inmarsat

The mobile satellite company™

Extending the reach of
communications on the grid

> Inmarsat satellite services for utilities

Introduction

Inmarsat satellite services connect Smart Grid applications by providing ubiquitous, two-way IP connectivity across a utility's entire service territory. This white paper presents the case for Inmarsat as a key component in the development and roll out of future communications networks by utilities. It focuses primarily on the automation of electricity distribution, where Smart Grid deployments are advancing rapidly, especially in the US. It also considers the role Inmarsat could play in other utilities, which share the need for reliable, secure and ubiquitous communications. Inmarsat services are currently deployed by electrical utilities as a secure and reliable solution for:

> Advanced metering infrastructure

> Distribution automation

> Substation connectivity

> Workforce mobility

> Disaster recovery

About Inmarsat

Inmarsat has been the world's leading provider of global mobile satellite voice and data services on land, at sea and in the air for more than 30 years. In addition to its many private-sector customers, it works extensively with the US government and other civil and military organizations around the world. Its reputation is founded on a long-standing record of 99.90 per cent overall satellite and network availability and robust performance in extreme conditions, including heavy precipitation and sub-zero temperatures.

In 2005, Inmarsat launched the world's most reliable global mobile commercial satellite communications network – the Inmarsat-4 (I-4) satellites as part of a $1.5 billion investment, enabling a new suite of voice and data services based on Internet Protocol (IP). The award-winning I-4 service, BGAN (Broadband Global Area Network), provides simultaneous voice and broadband data and has established itself across a range of sectors, including oil and gas, broadcast media and international aid agencies. BGAN is accessible via a range of highly portable, fixed and vehicular terminals, which are quick to set up and easy to use.

With its own secure global network, including points of presence in New York, Amsterdam and Hong Kong, Inmarsat is well placed to support the emerging communications requirements of the utilities sector. In addition to its existing broadband service, BGAN, Inmarsat has launched BGAN M2M, which provides a two-way IP data-only service for low-volume, high-frequency transmissions of the type needed to support regular automated data reporting from Smart Grid and SCADA applications.


BGAN terminal in a NEMA enclosure, mounted on a remote power pole to backhaul smart meter data collected through an adjacent concentrator and access point.

Flexible solutions for Smart Grid communications

Energy utilities around the world are developing 'smart' electricity grids that will facilitate greater control over energy consumption and costs. The US Department of Energy has stated that one of the "key technology areas of the Smart Grid is integrated two-way communications, which makes the Smart Grid a dynamic, interactive, real-time infrastructure." [1] A range of interoperable communications will be required to make this type of system viable, including fixed-line terrestrial links and wireless networks such as cellular and WiMax.

There is a compelling case for including Inmarsat services in this mix of essential communications for future Smart Grid deployments. The I-4 network is grounded in IP, which the National Institute for Standards and Technology (NIST) has already acknowledged will be an important Smart Grid standard[2]. Its flexible services are secure and reliable, meeting other key criteria for utilities.

