

Technical Note

Telemetry Overview

Bill Bonner, Lead Software Engineer

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Introduction

Telemetry is generally used to define any kind of communication capability with remote devices wherein the field device does not have to be connected directly via a serial connection to the user's computer.

Telemetry allows access to remote sites from the comfort of the office. Reducing the number of site visits and accessing data remotely saves time and money. Additionally, a telemetry connection provides real-time access to data that may otherwise only be available while visiting the site. This is particularly useful if real-time alarm or notification is required.

In-Situ's telemetry suite is built on four products, each serving a different purpose, each with its own advantages and disadvantages. The intended applications of and differences between these products are discussed in the following sections.

Terminology

This section covers some of the industry standard terminology.

GSM and GPRS Systems

There are two types of communication technology deployed in mobile phone systems today, GSM and CDMA.

GSM stands for **Global System for Mobile Communications** and represents the voice transmission and SMS part of the system.

CDMA stands for **Code Division Multiple Access**. CDMA systems do not use SIM cards for activation.

Additionally:

GPRS stands for **General Packet Radio System** and it represents the TCP/IP internet capabilities of the system.

SIM stands for **Subscriber Identity Module** - this is the card that you insert into the GSM phone to activate it.

GSM

The GSM system is the world-wide standard for mobile phone communication. It is the most commonly used system outside the domestic U.S. and Japan. Its major domestic providers are Cingular and T-Mobile.

CDMA

The CDMA system is an alternative to GSM and is generally available only in the U.S., however international standards exist. Its major domestic providers are Verizon and Sprint.

SMS

This is a service supported by mobile phone systems worldwide. SMS stands for **Short Message Service** and is basically text messaging. SMS has unique characteristics that make it ideal for moving data efficiently from field devices with small power budgets. Other important aspects of SMS messaging include the following:

An SMS message is limited to 160 bytes of data. SMS messages can be used to send/push real-time data to another phone (i.e., your phone or email).

SMS cannot be used to download data logs or configure/change settings on the TROLL.

An SMS message is moved to its destination using store and forward. This means the message stays in the system until delivered. In worst case scenarios, the message can be dropped but in most systems, this is rare.

When using this method to send data, payment/billing is based on the number of messages that you send.

Circuit Switch Data - (CSD or Fax/Dial-Up)

This refers to the practice of dialing a phone number to establish a modem connection. Dial-up has been supported in Win-Situ 4 and more recently has been added to Win-Situ 5 Plus. Most people at some time in the past had to use dial-up to send a fax or connect to the internet. In the context of telemetry, dial-up refers to the practice of making a phone call to a cell phone modem connected to a TROLL. Just remember the squealing modem connecting - that's dial-up.

In these plans, you pay the cell phone provider for the number of minutes that you are connected.

This mode is supported by Verizon and most international GSM network providers.

Dial-up gives you full Win-Situ capabilities to work with the TROLL.

Internet Connections

This refers to the capability of connecting a mobile phone to the Internet. Many people already use this technology to surf the web with a mobile phone.

Connecting to the web site from the mobile phone, is called **Mobile Originate** - because the cell phone is the starting point of the connection. When someone on the internet connects to the cell phone, this is called **Mobile Terminate** because the mobile phone is the end point of the connection.

The Internet plans charge you according to the number of bytes transferred.

Mobile Terminate (Static Public IP)

Customers can purchase phone plans that allow them to use Win-Situ 5 to open a communication link to the remote cell phone using the internet. In this scenario, the mobile phone must have a **Static IP** address that is publicly accessible from the internet. A static IP address is an address that stays the same each time the modem is turned on.

This allows the full Win-Situ capabilities to work with the TROLL (same as dial-up).

This capability is supported by Verizon and GSM network providers.

