THE EVOLUTION OF INTERNET GEO-LOCATION AND LOCATION-BASED SERVICES

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I. ABSTRACT

After the era of the personal computers and their applications using the Internet the future of the information science becomes mobile based surpassing the limitations of the non portable devices. Smart phones and tablets are the PC equivalent of this post-PC era.

Internet geo-location and location based services created in order to supply better results and more accuracy in our mobile usage of the internet. Providing specific information according to the our current location on Earth.

The implementations are so many and most of the time their use is not visible to the plain daily internet user.

Serving both the need for discrete information in order to improve the use of the internet but also helping state services to determine locations of people in case of emergency . Internet geo-location and location-based sevices are also a major part of the social networks , users of such networks happily share their exact location with their friends just like they share their thoughts and photos.

Ι.ΠΕΡΙΛΗΨΗ

Μετά το πέρας της εποχής των προσωπικών υπολογιστών και των εφαρμογών τους βρισκόμαστε πλέον στην εποχή της πληροφόρησης μέσα από κινητές συσκευές οι οποίες δεν παρουσιάζουν τα μειονεκτήματα των μη φορητών συσκευών. Τα έξυπνα κινητά τηλεφωνά και οι ταμπλέτες είναι πλέον ο προσωπικός υπολογιστής σε αυτή την μετά-υπολογιστή εποχή που διανύουμε

Οι υπηρεσίες εντοπισμού της γεωγραφικής θέσης μέσω του διαδικτύου καθώς και οι υπηρεσίες που βασίζονται στον εντοπισμό της γεωγραφικής θέσεις δημιουργηθήκαν για να προσφέρουν πιο εξειδικευμένες υπηρεσίες στους χρηστές σε σχέση με την γεωγραφική τους θέση.

Οι χρήσεις είναι τόσες πολλές και τις περισσότερες φορές δεν γίνονται αντιληπτές από τον τελικό χρηστή. Εξυπηρετούν την ανάγκη για παροχή εξειδικευμένων πληροφοριών που αποσκοπεί στην βελτίωση της χρήσης του διαδίκτυο αλλά και δυνατότητα εντοπισμού από υπηρεσίες έκτακτης ανάγκης (όπως Αστυνομία). Επίσης οι εν λόγο υπηρεσίες αποτελούν ένα μεγάλο κομμάτι των δικτύων κοινωνικής διαδικτυωσης , των οποίων οι χρηστές μοιράζονται με άνεση με τους φίλους τους, την ακριβή τους τοποθεσία. Όπως θα μοιράζονταν τις σκέψεις και τις φωτογραφίες τους.

II. INTRODUCTION

The internet was invented in order to serve the American army and provide a safe mean of communication under any circumstances like nuclear war. Being invented by the American Army and under the surveillance of American universities was clearly an English speaking mean of communication. The whole terminology even nowadays after almost three decades of internet existence is written in the English language.

Internet is no more a communication channel serving military operations and purposes. It's being transformed in a daily usage tool for serving almost any kind of communication and entertainment across countries and continents even serving the communication between earth and the moon or other space destinations. (e.g. **National Aeronautics and Space Administration "NASA"**).

But the evolution never stops and we can now say that the internet moves to a post-PC era. Becoming increasingly mobile and in many countries the usage of internet using mobile devices (e.g. **Smart phones , Tablets**) surpasses the usage of personal computers and laptops. That's the critical factor that sparked the idea of location based services and serving the users according to their current position on Earth that can reveal their native language and internet usage needs with a highly probable accuracy rate. For example a user that currently resides in Paris can just types on his mobile phone the address of the highly popular search engine google.com and get the initial page fully written in French language and the same time another user from Greece will get the Greek version of the same page.

The end user is most of the time unaware of the usage of location based services and the information he is revealing about his position on earth in order to use location based services. For example the first form of internet location based services was using the WHOIS database and the guessing of actual position using the IP of the user.

Geo-Location services are not only a feature of the Internet but it's a part of our everyday life using our mobile devices like cell phones and pagers. Every cellular service provider has to embed Geo-Location services in their system in order to locate the user in times of emergency (e.g. the 111 number in Europe that every cell phone can call without the use of a SIM card and the 911 number in the USA). The cell phone when calling these numbers is reveling the physical location of the user without the need of the user to talk and communicate with the police or the emergency service.