The following Inmarsat network diagram and subsequent section explains how Inmarsat services can increase the operational efficiency and extend network reach across a utlitiy's entire service territory:
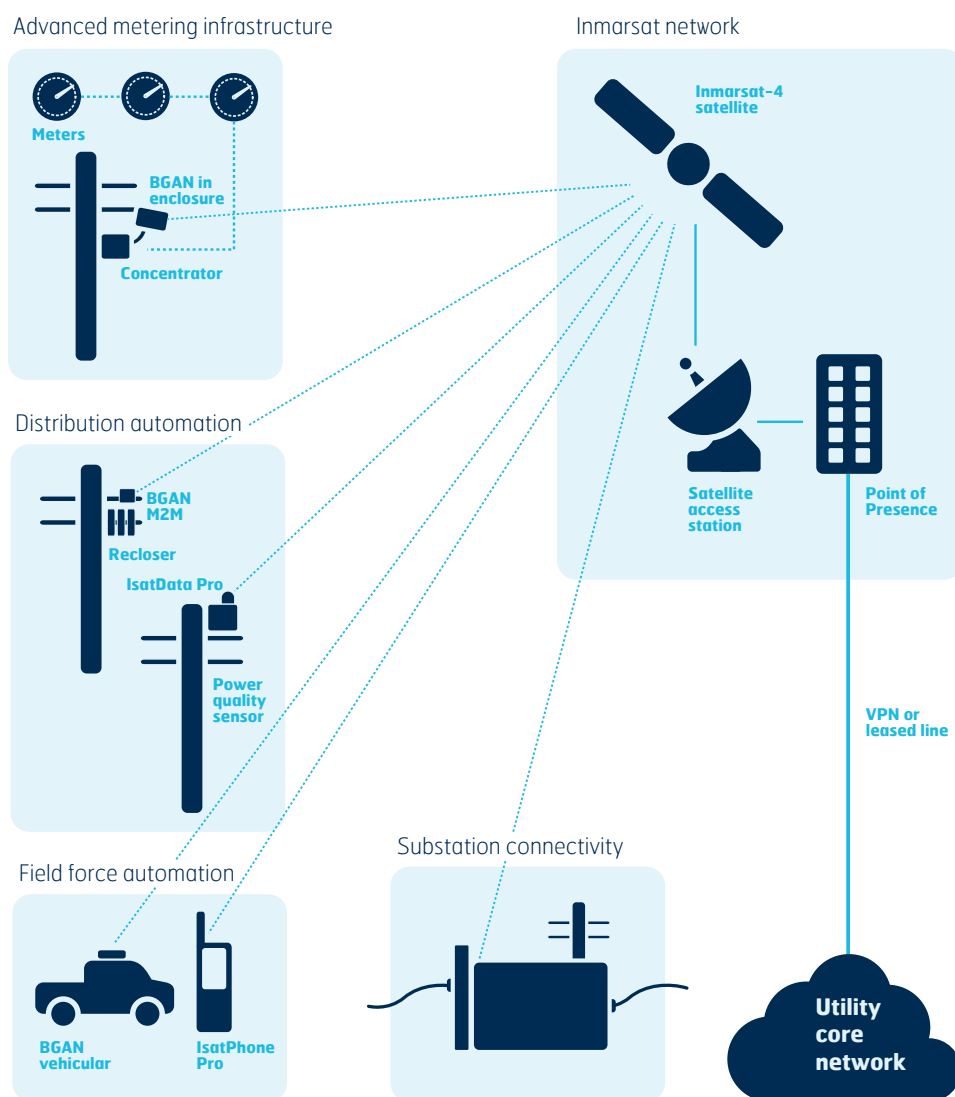
1 Smart Grid RFI, 75 Fed. Reg. at 26,207

2 NIST Interoperability Framework, Release 1.0, § 3.3.3 at 39 (Feb. 2010), available at http://www.nist.gov/public_affairs/releases/upload/smartgrid_interoperability_final.pdf.

Advanced metering infrastructure (AMI)

Smart Grids require 'smart meters' to help consumers manage their energy consumption and to provide utilities with visibility of demand. These devices are typically connected to an aggregation point through a local, meshed wireless network. These aggregation points, or 'concentrators', collect usage data from consumers in a limited geographical area, transmitting it back to the utility's data center, usually via a fixed link or cellular network. However, cellular networks are not always ideal for data backhaul for several reasons, including limited range, restricted bandwidth, a tendency to experience congestion, and is vulnerable to natural and other disasters. There are also many geographic areas where cellular and fixed line coverage does not reach, and maybe never will.

Inmarsat's BGAN service offers a high-quality, cost-effective alternative to backhaul usage data from AMI concentrators, allowing utilities to extend their network reach to their entire customer base. BGAN provides ubiquitous, global IP data and – as it is delivered via a secure and independent network, it does not traverse the Internet or other public networks so is not susceptible to public usage. And, as the service operates in L-band spectrum, the antenna has a high-degree of pointing tolerance that will help it retain a connection to the network even when its direction has shifted slightly due to wind or seismic activity. Privacy, scalability, flexible bandwidth, ease of deployment and reach are all significant benefits that Inmarsat provides as a comprehensive end-to-end AMI backhaul solution.

