WIRELESS SOLUTIONS

White Paper:

"Why GPRS is ideal for telemetry"

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Introduction

In recent years there has been explosive growth in the telecommunication industry. Mobile phone technology has fundamentally changed the way people communicate with each other. The evolution from analog, to GSM, to GPRS has traditionally focused on the needs of business and the consumer. Product and service offerings include voice calls and data applications such as text messages, digital images, and email.

“Machine to Machine (M2M) communication” is a new application of mobile phone technology that exploits mobile data for the purpose of automating business processes. M2M enables the supervision of remote systems via the mobile phone network and the internet. M2M is similar to telemetry with key technical and business advantages.

M2M has progressed from monitoring remote equipment using SMS, to new opportunities using powerful GPRS mobile technology. This white paper aims to build the case that M2M is telemetry “plus” and GPRS is an ideal enhancement or replacement for many existing telemetry and machine reporting applications.

With the rollout of GPRS complete, many new M2M opportunities arise for applications that were previously infeasible due to high cost and the inflexibility of SMS and traditional telemetry methods.

What is GPRS?

Generalized Packet Radio Service (GPRS) is a 2.5G mobile technology. It is the next stage in the evolution of GSM and offers enhanced data features. GPRS is available world wide and has become a preferred method of data transfer for applications that move modest amounts of data often.

GPRS is a data service that enables users to access the internet wherever there is mobile coverage. Extensive coverage is provided throughout metropolitan and regional Australia by Telstra, Optus, and Vodaphone. GSM is also the dominant mobile standard worldwide.

What is telemetry and how much does it cost?

Telemetry is the traditional means of supervising remote equipment and automated systems using private radio networks, dedicated leased lines, and modems.

Organizations such as mining, utility, and manufacturing companies use telemetry to control assets such as pipelines, transmission systems, and industrial processes. These applications typically require control data to be

transmitted constantly, ranging from several times a second to updates every few minutes.

Installing a telemetry system based on a private radio network requires a radio frequency (RF) site survey, obtaining a RF license, possibly acquiring land for placement of radio towers, and specialist knowledge for installing and configuring the equipment.

Installing a single point-to-point telemetry link might cost anywhere between $3,000 and $30,000. After the initial investment has been made ongoing operating costs in the form of maintenance may be incurred.

Installing a telemetry system based on a leased line involves provisioning by a telecommunications carrier, and an ongoing monthly service charge. Depending on the service and the distance to the remote site monthly rental can be as much as $10,000 per year.

A substantial portion of the total cost of any telemetry system is the design and installation services required, often exceeding the capital equipment cost.

GSM is not the same as GPRS.

GSM is 2G (or 2nd generation) technology and GPRS is 2.5G technology. GSM is circuit switched and intended for carrying voice calls and short text messages (SMS), while GPRS is packet switched and optimized for transporting data. The advances from 2G to 2.5G are marked by the improved ways that data is handled and priced over the mobile phone network.

GSM is not optimized to send data and to do so requires a modem dialling another modem through the phone system. Bandwidth is limited to 9,600 bits/second. Alternatively small amounts of data can be sent using SMS although delivery guarantees, pricing, and a limit of 160 characters per message are restrictive.

In contrast GPRS is designed as a data service with a bandwidth of up to 38,400 bits/second available. GPRS modems transport data natively using the internet protocol (IP) so no modem is required at the head office. Rather data is directly exchanged over the internet with software running on the company server.

What are the pricing differences between GSM and GPRS?

GSM usage is charged based on a flag fall and the duration of the call and sending data regularly is expensive. Typical consumer pricing for GSM are flag falls of $0.27, airtime at $0.60 per minute, and SMS costs of $0.25. Corporate rates are usually significantly lower.

In contrast GPRS usage is charged based on the amount of data transferred each ***session***. A session is "the act of a GPRS device being connected to the mobile network". A session is established at no cost and remains active for up to 24 hours. This means that devices can be "always on" and instantly available to send or receive data. Typical consumer GPRS pricing is less than $1 per megabyte per month of data transported, with corporate rates being substantially lower.