As we can clearly see Geo-Location and the location based systems are a most of the times transparent part of our life that sometimes threat our privacy by revealing our location to our cell phone provider and their affiliates. The Internet Engineering Task Force is working on a framework that will serve both Geo-Location services but also the privacy of end user that should not be exploited by any means. Thus protecting the user and serving the need of Geo-Location. This framework is called GEOPRIV System. (Barnes , Internet Geolocation. 2011)

III. HISTORY OF THE GEO-LOCATION SYSTEMS

We first need to clarify what Geo-Location is and what it stands for. According to Wikipedia " **Geo-location is the identification of the real-world geographic location of an object, such as a radar, mobile phone or an Internet-connected computer terminal. Geo-location may refer to the practice of assessing the location, or to the actual assessed location**. " . (Wikipedia.org)

The first and primitive form of Geo-Location was using the PSTN phone lines that actually used the phone numbers assigned to a specific area in order for the network to indentify which areas have to be served. This is a critical part of the nowadays phone network that can serve more applications that use Geo-Location services. It's a common phenomenon for nowadays companies to use 800-xxxx-xxxx style of phone number that serves the identification of the location. A user that calls to nationwide 800-xxxx-xxxxx type of telephone number is actually being diverted to the closest local pizza in order to be served quickly. (Internet Geolocation and location-based services) (Richard Barnes, James Winterbottom)

The second great step in Geo-Location services was the arrival of the cellular networks and the mobile phones. There was no need for a fixed location and each number was assigned to a specific person rather than a specific non portable device.

The main problem was that the location of the device could change drastically within a small portion of time . So every time the system has to identify the geographical location of the subject using the coordinates system of longitude and latitude.

The third major step in geo-location services was the GPS system (Global Positioning System) a satellite based navigation system that could work and provide information no matter the weather of no matter the location of the subject on earth(Wikipedia.org) . The system needs three or more satellites to lock their signal on the device so the actual location can be calculated and provided to the user. The GPS system was utilized by the DoD (Department of Defense) of USA . It is now a system that serves virtually every aspect of location identification services like air traffic , navigation , commercial and even entertainment purposes (e.g. Social Networks).

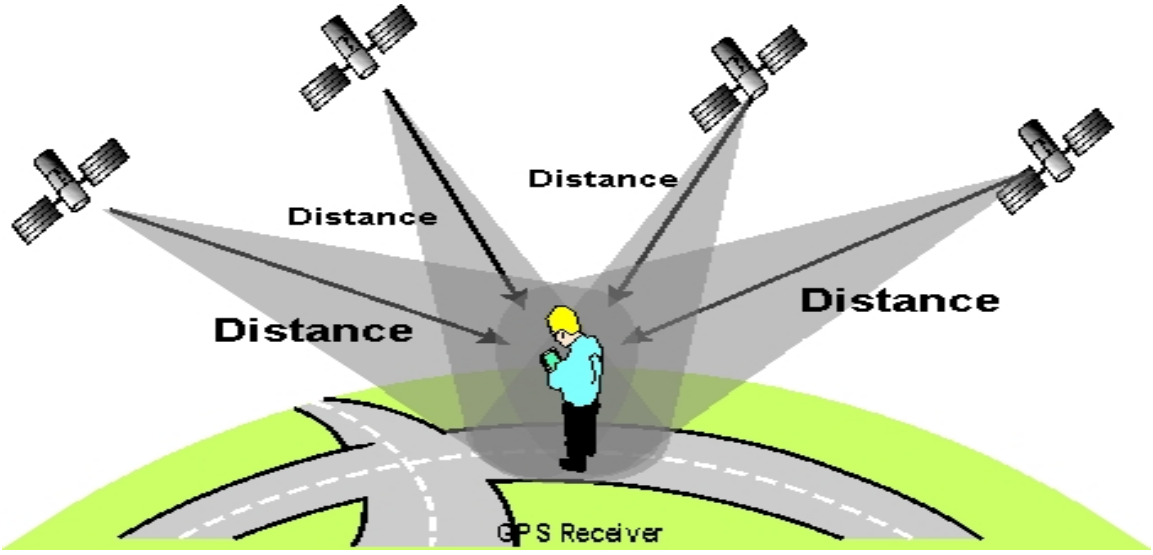

Image 1. GPS , Three or more satellites in order to calculate the location (Althos , Wireless Dictionary 2009)