Inmarsat's satellite services offer a secure high-quality and affordable alternative to cellular and other terrestrial links for AMI backhaul. Inmarsat BGAN services are being used by a flagship US electric utility to achieve 100% AMI coverage, extending its network to areas that cannot be connected through existing terrestrial technologies. This solution uses a Hughes 9201-M2M BGAN terminal to connect an AMI collection point to the utility's data center via the Inmarsat satellite network. Each collection point is linked to multiple smart meters via a local radio network. Its advanced antenna design allows for easier installation to accommodate mounting on pole tops. The project is ongoing, but already the utility has plans to use BGAN at remote access points to connect up to 100,000 meters. The BGAN solution provides real-time, anytime access to meter data, while lowering the cost of collection in the previously unconnected areas.

Distribution automation

Electric utilities can deploy either BGAN or BGAN M2M services along power distribution lines, as a primary or secondary link to the utility's data center. A single, two-way IP data connection will provide automated monitoring and control of reclosers, switches, or other distribution devices – anywhere - enabling utilities to maintain continuous surveillance of their distribution network for voltage fluctuations, outages and service demands. The compact and rugged build of BGAN and BGAN M2M terminals, make them suitable for pole mounting at most locations. Inmarsat's global coverage and 99.90 per cent overall satellite and network availability ensures real-time visibility and remote control along distribution lines, extending your network reach to the boundaries of your entire service territory, improving decision-making and operational efficiencies.

Substation connectivity

In locations that are difficult or too expensive to reach with fixed-line or cellular communications, Inmarsat can provide connectivity for SCADA or SCADA-like applications at electricity substations, either alone or in combination with VSAT. BGAN offers a portfolio of guaranteed Streaming IP data rates from 32kbps to 384kbps, and up to 492kbps on its Standard IP (best effort) service, so it has the flexibility to cope with both low-volume/high-frequency traffic and bursts of high-volume/low-frequency traffic. BGAN could also be used to provide backup communications at any substation, which would automatically take over when the primary link fails.

Reliable communications for daily operations

Utilities have common operational requirements, including communications that support their service crews wherever they are working. The following sections consider two key areas in which Inmarsat can help utilities to operate more efficiently and ensure continuity of service to their customers.

Workforce mobility

To work efficiently, engineers and maintenance crews in the field need to maintain regular contact with headquarters to receive work instructions and technical information. Cellular networks often meet this requirement, but cannot be relied on in rural and remote areas. They may also be unsuitable for exchanging large data files because of limited bandwidth in some areas.

Inmarsat offers a comprehensive suite of secure satellite services for mobile workers in the utilities sector from handheld voice, through to mobile broadband data at up to 492kbps. The IsatPhone Pro is a lightweight satphone purpose-built for the Inmarsat global network. With a long battery life and rugged design, it will equip mobile workers with clear, reliable voice communications from any location. Other features include voicemail, Bluetooth, text and email messaging, as well as GPS location data look-up-and-send.

When broadband data is required in addition to voice, BGAN terminals are available from a range of manufacturers. The lightest portable BGAN terminal weighs less than 1kg, and all are easy to set up and use. The service provides voice and simultaneous IP data up to 492kbps, and supports all standard office applications including email, internet browsing, videoconferencing, file transfer and VPN access. Roof-mounted BGAN terminals are also available making BGAN a true 'comms-on-the-move' solution.

Disaster recovery

Business continuity is vital for utilities that provide essential services such as electricity, water and gas to millions of people as they need to be able to recover immediately from natural or manmade disasters. When a catastrophic event causes terrestrial networks to fail, utilities companies can rapidly deploy Inmarsat terminals to provide an alternative communications path, enabling them to maintain communications, diagnose issues quickly, and run critical applications. For example, as Inmarsat offers a fully secure, scalable, end-to-end communications network protecting Smart Grid data and resources, it could be used to direct operations for teams working to restore electric, water or gas supplies, completely independent of terrestrial or cellular technology.