Important advantages over GPRS pricing to GSM are:

- GPRS data is charged based on how much of it is sent rather than how often.
- GPRS devices can remain available on the network for long periods of time at no charge.

Why is GPRS ideal for telemetry?

GPRS provides a cost effective basis for telemetry and machine reporting applications because it leverages the infrastructure provided by the mobile service providers and the advantages of a true packet data service. Unlike standard telemetry no specialized radio knowledge and equipment is required, no site survey and RF licenses are needed, and installation and configuration are very straightforward.

The system architecture of GPRS telemetry is also flexible and scalable. As all remote stations report directly to a central control room or head office there is no need for establishing local base stations as required for standard radio based telemetry. Furthermore, with GPRS the added option of mobility is available – remote equipment can be relocated to anywhere with mobile coverage without the need for reconfiguration.

What does it cost to operate a GPRS telemetry system?

To compare GPRS to other telemetry methods a table of monthly usage charges has been calculated for a single device as a function of how often it is polled for data.

	Telemetry/Machine Reporting Update Frequency						
Technology	**10 sec**	**1 min**	**5 min**	**1 hour**	**4 hour**	**8 hour**	**24 hour**
PSTN	$50	$50	$50	$50	$50	$50	$50
GSM	Forget it!	Forget it!	$7,527	$636	$167	$88	$36
SMS	Forget it!	Forget it!	$2,170	$190	$55	$32	$17
GPRS	**$39**	**$20**	**$15**	**$15**	**$15**	**$15**	**$15**

*Note that these costs are estimated based on typical consumer charges at the time of writing and are indicative only. Corporate rates are significantly lower for all technologies.

Assumptions:

Data Size:	256 bytes (160 bytes for SMS)
PSTN plan:	$20/month (need 2 lines), $0.30 flag-fall, local call only
GSM plan:	$10/month, $0.27 flag-fall + $0.60 timed
SMS plan:	$10/month, $0.25/SMS
GPRS plan:	$10/month, + $5 for < 5 MB/month $10 for < 20MB/month, $29 for < 80 MB/month, excess $1/MB

When data is required from the field more than once a day GPRS is clearly the technology of choice. If long distance rates apply to PSTN connections or dedicated leased lines are used, GPRS becomes an even more attractive proposition. Comparing GPRS to private radio networks involves measuring the lower system cost and monthly carrier charges against the higher upfront cost of the private radio network and ongoing maintenance contracts.

How does a GPRS telemetry system work?

GPRS telemetry applications work differently to traditional telemetry or machine reporting systems. Unlike a regular dial-up or GSM modem, a GPRS modem does not dial a phone number. Instead, it establishes a direct internet connection using the GPRS network. In effect the GPRS network acts as an internet service provider (ISP).

The key component of a GPRS telemetry system is the software. In the field specialized software must be embedded in the application or the GPRS modem to establish the session and communicate using the internet protocol (IP) with software running on a server in the head office or control room.

The server software can either interpret the data from the field, or pass it to an existing control package for display and interpretation. In this way GPRS telemetry can interface with established control systems. The GPRS modem can remain always on and the server can send control or configuration data to the field at any time.

How secure is GPRS telemetry?