The final major step is the Internet geo-location and the location based services that are used to provide and deliver more accurate and specific content to each user according to his location on earth. But that's not the only use of Geo-Location on the internet. Social networks are a major part of the daily internet activity of many people and so many people are using social networks for either entertainment or business purposes. There are social networks just like **Foursquare** (a mobile phone based social network) which the main thing that you share with your virtual friends is your location. So does and the famous Google Android platform application called **Path** that not only is using your location at any specific time but also the users are uploading photos that contain the location that the photo was taken thus revealing the location of the user.

IV. THE INTERNET GEO-LOCATION

The most common form of internet Geo-Location is based on the IP address of the subject. The whole TCP/IP protocol is divided among continents and countries , Internet service providers and the users. Geo-location based providers emerged and become a virtual bank of information about IP addresses and their assigned geographical locations. WHOIS services was the ancestor of the current geo-location information providers.

A user of the famous search engine www.google.com that types down the URL of the search engine is actually sending a request to the server that is running the Google website. But before the server responds to the user it is sending a request to the geo-location provider (Bennet ; Capella) that has probably information about the user that

made the initial request. The results are being analysed by the Google server and the user receives a webpage that is more suitable to him according to his location on the map. (**e.g. The country that he lives but not only , even different provinces in the same country , like Quebec in Canada in which the most search engines return a webpage written in French) .**

The definition of location specific content is " Systems, methods, and computer program products communicate location information associated with a device, such as a mobile device, to a server. Content identified by the server is received at the device, from the server and/or from a content service. The content can include an application associated with the location information. The content received at the device is displayed on the device only while the device is at or near a particular location identified by the location information. " (Location Specific Content) (Herz, Scott (San Jose, CA, US).

Another form of Internet Geo-location is to restrict access to various WebPages that clearly demand only specific IP addresses or even specific locations on the Earth. For example the Chinese and Iranian government restrict the access to their citizens to WebPages that are written and published from people outside of the country (A land without Google , New York Times,2011) . And many TV channels that broadcasting over the internet are not allowing streaming of their media to people that are outside from the country of origin.

The mobile devices that we are all using to access the internet are a better and more accurate provider of information that reveal our location on the planet. Smart phones that have GPS navigation abilities and Wi-Fi connection abilities are very capable of providing specific and accurate location-about information to the various services of

the internet that we are using (e.g. Search engines and social networks). Our mobile phones send the information of our location to the provider of the service that we are using and the whole process is much faster and accurate because the geo-location information provider can save information about our location that is more accurate than the IP method. (Richard Barnes ,2011)

The signals that Wi-Fi networks broadcast can also provide geo-location identification because of the patters that are created from the Wi-Fi networks that are saved into databases of geo-location information providers. Some devices like Apples iPod touch are using Wi-Fi signaling in order to find their location on the map and use their installed services like maps and navigation that is most of the time assisted by a GPS functionality.

