CELLULAR SERVICE PROVIDERS

Standard use of a mobile device requires it to connect to a cellular service provider network to make calls, send text messages, access e-mail or browse the internet if it is not using a Wi-Fi connection. The mobile phone connects to the provider network via radio signals to the provider's antennas, also known as cell sites, which typically have a range from 1 to up to 30 miles. So location data can also be found in cellular service provider records such as historical cell site records. Historical cell site data is based off which cell site the device used to handle the cell call, but lacks the accuracy of a GPS location or Wi-Fi data. The cell sites are contained in the provider records and physical locations listed by latitude and longitude.

In this article we discuss the different service providers and the cellular technologies used; the types of data available, the retention periods, and how to obtain the data.

Cellular Service Providers

There are five main cellular service providers in the United States: AT&T, Sprint, T-Mobile, Verizon and US Cellular. Other carriers such as Boost, Virgin Wireless, TracFone, Family Mobile etc., are subsidiaries of the five carriers listed above.

Cellular Technologies

The two cellular technologies in use in the United States today are CDMA (Code Division Multiple Access) and GSM (Global System for Mobiles).

CDMA is primarily used in the United States while GSM is used in the rest of the world. Devices using one technology can't use the cell sites of a different technology. This difference becomes important when analyzing and plotting historical cell site data.

CDMA
Sprint
Verizon
US Cellular

GSM
AT&T
T-Mobile

Record Types

The most common types of records available from Cellular Service Providers are as follows, and discussed in greater detail in the following sections:

- Historical Call Detail Records with Cell-site Location Data
- Per Call Measurement Data
- Records Key to Interpreting Data

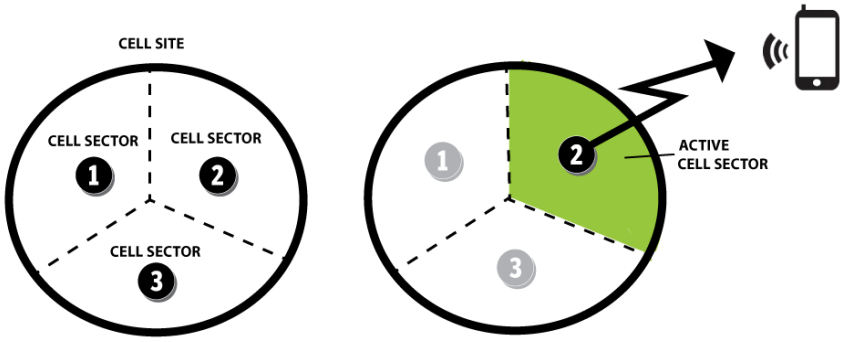
Historical Call Detail Records

Historical call detail records are maintained by the service provider and show the cell site to which a phone connects for billing and maintenance purposes. This data can be used during an investigation for the purpose of generally placing a cell phone in a location on a map with cell site locations. The evidence identified from call detail records with cell site data can be especially powerful in showing contact between individuals, establishing the proximity to a scene of crime, identifying patterns of movement of suspects, and testing the strength of alibi evidence.

The physical locations of the cell site used are listed in the records usually by latitude and longitude. The records can also identify the sector or antenna direction that handled the event which is included in the records or separate key.

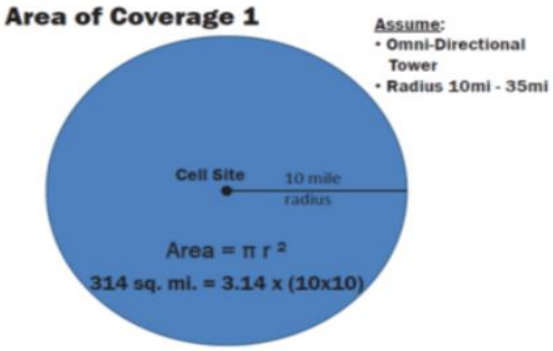
Cell Sites

Cell sites may be located on a building, water tower or other structure. A cell site may contain only one antenna (Omni-directional) that covers a full 360° area. This area is referred to as a sector. Most cell sites will have three sectors which cover approximately 120° each and others have four sectors of 90° coverage.



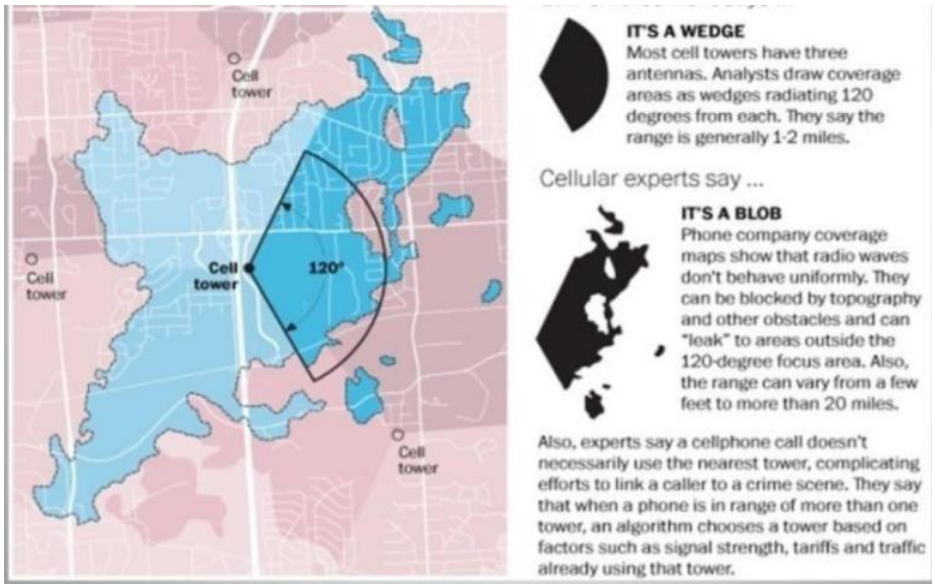
Range of Coverage:

Cell site antennas have various ranges. In an urban area where usage is higher, cell sites typically will have a shorter range and the sites will be located closer together and with a larger overlap in coverage. Cell antennas may have a range of less than one mile or up to thirty miles or more in flatter, more rural areas.