Mobile Originate (Dynamic Private IP)

In this mode, the mobile phone gets a new IP address from a pool of private addresses each time it is turned on and registered on the network. This is how typical phone web surfing works. Because the IP address changes each time the phone is turned on, and because the IP address is private, the phone cannot be accessed by a computer from the internet. In this mode, the phone must initiate contact with an internet server (i.e., www.In-Situ.com). This scenario requires that the phone open a connection to a data center that will accept the connection request.

This capability is supported by all network providers and is the most common and cost-effective method for moving data via IP.

This mode (like SMS) can be used to send/push real-time data to the data center. In-Situ does not support Win-Situ control of the TROLL in this mode.

Issues

Domestically, the only provider supporting dial-up is Verizon (CDMA) and T-Mobile (GSM). Coverage is limited.

Internationally, dial-up and SMS are the preferred choice for connecting and moving data over the mobile phone network. Coverage is extensive.

International Static IP plans tend to be very expensive.

Satellite Systems

There are numerous consumer data satellite systems in service today. Four of the most common services are GOES, Iridium, Orbcomm and Globalstar.

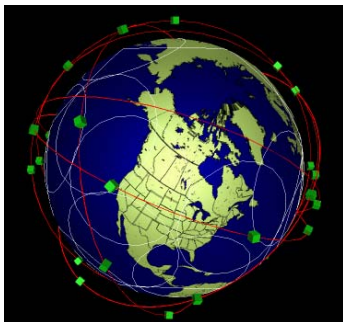
GOES - Geostationary Operational

Environmental Satellite is a key element in the U.S. National Weather Service. The GOES satellites are geostationary, meaning they orbit roughly above the same spot on the equator at extremely high altitudes (about 22000 miles). This system is commonly used by USGS systems to collect data from remote sites. It requires significant power to transmit from the ground to the satellite and in the higher North or South latitudes, the declination or angle to the satellite is so low that deployment becomes problematic and inconsistent.

Iridium - a constellation of 66 polar orbiting satellites. The name Iridium is from the element Iridium with an atomic number of 77. This was the original targeted number of operational satellites in the constellation. The system was originally designed as a world-wide phone service but met with bankruptcy in 1999. The system was purchased in 2001 and made operational again by a private investor group Iridium Satellite LLC.



Orbcomm - a constellation of 30 low earth orbit satellites (LEO). Orbcomm filed bankruptcy in 2000 but emerged as a public company in 2006. Orbcomm coverage is significantly less than Iridium because its orbit is lower and there are fewer satellites. This means that the latency or time between opportunities to transmit data to a visible satellite is much longer than Iridium.



Globalstar - a constellation of 40 low earth orbit satellites (LEO). Globalstar filed bankruptcy in 2002 and it emerged in 2004. Globalstar does not cover polar areas. This system's latency is better, but is still not as good as Iridium. The Globalstar system is failing due to engineering design errors on the satellites that make them susceptible to space radiation.

Issues

Satellite systems are only useful for sending real-time data values to a data center. These systems cannot be used for setting up or downloading logged data.

Satellite systems are generally more expensive and always require data center services.

Satellite systems are in many cases the only viable option for areas where there is little or no cell phone coverage. The Iridium system is effective in mountain canyons and other closed environments because the satellites pass overhead and allow data transmission to occur.

Geo-sync systems are typically unable to transmit from canyons or closed environments (except near the equator) due to the angle of declination to the equatorial plane.

In-Situ Telemetry Products

In-Situ has 4 telemetry products as follows:

TROLL Link 100 - a GSM/GPRS capable system allowing the customer to use the system in SMS, Dial-Up or IP Connect modes.

TROLL Link 101 - a GSM/GPRS system that is dedicated to using the GPRS push method to send data to the In-Situ Data Center (<http://www.isi-data.com>).

TROLL Link 102 - a **domestic only** Verizon based CDMA system that allows for the use of the Dial-up method.

TROLL Link 201 - an Iridium based telemetry solution that pushes data into the In-Situ Data Center (<http://www.isi-data.com>).