

Engineers: **Category 1:** This feature will be feasible to implement by the end of the semester. Fraternities and sororities can offer documents using the current FLIP model.

- The Social Networking Layer
 - With the integration of social networking websites like Facebook, a user would be able to see a users' status/tweets and current events
 - The information would help users identify people familiar to them, especially in a crowded area
 - People can find people they know - helpful in crowded or loud locations

Engineers: **Category 2:** This feature will possible to implement using the FLIP Protocol, but its code cannot be written and tested by the end of the semester. This is implementable by storing a user's facebook/twitter identity in a token. In its simplest form, this will ship off the user to an external website instead of integrating the data locally.

Overview

This document outlines the contract between the Gemstone Team FLIP and the SEAM Team FLIP for the fall semester of this year, 2010. SEAM Team FLIP is responsible for the construction of the core functionality of the FLIP protocol including a set of required operations and a set of intended future operations. The final deliverable must perform the required operations, while have been constructed in a manner that would allow the later addition of the future operations to the core architecture. Finally, this document addresses that several features face problems to which we have yet to decide a solution, while various features rely on developments by other SEAM teams. The crux concept of the FLIP protocol is the ability for users to share information on “layers,” or geocentric networks of users, and the final deliverable must functionally mirror this goal.

1. Requirements 1.1 The User

The FLIP protocol must associate a user with their geographical location. The users can be assumed near-static, such that FLIP updates their associated location infrequently to conserve resources. FLIP must be able to receive and store data files from, and send data files to the user’s device when prompted.

1.2 Layer Creation and Management

The FLIP protocol must be able to associate a central geographical point, a group of users, and multiple data files (or references to these files); these three components form a layer. If a user were a member of a layer they must be able to access a list of the associated users and data files, as well as download said files to

their device. A user will be able to share data with a layer by uploading it to the FLIP server, which then grants the layer's associated users access to the file. Should the data be a simple string of text, or "status message," they must be able to share this directly from the FLIP interface (section 1.4) rather than by sharing a text file.

An administrator defined "global" layer must be possible such that all users can join it however, a user, upon querying the list of associated users, would only receive a list of those within a specified proximity. The data files associated with the global layer would continue to be available to all members of the layer, however, user privileges are assumed limited (section 2.1).

One such Global layer will be the "Home" layer, at which we expect the user to begin. The Home layer will be different from all others in the respect that from it a user could query a list of nearby layers (nearby meaning the relative distance between the user's location and the layer's associated central point). From this list, the user must be able to join any of these layers. The Home layer may be the only global layer included in the final FLIP protocol as a proof of concept, however, there must exist the capability to add more.

Any user must also be able to create a layer from a prompt at the Home Layer, defining its name and available distance (within an accepted range to match the provided use cases). The layer's central point would be defined as the user's associated location. Proximate users could then find this layer via their Home layer query, join it, and share. A user must be able to be a member of multiple layers (global and/or proximate) simultaneously.

1.3 Layer data

Information shared on a layer must take the form of an organized communal space, to which users are contributing. The correct type of organization remains debatable, but one must exist. The inclusion of “status messages” (addressed in Section 1.1) suggests that the information should be organized chronologically similar to a newsfeed. SEAM-FLIP has addressed concerns with this structure due to user preferences, which should be balanced against the pros and cons of other possible structures throughout development. Gemstone-FLIP and SEAM-FLIP will continue to communicate on this issue throughout the semester to determine the best organization, due to both system architecture and user preferences, so that one is included in the final deliverable

1.4 User Interface

As the FLIP core focuses on functionality only the groundwork of a user interface must be laid. The final deliverable’s user interface need only address access to the required features: the Home layer and associated functionalities, the user prompts to the FLIP server from a layer, a layer’s associated data files, and the ability to toggle between multiple layer “views” of which the user is a member.

At the time of this writing Gemstone-FLIP believes the most appealing interface revolves around a map of the proximate area populated by users, events, etc. SEAM- FLIP and Gemstone-FLIP will keep open communication with SEAM-TerpNav to insure that their deliverable and the FLIP protocol remain compatible (section 3.3).

2. Considerations to Future Operations 2.1 Privileges

While the core functionality of the FLIP protocol assumes all users equal, there are several use cases that necessitate limiting a user's rights within a layer. The ability to view content on a layer will always be associated with the ability to join, however, allowing only specific users to share content would be very beneficial under some circumstances. The FLIP protocol must support the ability to associate levels of privilege with users specific to the layer.