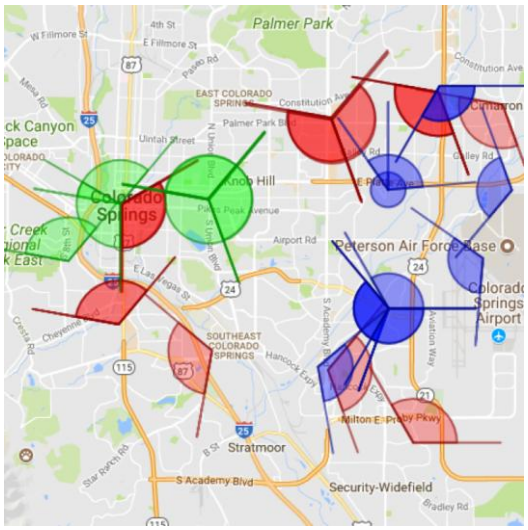
An Omni-directional cell site with 10 mile range has a coverage area of approximately 314 square miles

Cell sites are typically identified as circles with wedge-shaped sectors on a two-dimensional map. But the radio signals can be blocked by man-made or natural obstacles and the coverage is not uniform. Cell phone experts may offer propagation maps which better depict the coverage at a specific time, but will not necessarily represent the actual coverage at the time in question.



Per Call Measurement Data

A more accurate way to determine a location of a mobile device is Per Call Measurement Data (PCMD), a feature built into the equipment of some of the largest cellular service providers using CDMA technology. PCMD was developed to aid in improving cellular service in a particular area. It can measure the time it takes a signal to leave a cellular handset and the return back to the tower. It is this information which can provide previously unavailable information regarding the location of a particular handset. PCMD is captured not only for every phone call, but also for every text message and data event. PCMD is captured anytime there is a connection or data event between the cell site and the mobile device.



Because the speed of a cellular signal is a known constant it is possible to calculate the distance the handset is from the tower by measuring the time it takes for the signal to make a roundtrip. When combined with the cell sector information, there is now an opportunity to gauge how far away the handset is from the cell tower.

Location Services Enabled

If the device also has the location services enabled the device will also transmit location information from available Wi-Fi and Bluetooth signals it sees. Because the range of Bluetooth and Wi-Fi are considerably less than cell sites this added information and data point could be more accurate.

Terminology

Sprint uses the term Per Call Measurement Data (PCMD) and Verizon refers to PCMD as Real Time Tool (RTT) and Round Trip Delay (RTD). However, they do not provide RTT/PCMD during routine requests, such as court orders and search warrants. The requests are handled through the electronic surveillance division of Verizon and not through the subpoena compliance department. You must specifically ask for RTT/PCMD in your request.

AT&T Network Event Location Service

On the AT&T GSM network the location data derived by AT&T from passive environmental recognition of available connections is called NELOS (Network Event Location Systems) records.

Accuracy
Many factors affect the cell tower used by a device and the historical call record data, and the PCMD information is not nearly as accurate as GPS location data. They are only best estimates that can place a device in a general area, but there is no way to say with any certainty that a device was in an exact location using these records.

Retention
PCMD is extremely perishable and is not something that is going to be routinely preserved with the receipt of a preservation letter pursuant to 18 USC 2703(f). It must be specifically requested as quickly as possible.

Obtaining Records
Because each provider stores, labels and retains their records differently, what the records are called and how long data is retained can vary by provider. The IRIS LLC Digital Evidence Toolbox contains resources to locate, identify and obtain these records.

Retention Schedules
The data retention periods also vary widely between carriers and data types. For current service provider retention schedules, see the I.R.I.S. Digital Evidence Toolbox – Retention Schedules & Sample Letters of Preservation drawer.

Letter of Preservation
If use of the data is anticipated, a Letter of Preservation can be sent to the service provider until a subpoena or Court Order can be obtained to prevent the spoliation. A sample Letter of Preservation can be found in the I.R.I.S. Digital Evidence Toolbox – Retention Schedules & Sample Letters of Preservation drawer.

Subpoena Compliance
Obtaining cellular provider records is a standard procedure and each carrier has designated subpoena compliance departments. A current Subpoena Guide and other tools are available in the I.R.I.S. Digital Evidence Toolbox – Service Provider Subpoena Guide & Samples drawer.

Additional information regarding service provider records and cell sites is available in the Call Detail & Cell Site Analysis drawer of the IRIS Digital Evidence Toolbox.

DIGITAL EVIDENCE TOOLBOX

For more topics and information on digital evidence, see our Digital Evidence Toolbox at:
http://www.irisinvestigations.com/wordpress/iris-digital-evidence-toolbox/

For more information on location evidence, call now and speak with a certified expert. I.R.I.S. LLC is available 24 hours in emergency cases.

cellebrite delivering mobile expertise
WE'RE CERTIFIED.