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RESEARCH ARTICLE

PROVIDER SIDE CELL PHONE FORENSICS-AN INTRODUCTION AND ANALYSIS

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ABSTRACT

Cell phones have been widely used since their invention in the early 21st century as they have provided lot of comforts and ease for its users across the globe. However, for the past few years, these tiny devices are used by criminal organizations to carry out certain heinous criminal activities. For this purpose, a new discipline named as Digital Forensics was initiated in various institutes not only in Pakistan but also worldwide. This research paper describes the process of locating the criminals via cell phone forensics while specially focusing on the detailed description of this procedure. It also provides a brief introduction and overview of the discipline of mobile phone forensics.

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INTRODUCTION

Since their invention in the 21st century, cell phones have completely transformed our lives by connecting people across the globe and keeping them up-to-date about the happenings in the world. These tiny devices have played a vital role in making our lives luxurious, easy and fast-paced. However, during the past few years, these cellular phones are being used by various criminals in carrying out certain heinous crimes. For this purpose, an innovative discipline called Digital Forensics have been introduced in various institutes which enable the concerned authorities and the students to locate these criminals and their places of crimes. Now-a-days different technological devices are being used by the government and the concerned authorities to provide useful information to the law enforcement institutions by applying various methodologies. A forensic investigator can obtain the call data records which is a useful technique to gain essential information about the calls placed by the caller. This research paper is written with a purpose for analyzing the call data records (CDRs) of the cellular companies and comparing them to the results of call series used as a test.

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CDRs usually carry information which is used to locate the area from where the call was carried out. During their previous research, the Cellular Telecommunication and Internet Association found out that almost 233 million U.S. citizens were the regular subscribers of the cell phones during the year 2006 and this number will continuously increase in the future.

As soon as the caller places a cell phone call, it is received by the individual tower via its specific antenna. Every cell tower generally contains three directional antennas. The signals of the call are received by this directional antenna with very high intensity in its pointing direction and differentiates it from the received signal outside its field direction. These three directional antennas located on the cell tower generally divide the 360 degrees circumference of this tower into three 120 degrees areas where one area is fixed for each antenna. A cell tower contains first of these three antennas located on due North or on zero degrees. This antenna contains an area of 120 degrees which is 60 degrees wide on each side of the North angle. Its field is from 300 degrees to 60 degrees which is termed as North facing antenna or the Alpha antenna. Its second antenna is located at 120 degrees whose covering area is from 60 degrees to 180 degrees. It is termed as the Southeast facing antenna or the Beta antenna. The third antenna in the system generally covers the remaining area of the field which is located on 240 degrees covering the area from 180 degrees to 300 degrees. It is called the Southwest facing antenna or the

Gamma antenna. The tower and antenna receiving the call is generally checked out by the fact that which antenna is receiving the signal currently from the mobile. The signal is strongest when the tower is not teemed with calls. If the tower is already loaded with calls, it shifts the coming call to another tower which is in the alternate antenna's field receiving sufficient signals. By analyzing cell towers, their directional antennas and by analyzing the usage data for an hour of the towers, the area of the origin of the incoming call can be easily determined and calculated.

Process of Determining Location of Call Via Cell Phone Forensics

In order to find out the location of the call via cell phone, first of all the area of interest along with its specific regions must be specified. Once the location is determined, then the crime areas in which the witness was present at the time when crime occurred are to be find out. Then the cell phone of the service provider was obtained from the defendant. It was involved in various calls. Afterwards, the place of every call was determined by marking it on computer mapping software which is used to provide the latitudinal and longitudinal reading of the required place. In order to move from one location to another, a GPS system was used for speeding up the procedure of locating the places in non-familiar areas. It was also used to confirm the location when the investigator reached there. This activity was beneficial as the places were unfamiliar because they were generally named rather than being numbered.

As soon as the call was initiated, the time and the number of the cell phone placing the call were recorded on a paper logbook. Then they were sent to the time/temperature service unit or to the mobile phone of the investigator investigating the crime. After that the state police department issued a subpoena to obtain the call data records of the cell phone. CDR is generally obtained in order to show the time of placing of call, the tower from where the call was placed, and the antenna receiving that call. CDR determined the time stamp of placing the call which was then used to find out the location of the call via mapping device. Every antenna was being equipped with its own individual mapping icon. For example, a red X was designated to North faced antenna of the tower 148 while a red flag was designated to the Southwest antenna of the tower 148.

The technical information regarding the cell phone was found out from the cell phone provider by issuing a subpoena. The statement of the operational status of both the defendant and the examiner is essential to get hold of for locating the place of the crime properly. Then the towers and antennas were checked thoroughly for carrying out a proper operation. After that, the reports regarding the cell phone usage and the percent of the dropped calls were obtained on daily and hourly times for the marked days in which the defendant and the author placed their calls.

The provider was then requested to provide the details regarding the cell tower's antenna at the time of placing the call. Each antenna covers almost 120 degrees of its own area while covering the signal strength of approximately two surrounding antennas. Generally, the towers in rural areas carry much greater signal radius than in urban areas. The signal radius of an urban area tower is almost up to two miles while the signal radius of rural area is approximately nine miles in length.

A call placed on the 19th southwest antenna of the tower can fall into 120 degrees wide main field of the antenna or it can also come under southwest antenna's range which is approximately 160 degrees wide. Finally, it is concluded from the above analysis that the tower 19th southwest antenna receiving the call places that call somewhere within the range of that antenna's own field line. It is correct for all calls placed via this antenna. The size and length of this antenna's field cannot be measured exactly, we can only estimate the radius of this tower approximately. One can assume that the radius in rural areas can go up to 12 miles in length which is estimated to be the highest range for a cell phone receiving tower. The patterns of the tower usually vary slightly in range owing to fluctuations in weather conditions and excess or lack of trees in a particular area. This whole concept is very essential for understanding the value of the call data records in detail.

Conclusion

Cell phone forensics is a new and innovative discipline which is currently used extensively across the globe in order to locate criminals carrying out gruesome crimes. The author of this research paper expects from its readers that after getting some basic information about the discipline of mobile phone forensics and the process of locating the criminals, the readers will surely become aware of the process of locating such criminal organizations and will help the government and the concerned authorities to make this world a better place to live in by pointing out towards such criminal minds.

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