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The Future of Lawful Intercept

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Imagine a group of criminals embarking on a crime spree throughout a city. Using mobile phones, they coordinate their actions from miles away, sharing information to evade law enforcement agencies (LEA) and map out an escape route. But there's a twist. The LEAs are well-coordinated as well, quickly securing a warrant to tap into the criminals' wireless communications. In addition to listening in on their conversations and data transmissions by intercepting them, the law enforcement agency is able to precisely pinpoint the locations of the handsets sending and receiving the transmissions, letting the agents swoop in and capture the dumbfounded criminals.

It may seem like a plot twist in the latest spy novel or futuristic technology in a science-fiction movie, but Lawful Intercept (LI), a solution that allows law enforcement agencies to track wireless communications, can now pinpoint the locations of handsets to within tens of meters, allowing them to better coordinate a swift response to crisis situations and make it more likely they save lives and bring criminals to justice.

LI's solutions incorporating accurate location information can help law enforcement agencies track a handset's activity over a set period of time and trace its movement like a virtual "bread-crumb trail"; set up an electronic geo-fence around a geographic area where movements are analyzed in and

around the vicinity; and track the accurate location of handsets on a large scale for many subscribers, if permitted by law, on a mobile network.

These lawful intercept applications can collect location information for use in criminal investigations and anti-terrorism measures, depending on local laws. The technology centers around using solutions that were originally intended to locate people who needed help (E911) or were targeting consumers (zone advertising), and adapting that technology to locate people who may not want to be found -- such as criminals, terrorists, or other targets of law enforcement agencies.

Using Location in Emergency Situations

To investigate how lawful intercept can help law enforcement agencies, we can use as an example the November 2008 terrorist attacks in Mumbai, India, where a group of well-armed terrorists carried out a series of highly-coordinated raids on targets across the city. One incident took place at the Taj Mahal Hotel where two gunmen -- using mobile devices to communicate -- were holed up for several days with hundreds of hostages. If Mumbai law enforcement agencies had highly-accurate LI location solutions in place, they could potentially have used the location information to coordinate a swift response that might have saved lives sooner.

Shortly after reports of gunfire and explosions, the authorities could have used an LI location solution to set up a geo-fence surrounding the hotel, tracking all wireless activity within its borders. Dispatchers could have analyzed the data in near real time, identifying the attackers and innocent bystanders and relaying that information to SWAT teams approaching from the perimeter. Agents could have estimated the specific locations of the terrorists inside the hotel to within tens of meters and, given a map of the building, been able to identify the areas of the building they were in. Dispatchers could have also tracked the movements of their own agents, making sure the response was coordinated and that every exit was being covered -- all while maintaining secrecy.

LI solutions with location capabilities can also revolutionize border control. As the global economic meltdown has strained international borders, national governments are seeking more reliable methods of tracking people entering a country illegally. Border patrol agencies can simply set up a geo-fence along the border and track electronic communication as it flows into or out of the area. As

people, i.e. drug and gun smugglers, increasingly use wireless communication to coordinate their runs, highly accurate LI location solutions can be used to pinpoint the locations of those handsets, giving law enforcement agencies a more complete picture of activity in the area.

As you can see in these real-life scenarios, access to highly-accurate location information can help law enforcement agencies work within the law to quickly take control of a situation before it gets out of hand or stop the criminal activity as it is happening. Instead of relying exclusively on interpreting intercepted data and voice communications, agents can reliably plot the location of suspects and use this new information to put available evidence within its proper context -- turning intercepted information into actionable intelligence.

Key Challenge: Accuracy

As you can imagine, one key to LI solutions incorporating location is accuracy. In the Mumbai example, law enforcement agencies were not able to pinpoint the exact location of the gunmen, instead relying on unreliable witnesses inside the hotel. Location technologies like GPS would have been unhelpful because the terrorists were not using GPS-enabled phones or, if they had, they could have simply turned off that capability. Even if GPS was available, it is not reliable in dense urban and indoor environments due to line of sight challenges.

Other location technologies like Cell-ID -- a solution that uses crude location from cell towers to determine approximate position of a handset -- can determine location to within several hundred meters or a few city blocks. However, the information wouldn't have been new or useful to Mumbai police since the gunfire and explosions in the hotels had already given away the terrorists' general locations. More accurate information would have been valuable to responding personnel, allowing them to place the gunmen in, say, the east wing or in a specific ballroom.

One such method that can provide the appropriate level of accuracy is pattern matching location technology, a technology that uses the principle that every location has a unique radio frequency signature. Like a fingerprint's pattern of lines and swirls, a location can be identified by a unique set of values, including measurements of neighboring cell signal strengths, time delays, and other network parameters. Unlike GPS, pattern matching is enhanced by surrounding buildings and other clutter, using the interference to further enrich handset signatures.

A product architecture that leverages existing wireless location technologies to mine network measurement information can determine accurate locations to within tens of meters in urban areas. These LI systems incorporating accurate location information can capitalize on multiple sources of data, including passive probes on standard wireless network interfaces. In addition, standard location-services control plane interfaces can be used to give the LEAs the ability to query for location on an on demand basis, as court orders or warrants permit. As the technologies on devices continue to expand, the handset signatures become richer and further enhance accuracy -- perhaps one day even providing vertical coordinates.

Reduce Complexity, Cost

In addition to accuracy, LI solutions need to be easy and cost efficient to deploy before they are widely adopted. While some solutions call for expensive and disruptive equipment to be installed on cell towers, the ideal solution will be software based, making it more scalable and cost efficient to deploy. Also, a software-based solution would make it easier for disparate law enforcement agencies to access the location information securely and from distributed (perhaps mobile) sites.

While law enforcement agencies already have the ability to tap into voice and data communication over a wireless network, adding accurate and specific location information could help them deal with emergency situations in a more meaningful and rapid manner. However, these lawful intercept location solutions need to be highly accurate, highly reliable, highly scalable, and be able to be deployed easily and cost-efficiently. Only then will lawful intercept applications truly transform the way law enforcement agencies manage a crisis and bring criminals to justice.