2.2 Visibility

Under some conditions a host user might want their layer only accessible by specific users. To meet this demand the FLIP protocol will need to hide layers from typical user prompts, allowing membership through some sort of invitation from the layer host.

2.3 Search Feature

The further development of the FLIP protocol may necessitate a search feature to assist the user in finding a specific nearby layer. A successful search feature would require a more detailed information base than simply a list of layer names. Searching through layer content would be far too expensive, so various other items would need to be associated with a layer such as but not limited too: a category, host user, and/or description. Thus, this implementation would also require additions to the user's creation of a layer (section 1.2). Both must be possible in the FLIP protocol.

2.4 Events

Information catering to a specific time and/or location may be more effectively communicated in the form of an event. This feature depends largely on the

final deliverable from SEAM-TerpNav (section 3.3) as well as the final user interface (section 1.4).

3. Existing Concerns

3.1 Host and Layer

To what extent is the host of a layer and said layer attached, if at all? Should the host have the ability to leave the layer while allowing its continued existence? How would this impact privileges and the possible resignation of administrator privileges to another user?

3.2 Layer Deletion

Does the host have the ability to delete their layer? Does that affect the decision reached in section 3.1? Should old and/or unused layers be removed automatically, and if so how are these features defined and the appropriate layers found?

3.2 User Authentication

Flip users are expected to authenticate through the system established by SEAM-Social Networking. At the time of writing Gemstone-FLIP have received the SEAM- Social Networking proposal but no further developments. SEAM-FLIP and Gemstone-Flip will continue communication with SEAM-Social Networking to ensure the compatibility of the two deliverables.

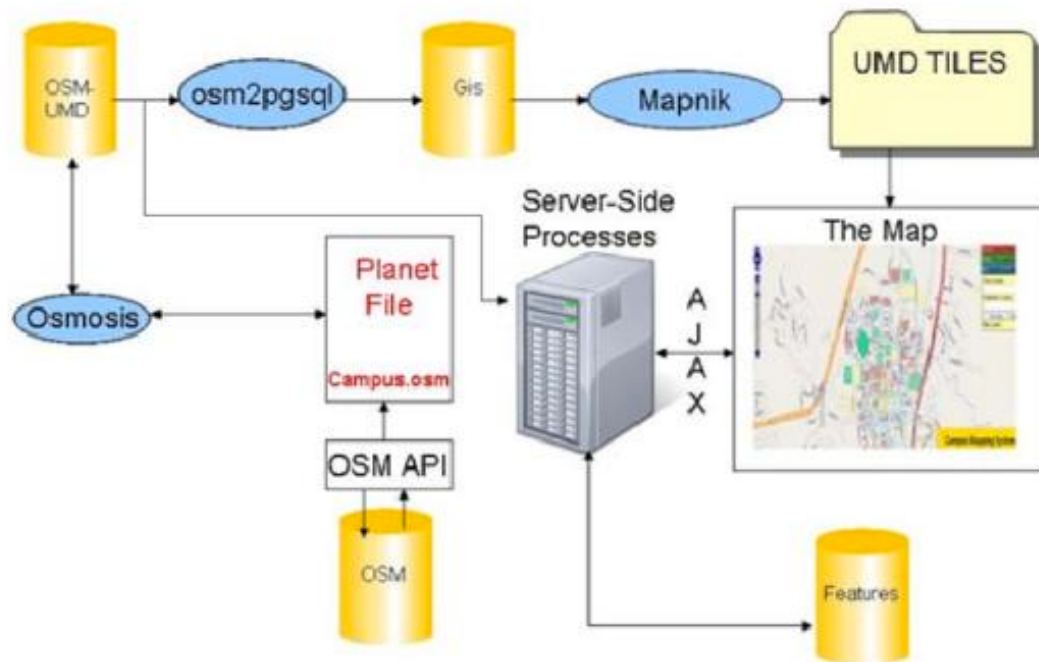
3.3 Map Inclusion

Gemstone-FLIP believes that a map remains the most visually appealing focus of the user interface (section 1.4). The map would represent an area covered by the layer, populated by users, events, and other information associated with a location.