Inmarsat is already a proven solution in disaster scenarios, and is used extensively by international aid agency Télécoms Sans Frontières, as well as the Federal Emergency Management Agency (FEMA) and the American Red Cross, as well as other worldwide aid organizations. BGAN terminals are rushed to locations affected by natural catastrophes because they provide immediate and dependable communications for coordinating disaster relief. They can be deployed within minutes, are intuitive to use, operate from batteries or external power sources, and deliver out-of-the box access to the internet and global telephone networks.

Conclusion

Satellite communications technology will play a critical role in Smart Grid efforts for the utilities sector. Companies like Inmarsat are delivering broadband data speeds and machine-to-machine connectivity using equipment small enough to be affixed to any utility pole, and stable enough to operate through virtually any environmental condition. The ubiquitous, always-on nature of satellite communications makes it the perfect option for utilities seeking to close the gap in terrestrial network coverage and subsequently achieve a significant increase in operational efficiency in Smart Grid applications and general communications across their entire service territory.

For more information, please contact **utilities@inmarsat.com**.

Inmarsat services

Inmarsat offers a suite of ubiquitous satellite broadband, machine-to-machine and voice services to meet a utility's varied communications requirements and complements their existing communications services.

Application requirements	Smart metering	Recloser control	Fault detection & response	Workforce mobility
Transport Protocol	TCP/IP	TCP/IP or DNP-3	DNP-3 or Modbus or serial	TCP/IP
Bandwidth/ Payload [1]	Medium	High	Low to Medium	High
Latency [2]	Medium	Tight	Medium to Tight	Medium
Reliability [3]	Medium	High	High	High
Security [4]	Medium	High	High	Medium
Power	Mains	Solar or battery	Solar or battery	Engine or battery
Devices per satellite terminal	250	1	1	1
Typical daily transactions per satellite terminal	8	24	24	1
Typical transaction size (KBs)	312.50	1.74	0.08	166.67
Typical monthly data per satellite terminal (KBs)	75,000	15,000	58	5,000
Inmarsat Service*	BGAN	BGAN M2M	IsatData Pro	BGAN vehicular

Key

1 Bandwidth:
Low < than 10kbps
Medium 10 - 100kbps
High >100kbps

2 Latency:
Loose Can tolerate high latency in absolute terms and high variability in the latency
Medium Has some relative limits to the absolute amount and/or the variability of end-to-end latency
Tight Strict requirements for the absolute amount and/or the variability of the end-to-end latency

3 Reliability:
Low No significant operational harm would result if connectivity were lost for a significant (minutes to a few hours) amount of time

Medium Operations would be impacted, but unlikely to result in loss of service or similar impact if connectivity were lost for a significant (minutes to a few hours) amount of time
High Significant harm might occur if connectivity were lost for a significant period of time

4 Security:
Low No significant operational harm would result if link were intentionally compromised
Medium Significant but limited harm would result if link were intentionally compromised
High Highly visible and widespread harm could result if link were intentionally compromised

* Suggested service only as actual data volume and consumption may vary depending on location and configuration of application

BGAN

Inmarsat Broadband Global Area Network (BGAN) service offers simultaneous voice and IP data up to 492kbps.

The service is accessed via a range of portable, fixed and vehicular terminals making BGAN ideal for utilities requiring a broadband link for:

> Transmitting bursts of high volumes of data in a fixed environment

> Workforce in-the-field who require immediate, real-time access to information while on-the-move with the vehicular terminals, or via the highly portable plug and play BGAN terminals.

BGAN M2M

Provides ubiquitous two-way IP data connectivity for low volume, high frequency bursts of data and supports SCADA applications.

IsatData Pro

IsatData Pro provides a global, low data rate service, providing a two-way packet data service for machine-to-machine communications, for both fixed and mobile assets.

IsatPhone Pro

A global satellite phone, purpose-built for the Inmarsat-4 network offering clear voice telephony, voicemail, SMS and short email messaging for remote communications.

How to buy

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