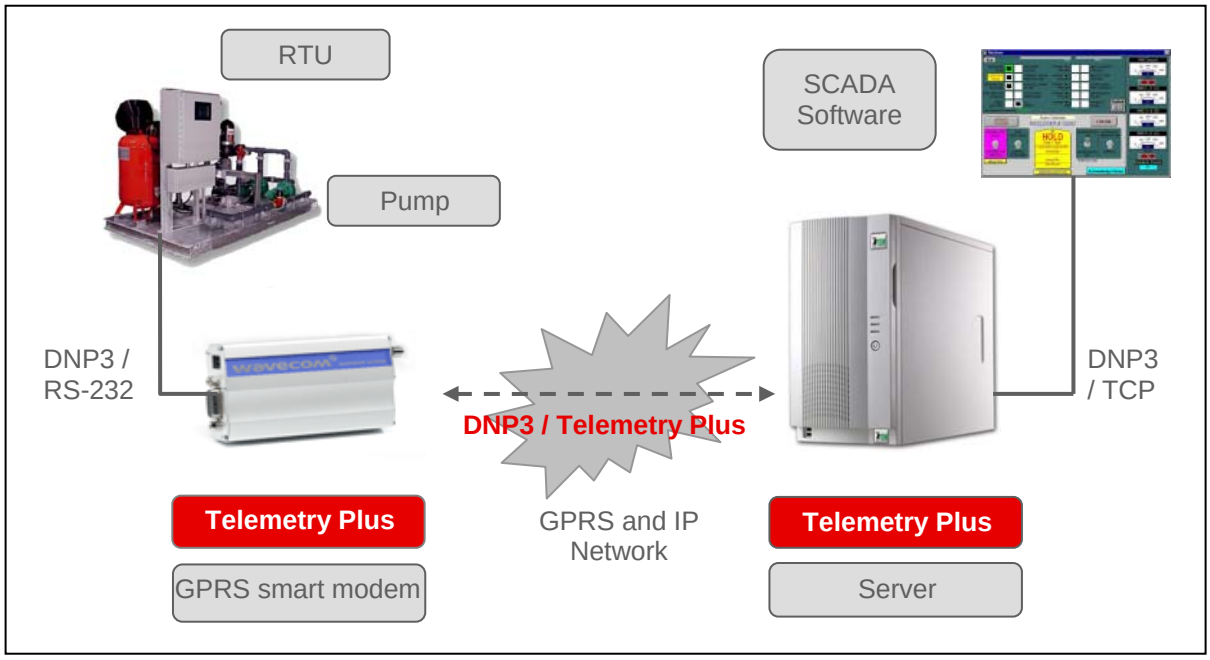
Users of telemetry are becoming increasingly concerned with ensuring adequate security for their systems. Most data sent over private radio telemetry systems at present is not protected.

In contrast, data sent over the mobile network using GPRS is encrypted as part of the standard. Users also have the option of purchasing a private IP network from the telecommunications carrier. In this architecture IP packets from a GPRS modem do not traverse the public internet and are instead delivered over dedicated infrastructure to the corporate facility. This can provide benefits in terms of an improved quality of service and network security.

Prudent GPRS users further enhance system security by utilising virtual private network (VPN) software. This allows sophisticated encryption algorithms to be used to ensure data is protected not just between the modem and the base station, but end-to-end, from the remote application to the control room server.

A GPRS telemetry example

In the figure below an example GPRS telemetry system is shown where a pump controlled by a remote terminal unit (RTU) in the field is supervised from a SCADA[1] system in the control room. The control protocol in this example is the widely used DNP3 protocol. The communication link between the RTU and the application software is provided by the *Telemetry Plus* product from Gnome Technologies.



Telemetry Plus is a distributed software platform that provides reliable, efficient, and secure data transport between the field and the control room over the GPRS and IP networks.

A GPRS smart modem with embedded software is used to establish and maintain communications with the server over a virtual private network (VPN) to provide system authentication, integrity, and security. A smart modem means that the RTU need not be GPRS aware and can simply send standard control protocols such as DNP3 to the modem over a serial connection. In some applications an RTU may not even by needed and the modem can interface directly to the remote equipment.

[1] SCADA: Supervisory Control And Data Acquisition

The *Telemetry Plus Server* software terminates the VPN in the control room and passes the data to third party software packages for interpretation and control. *Telemetry Plus Server* provides detailed statistics on GPRS traffic and allows system performance to be optimised to minimise carrier charges.

Conclusion

The advantages of using GPRS for telemetry are:

- No infrastructure to install – no radio towers or phone lines needed, no non-line of sight problems
- Scalable – easy to add new remote sites.
- System flexibility – easy to change system configuration from the office
- Mobility – operate anywhere there is mobile coverage
- Remote system availability – GPRS is always on
- No paperwork – no licenses to apply for, no RF site surveys, no land easements to negotiate
- Lower system design, equipment, and installation costs.
- Cost effective to run – low monthly data usage charges

For more information about using GPRS for telemetry applications contact Gnome Technologies.

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