INTERNET PROTOCOL IP TELEMETRY & MESSAGE BASED TELEMETRY

Unidata's Neon Internet Protocol Telemetry Dataloggers and associated Neon Server Applications Software facilitate transport of data from the measuring instruments in the field to a central office. Telemetry systems have been used extensively for successfully transporting data from field measurement devices to central computer systems for many years. With the growth of coverage of internet and telecommunications networks, especially cellular and satellite networks, there are now more options available for telemetry.

PULL AND PUSH TELEMETRY – A SHORT HISTORY

In past years, data was recorded from field instruments with chart recorders and the charts were collected from the field and brought into the office for analysis. In the 1970's data loggers came into wide usage allowing the transfer of data either in the field or by taking the logger back to the office. Fixed phone lines and modems at the site allowed data transfer without a physical visit to the site. With this development, "pull telemetry" was born and soon expanded with the advent of mobile and satellite phones. However, the transaction still required modem and a connection to be initiated to transfer data.

With the arrival and expansion of the internet and TCP/IP data a new method was possible, whereby a shared packet networks (public and private) could be used to transfer data from the field to the office by sending the data in packets across shared TCP/IP networks.

With a packet network the sending end initiates the transfer; hence this type of telemetry is called push telemetry or connectionless telemetry, removing the need for a dedicated connection. Another method of push telemetry is cellular short messaging, but this is not a guaranteed delivery method, which is an important consideration for telemetry applications.

With TCP/IP each packet sent should receive an acknowledgement or the packet will be resent, ensuring data delivery.

With SMS type messages there is generally no such acknowledgement method built into the system and messages may be lost.

MOBILE / CELLULAR PHONE NETWORKS

Telecommunications providers continue to expand their cellular networks to provide more coverage, services and speed. Whilst mobile / cellular networks are an ideal fit for push telemetry, which only require slower speeds, there is one design aspect which is very relevant to telemetry applications.

Network growth is generally related to population growth, with most providers advertising coverage by percentage of population. However most of the population is in the large cities where infrastructure, shared across many users, makes expansion economically viable. Generally, telemetry is needed in remote, less populated areas where extra base stations are not economically viable. Hence while 90% of the population may be covered by such networks, perhaps only 50% of the country area is covered by the network.

Regardless of this, mobile / cellular phone networks will always offer the most economic method of communication where there is coverage.

LPWAN COMMUNICATIONS

There are several LPWAN technologies available, including technologies such as LoRa and Sigfox, but all of these services can be considered as low power, long range WiFi links and they are in the mix of services available, however their capacity is limited to a message only service. Unidata supports the most common LoRa technology for LPWAN applications

SATELLITE COMMUNICATIONS

Whilst there has been a rapid expansion of cellular / mobile networks, the global coverage of satellite communications still offer the most effective means of communications with remote sites outside of cellular coverage. There are two main types of satellite services, equatorial orbit satellites and low earth orbit satellites. The diagram, over page, shows in diagrammatic for such services.

Equatorial satellites orbit the earth at around 26,000km at the same speed as the earth rotates; and so are stationary with respect to the earth's surface. This means that they can act as a stationary radio repeater, receiving microwave signals from one point, amplifying and changing their frequency and re transmitting them back to earth, usually using focused antennas which point to the required area of coverage. Low earth orbit (LEO) satellites complete the orbit within an hour or two and cover a smaller area. They are "accessible" during the time when they are overhead, within

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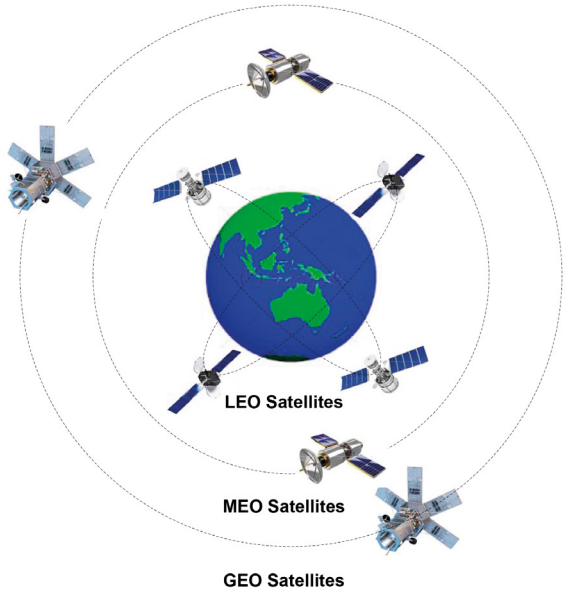
view of the user on the earth. LEO satellites are at a height of around 1000 km and there are generally 20 or more satellites in any LEO system. On average there will be at least one to 4 satellites in view at any one time.

For communications to occur one of these satellites needs to be acquired, communication established and the data transfer completed in 10 to 20 minutes while the satellite is in view.

Some systems can effectively transfer the call or data transfer to another satellite automatically as indicated in the diagram above right. As a general rule equatorial satellites require more power and are more expensive per call than a LEO satellite system. Also, as the equatorial satellite does not move in relation to a user on the earth, they are always available immediately. Unidata offer a range of products that allow data communication using cellular or satellite networks and these are detailed further in the Products section.

There are emerging new services based on microsatellites and these are low capacity services, hence they are message based services rather than full IP protocol services. The service levels are lower, however costs for bandwidth are also lower.

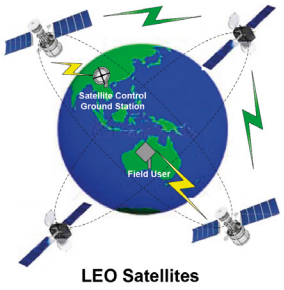


LEO Satellites – Low Earth Orbit 100 to 1,500 km
MEO Satellites – Medium Earth Orbit 5,000 to 10,000 km
GEO Satellites – Geostationary Orbit 36,000 km

THE NRL FULL PROTOCOL IMPLEMENTATION - INTERNET CONNECTION REQUIRED

The Internet provides the transport mechanism between the Neon Servers and the telecommunication provider gateways. This means that NRL units can be used anywhere in the world provided there is an internet connection available. The connection to the internet can be via a cell phone data service, a satellite service or a WiFi or Ethernet connection.

With the full protocol service the communications between the NRL and the Neon Server are closely coupled and each transmission is checked and acknowledged, such that a beak in communications does not result in lost data. Rather the NRL attempts to communicate with the Neon Server on a pre-set schedule and continues to log and store data and then re send if and when the communications link and or the Neon Server service is restored.



Also the remote NRL can be configured online, parameters can be adjusted and a new program (scheme) and updated firmware can be downloaded remotely from the Neon Server.

THE NRL MESSAGE BASED IMPLEMENTATION - LORA LPWAN & SATELLITE SERVICES

There are communications services available which provide a short message service, similar to an SMS text message service.

The NRL supports LoRa LPWAN, Iridium Short Burst Data service and also other emerging message based services. These services are in general terms message only services, where a message is sent from the NRL to the Neon Server without acknowledgement, without the ability to reconfigure NRL online and without the ability to download programs (schemes). These message based services are generally lower cost and they suit low data rate applications very well and are less expensive.