The possible rendering of the image from a resource such as the existing TerpNav program will be addressed by SEAM-TerpNav. At the time of writing Gemstone-FLIP have only received a verbal proposal from a team representative. SEAM-FLIP and Gemstone-Flip will continue communication with SEAM-TerpNav to ensure the compatibility of the two deliverables.

Appendix B: TerpNav Information Flow Diagram

Figure B1: This figure shows the architecture of the original TerpNav, as described in Team FASTR's thesis. FLIP content resides in the "Features" database, with the logic occurring in "Server-Side Processes."



Appendix C - IRB Application

Principal Investigator/ Project Faculty Advisor <i>(NOT a student or fellow)</i>	James Purtilo, PhD	Email Address	purtilo@cs.umd.edu
		Telephone Number	

Co-Investigator		Email Address	
		Telephone Number	

Student Investigator	Xinyu Weng	Email Address	weng.cindy@gmail.com
		Telephone Number	301-693-1987

Project Title	FLIP: File Lending in Proximity – Research Study
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Department/ Unit Administering the Project	Gemstone Program/ Honors College
Where to send Approval Documents	6901 Preinkert Dr. Apt. #2509C College Park, MD 20740 weng.cindy@gmail.com
Check if this is	Student master's thesis <input type="checkbox"/> OR Dissertation research project <input type="checkbox"/>

Funding Agency(s)	
ORAA Proposal ID	

Number	
---------------	--

Target Population: The study population will include (Check all that apply):

- | | | |
|--|--|---|
| <input type="checkbox"/> pregnant women | <input type="checkbox"/> neonates | <input type="checkbox"/> individuals with mental disabilities |
| <input type="checkbox"/> minors/children | <input type="checkbox"/> prisoners | <input type="checkbox"/> individuals with physical disabilities |
| <input type="checkbox"/> human fetuses | <input checked="" type="checkbox"/> students | |

Exempt (Optional): You may suggest this protocol meets the requirements for Exempt Review by checking the box below and listing the Exempt category(s) that may apply. Please refer to the Exempt Category document for additional information.

☐ **Exemption Category(s):**

Rationale:

Date	Signature of Principal Investigator [REQUIRED]
Date	Signature of Co-Principal Investigator
Date	Signature of Student Investigator
Date	Signature of IRB Liaison/Department Chair [REQUIRED]

1. Abstract:

As the Internet has become more and more ubiquitous in the daily life of people around the world, its limitations have become more and more apparent. Current models of information sharing take little account of the location of users or the proximity of groups of interacting users. Team FLIP seeks to create a way to share files with respect to the people that usually matter most to us, the people around us physically. The FLIP software works as a geo-centric wiki, with information closest to you presented most prominently, while things out of range are not displayed at all. FLIP will be conducting field studies with accompanying surveys which will be used to gauge whether or not this sort of location-based sharing over the Internet is effective and desirable to its primary user base:

2. Subject Selection:

- a.

We will contact administrators of the Honors and Gemstone listservs and ask them to email out the following message:
Want to know more about what's going on at Maryland? Do you use the Internet on a daily basis? Then participate in Team FLIP's Gemstone research study for a chance to win one (1) of 30 prizes of \$10 cash! Visit flip.cs.umd.edu for more information or contact flipresearch@gmail.com.

Furthermore, we will create a Facebook event and invite current undergraduate students at the University of Maryland to participate in the event. Please see the supporting document for the exact wording of the Facebook event.
- b.

Participants must be undergraduate students at the University of Maryland, College Park.
- c.

Participants must be students at UMCP because of limitations in our application's authentication system. Credentials are provided by the University and as such, only those affiliated with the University can access the full potential of the application.
- d.

We will plan to enroll a maximum of 200 participants.

3. Procedures:

4.

Our Facebook event will direct people to the FLIP web application. Upon logging in, the users will see some example use cases of the FLIP software as shown through tutorial videos. Users will then be allowed to explore the FLIP website, and use and evaluate in at their leisure. After using the website for any amount of time that they like, the user will complete the survey that was linked from the Facebook event. (Please see supporting documents for the survey example.) At the end of the survey they will be asked to read and sign a consent form, and to enter their email address (optionally) if they wish to receive payment in return for taking the survey. Those who fill out the survey will have the chance to receive one (1) of 30 prizes of \$10 cash. This will be determined by a random raffle.

The study will only expose the participants to the same risks associated with using an Internet browser on their own personal computer. However, for the sake of our study we only want participants who already use their personal computer to access the Internet regularly, as detailed in our participant selection. Therefore, the participants will not be exposed to any risks they do not already take every day.