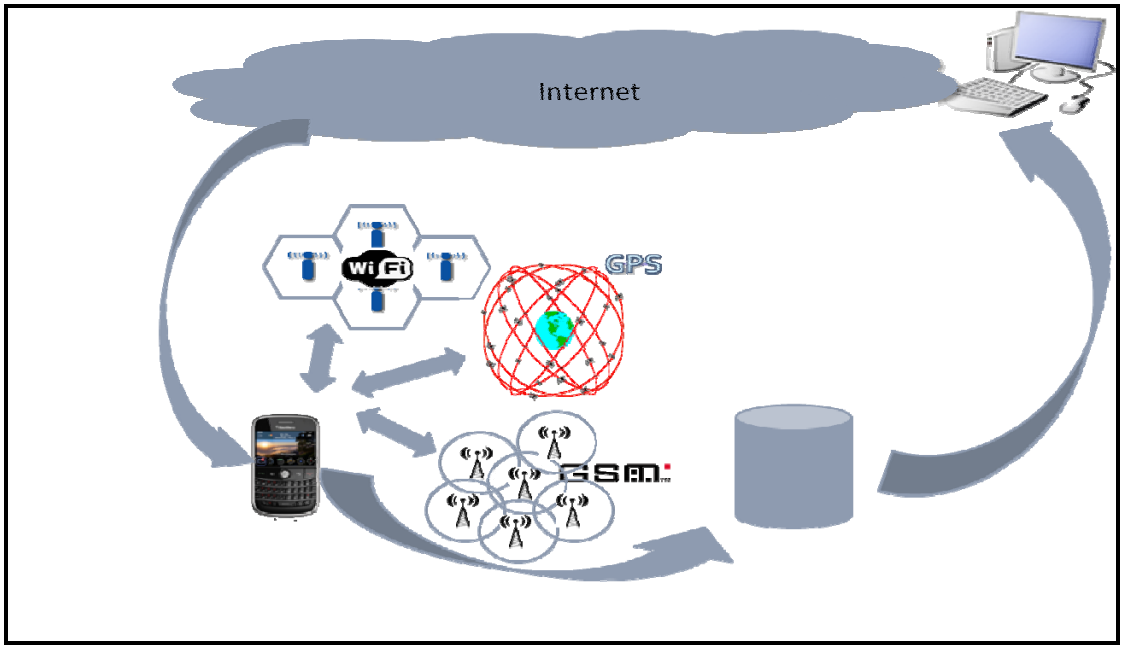

Image 2. Geo-location using the WiFi signaling , the GPS system and the GSM cellular network.

V. MAIN CATEGORIES OF LOCATION BASED APPLICATIONS.

- The GPS navigation system.

  Either in the form of an autonomous GPS receiver or as a part of a cell phone capabilities GPS navigation is really helpful and beneficial for the user. GPS systems can notify the service provider in you are in a case of emergency and let them know your exact position.

  GPS systems can inform you about the traffic on an road or even correct your driving route when you are not in the optimal road/path. (DHII, Technoblog 2008) .

- Location based content in Search Engines.

  Particularly helpful in order to filter out information that may be not be useful for the final user. The search engine is using the users location in order to provide information that are coherent with the current location of the user than the actual words or search terms itself. For example a user might type the word "Chinese Food " and instead of getting all the results that contain the words "Chinese Food " only get in return the Chinese Food restaurants in his broader area.

- Location based advertising.

  A new form of advertising and marketing by using the mobile phones as the main target and mean of advertisement. Of course the actual target is the mobile phone user. That can see localized advertisements on the screen of his phone. Most of the location based advertisements are using the push method. Pushing messages to the mobile device without the approval of the user. (Bruner, G., & Kumar, A. (2007). Attitude toward location-based advertising.).

- Location based emergency management systems.

  A particularly helpful system that uses the cell phone carriers in order to directly inform people about special circumstances in a specific area. Like fire or flood and help them avoid natural disasters (e.g. a typhoon headed to a city).
  Australia is the only country in the world that owns a full featured location based emergency system that informs the citizens automatically by either using PUSH method SMS or even phone calls with automated messages. (Shahida Sweeney, Connected Goverment, 2012)

- Location based business intelligence.

  Location based business intelligence can give an insightful view to the companies about their area of interest and other competitive business. By monitoring their area of interest and manage the real time data and information corporations can improve their outcome and future business operations. (Adriana Not ton , Location Based Perspective to Business Intelligence ,2010)

VI. LOCATION BASED APPLICATIONS AND SECURITY CONCERNS.

Exposure of personal information to 3rd party people or companies.

Social networking is widely used across the globe. The mass adoption of websites like Facebook , Myspace or Google+ made people less and less sensitive upon revealing their personal data. People are uploading photos , writing comments ,"checking in" while using location awareness mobile applications and post the results on their social networking webpage. Social networking applications need to be used cautiously because can reveal really sensitive information about the user.

Information like home address , living alone or with your family , geotaging information on pictures of the user or his family can really expose the user to the public and maybe even greater danger like criminals that collect information about the user. (Location based services perception , Microsoft Corporation , Cross tab marketing research ,2011).