5. Benefits:

- **Participants** - We hope that the participants will see benefit in the addition of the FLIP system in their daily activities. Our study hopes to find that the geocentric model on which FLIP is based does match the user's Internet activities better than existing software. We also hope to find that the users enjoy using the FLIP system, find it a useful tool, and use it outside of the study for everyday purposes.
- **Overall benefits** - The core feature of our study is the implementation of a "proximate internet." We believe that existing Internet users would benefit greatly from the introduction of this technology. The FLIP system strives to make everyday Internet and telecommunications exchanges easier, more efficient, and more applicable to the demands of the user.
- **Risks v. Benefits** - As the participants are already exposed to the risks of using FLIP in their everyday life, the possible benefits of improving their day-to-day Internet usage outweigh the risks.

6. Confidentiality:

Data collection from the program will be an anonymous process. We will not require our subjects to provide identification information other than their UID. However, a user's UID will not be traceable to their survey responses due to the fact that they are hosted on different servers. Subjects will have the option to allow any bugs to be reported to the central server, however, we will not collect data on the content of their usage. Users will have to opt-in to participate in the bug reporting service.

The survey responses will also be completely anonymous. Users will fill out surveys but we will not ask for contact information unless they would like to be informed about the results of the study. These surveys will be completed via Google Spreadsheets.

Our usage data will be collected using servers at the University of Maryland. Team FLIP will also keep a backup copy of data for insurance and security reasons. The data will remain on the University of Maryland's server for three months following publication.

The only people who will have access to the data collected will include the members of Team FLIP. The members of team FLIP will have full data privileges in order to allow for in-depth analysis of the data.

7. The data that we collect will be deleted from University of Maryland's servers to ensure the safety of the information. The data after being compiled will be used in the final thesis;

A consent form will be included in the online survey that students will be taking. All users will verify that they have read and agree to the consent form by submitting their electronic signature in the space provided. The privacy with which students complete the survey is at their discretion as it is an online survey and we will not be present at the location at which they take the survey.

8. Conflict of Interest:

No conflict of interest

9.

Not applicable

10. Research Outside of the United States:

Not applicable

11. Research Involving Prisoners:

Not applicable

Each copy of the application must include the IRB application cover sheet, the information required in items 1-11 above, and all relevant supporting documents

including: consent forms, letters sent to recruit participants, questionnaires completed by participants, and any other material that will be presented, viewed or read to human subject participants.

For funded research, a copy of the Awarded Grant Application (minus the budgetary information) must be included. If the Grant has not been awarded at the time of submission of this Initial Application, a statement must be added to the Abstract Section stating that an Addendum will be submitted to include the Grant Application once it has been awarded.

NUMBER OF COPIES

Please send 1 original application including the signed cover sheet to:

**IRB Office
1204 Marie Mount
College Park, MD 20742-5125**

Supporting Documents:

Facebook Event

The screenshot shows a Facebook event page for "FLIP Paid Research Study" created by Cindy Weng. The page is viewed in a web browser with the URL <https://www.facebook.com/events/368589733157191/>. The Facebook interface includes a top navigation bar with the Facebook logo, a search bar, and a user profile for Cindy Weng. On the left sidebar, there are sections for "Going" (showing Cindy Weng as the host) and "Invited". The main content area displays the event title "FLIP Paid Research Study", its status as a "Public Event", and the organizer "Cindy Weng". Action buttons for "Events", "Invite Friends", "Edit", and "Going" are visible. The event details specify it runs from Monday at 1:00am until Wednesday, February 29, 2012 at 4:00am, and is located at "Your Computer". The description explains that FLIP is a Gemstone research project aimed at experimenting with different ways of sharing files. It provides a list of five steps for participants: 1. Check out the YouTube channel at <http://www.youtube.com/teamflipvideos>; 2. Watch videos and start exploring <http://flip.cs.umd.edu/>; 3. Complete a survey at https://docs.google.com/spreadsheet/viewform?hl=en_US&formkey=dDR5TEo1X2xyT1JlNzU2TThoNTRQTnc6MQ#gid=0; 4. Input an email address for compensation; 5. Thank you message. A note at the end states that 30 participants will be randomly chosen to receive \$10 cash. At the bottom, there are sharing options (Post, Link, Photo, Video) and a text box for comments.

facebook Cindy Weng Home

FLIP Paid Research Study

Public Event · By Cindy Weng

Monday at 1:00am until Wednesday, February 29, 2012 at 4:00am

Your Computer

FLIP is a Gemstone research project that seeks to experiment with different ways of sharing files. What's new about FLIP? It only shows you information that is relevant to your location.