Cyber bullying can occur because bullies can now know the exact location of their victim and threat him or blackmailing him in order to obtain financial / emotional benefits.

Most of the users seem to have no concern about their privacy as long as they find the application usefull or fun. (Location-based services and privacy law,McArthy Tetreault , George S Takach , Canada , 2011).

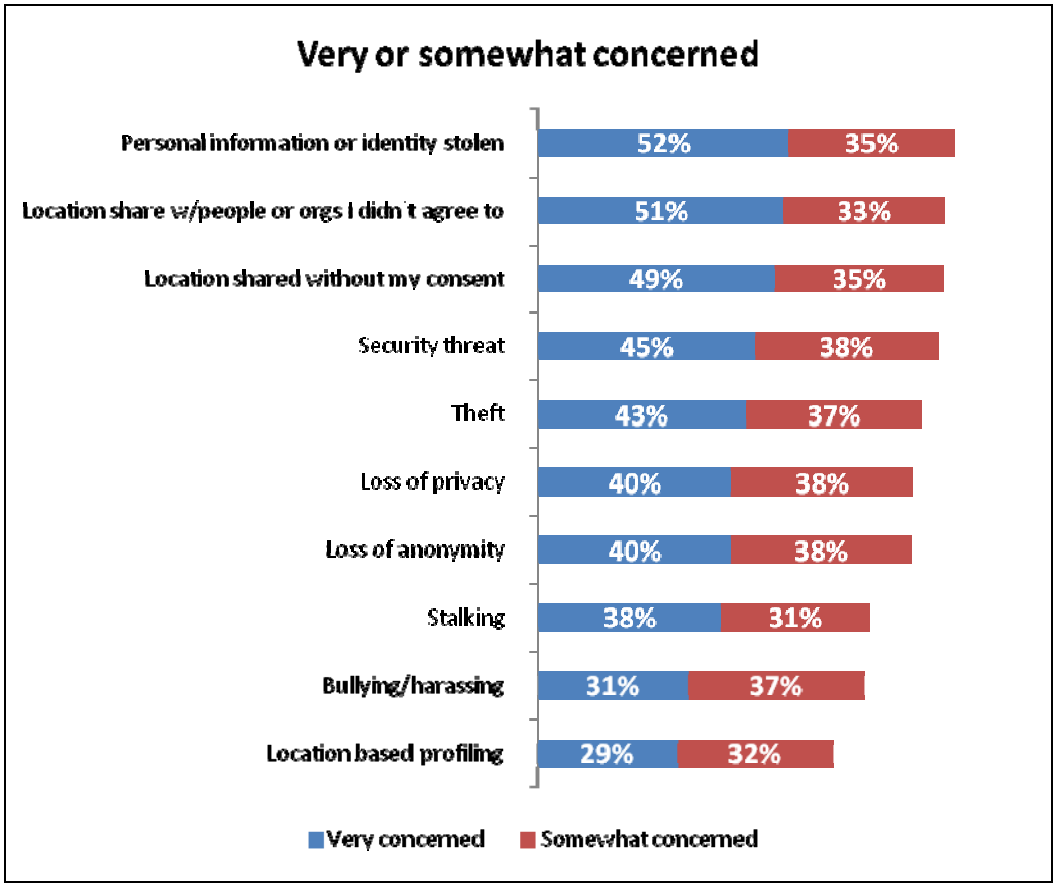

Image 3 . The main dangers that can occur by using location based services for social networking and how people are concerned about it . (Cross tab marketing research ,2011(For Microsoft Corporation)).

VII. CONCLUSION

Location based services are a useful and beneficial part of our technological world. Ruling the mobile devices and the internet location based applications can provide a richer experience on the internet and help us deal with daily problems.

But there are also privacy concerns that we have to deal with when using location based applications and services. It is maybe the aggressive advertising push message that we receive that concerns our privacy;
Or our voluntarily exposure of personal information about our exact location by sharing it on social networking websites and mobile phone applications.

The future of the internet geo-location and the location based services seems exciting. As the internet evolves and becomes a deeper and deeper part of our everyday life so does the need to provide more specific information based on the location of the subject , more specific content , more advertisements , more sharing with our friend on social networking websites.

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