Here's all you need to do:

1. Check out our YouTube Channel at <http://www.youtube.com/teamflipvideos>. Here you'll find information about how to get started on FLIP.
2. After watching a video or two, you're ready to get started! Start poking around at <http://flip.cs.umd.edu/>
3. Once you've taken a look around the website and tried posting, complete the survey located here: https://docs.google.com/spreadsheet/viewform?hl=en_US&formkey=dDR5TEo1X2xyT1JlNzU2TThoNTRQTnc6MQ#gid=0
4. Remember to input your e-mail address if you wish to be entered to get compensated!
5. That's it! Thanks for helping us pursue our goal of making information more accessible and relevant to you.

At the end of the study, 30 participants will be randomly chosen to receive \$10 cash.

Share: Post Link Photo Video

Write something...

Questionnaire

Team FLIP Usage Questionnaire

Please watch the videos at <http://www.youtube.com/user/TeamFlipVideos> and go to <http://flip.cs.umd.edu> to help you answer the following questions.

Consent Form Link: <http://goo.gl/vIPHC>

*** Required**

Do you see yourself using location based technology to share information in the future? *

1 2 3 4 5

Never ☐ ☐ ☐ ☐ ☐ All the time

Do you use "check-in" services like Facebook Places and Foursquare? *

1 2 3 4 5

Never ☐ ☐ ☐ ☐ ☐ All the time

Do you think location-based sharing increases your ability to connect to others near you? *

1 2 3 4 5

Not at all ☐ ☐ ☐ ☐ ☐ Very much

How would FLIP's new location-based features affect your usage of TerpNav? *

1 2 3 4 5

Greatly decrease ☐ ☐ ☐ ☐ ☐ Greatly increase

How would you rate the convenience of using FLIP to share files COMPARED to the following technologies: *

Watch the FlipStream video at <http://www.youtube.com/user/TeamFlipVideos>

	Less convenient	About equal	More convenient	n/a
Using flash drives	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dropbox	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Email	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Uploading to hosting websites (e.g. MegaUpload, MediaFire, HulkShare, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other software like Mojo, AirDrop	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How often do you use your phone or laptop to find nearby people, events, places, and other information? *

1 2 3 4 5

Never ☐ ☐ ☐ ☐ ☐ All the time

Has FLIP contributed to your knowledge of campus information (e.g. Food Deals, Blue Light locations, Bike Racks, etc.)? *

1 2 3 4 5

Not at all ☐ ☐ ☐ ☐ ☐ Very much

Comments:

Please read our consent form. The link is provided at the top of this survey. *

Please type your full name below to verify that you have read and agree to the terms on our consent form. We will not use your personal information for any purpose in our study and all answers will remain anonymous.

If you wish to receive \$10 cash for completing this survey, please enter your email (optional):

Powered by [Google Docs](#)

[Report Abuse](#) - [Terms of Service](#) - [Additional Terms](#)

Glossary:

Android - Google's open-source operating system for mobile devices

API - application programming interface; an interface of a specific software that allows other software (such as third party applications) to interact with it

Dongle - a small piece of hardware that connects to a computer, and may be portable

Driver - A computer program allowing higher-level applications to interact with a hardware device

Emulator – A piece of software designed exactly to simulate another piece of hardware or software (e.g. an operating system)

Encryption - converting data or information into code

Firmware - something in between hardware and software; like software, it is created from source code, but it is closely tied to the hardware it runs on

IEEE 802.11 Protocol – A set of standards for carrying out wireless communications, of which Wi-Fi is an implementation

Node - any computer or server that is hooked up to a network

Open Source - software whose source code is freely available to the public

Packet - a unit of data transmitted over a network

Rights Revocation - the ability of a file-sharer to revoke rights of access to any shared file

Tethering - allowing the owner of a file to share a file while still controlling the rights of ownership and access

URL – uniform resource locator; a string which constitutes a reference to an internet resource

W3C – World Wide Web Consortium; the international standards organization for the World Wide Web.

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