



Demise of a Serial Story: TCP/IP Based Multi-Medium Telemetry Communications

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Abstract

Transco has a communications network based on analogue leased lines and UHF radio to collect data from remote sites across the UK and to allow remote control of plant on these sites from a central location. The network is costly to operate and involves considerable maintenance and support due to the wide range of equipment in use.

Logica, Gilat and Transco are working together to develop a new communications network that is cheaper to operate and requires less maintenance and support. The new network must also be more flexible in order to meet changing business requirements.

The new network will provide flexible TCP/IP communications across a wide range of communications media with satellite at its core together with UHF radio, PSTN, ISDN and digital leased line.

Transco

Transco is a major utility organisation based in the UK responsible for the distribution of natural gas through 275,000km of pipelines. The pipelines supplies 48% of Britain's energy needs and serves 20 million commercial, industrial and domestic customers.

Logica

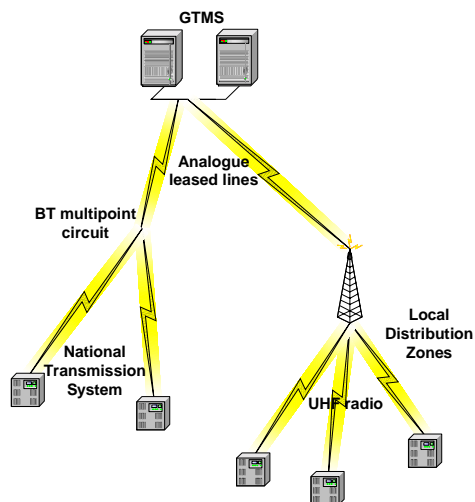
Logica is a leading global solutions company providing management and IT consultancy, systems integration, products, services and support. Logica's clients operate across diverse markets including telecoms, financial services, energy and utilities, industry, distribution and transport and the public

sector. Founded in 1969, the company now employs over 11,000 staff in 34 countries around the world.

Gilat Europe GmbH

Gilat Europe is a leading provider of fully managed high-speed data and multimedia networks and a world leader in the development of Very Small Aperture Terminals (VSAT) satellite equipment. Gilat Europe brings global reach and a depth of resources and expertise to its customers.

GTMS – Gas Transmission Management System



The GTMS architecture.

Much of the equipment that comprises GTMS has been retained from the days of British Gas who worked as 12 separate regions. The key elements are:

- over 1,800 RTU for collecting data on sites
- Front End Processors to collect data from outstations and present to central computers

GTMS communications are based on analogue leased line (including multipoint circuits) and UHF radio. Regional and central systems communicate with sites either directly via multipoint leased line connections or indirectly via UHF radio hilltops.

The existing equipment used varies depending upon the region. As a result, Transco currently have to maintain communications with 14 different types of RTU each using its own

communications protocol.

Changing Times

The multi-point analogue leased line circuits that form the core of GTMS communications are now obsolete. In addition, they are costly to operate.

Maintenance costs are escalating because of the proliferation of RTU and protocol standards. Much of the equipment is reaching the end of its useful life and needs to be replaced. Remote management of the equipment is limited and in most cases non-existent.

Although the system currently achieves all that Transco need to achieve to operate a safe and effective gas distribution business, there is little or no room for growth or enhancement. In particular, communication rates of 1,200 baud limit the data that can be transmitted over the existing links. New equipment must therefore communicate over new links thus increasing communications costs.

Interfacing of new and old equipment is costly or in some cases not possible due to the limitations of the old equipment.

Transco recognised these issues and decided to institute a programme to design a replacement communications system that would allow operations as at present whilst providing the capabilities required for future expansion.

Ulysses

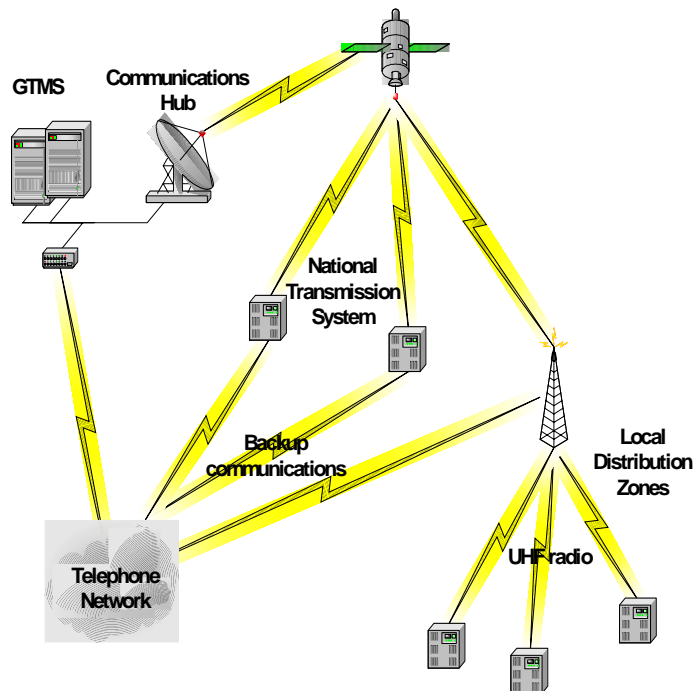
Ulysses is Transco's programme for the replacement of GTMS and related business systems. It consists of a number of phases from infrastructure replacement to system development.

The infrastructure replacement phase replaces the RTU and communications equipment. The key requirements are:

- A single RTU solution to reduce maintenance costs
- Enhanced capabilities in the RTU to increase local automation and equipment interfacing.
- Low cost, reliable and flexible communications.
- TCP/IP everywhere to improve system management and increase system flexibility

Logica is the prime contractor for the infrastructure replacement phase. Along with Gilat and over 40 other sub-contractors, Logica is responsible for the design and realisation of the new RTU and communications infrastructure.

Ulysses uses satellite communications at its core. Transco was attracted to satellite as a communications medium because of its low operational expenditure requirements.



The Ulysses architecture.

The infrastructure replacement phase of the Ulysses programme is extremely challenging and involves:

- Supply of equipment for all RTU sites and radio hilltops

- Installation of 70% of RTU sites and all radio hilltops
- Development of a bespoke serial-IP interface to enable smooth network migration
- Development of new interfaces and features for Ulysses

Key components

In addition to the RTU software provided by Logica and the satellite equipment provided by Gilat, the Ulysses communications infrastructure is based on commercial off-the-shelf equipment provided by world-renowned suppliers in their fields:

- *Microwave Data Systems radios* – The Master radio operates in dual redundant mode to increase availability. The radios support SLIP communications at 9,600 baud. The Master radio supports dynamic IP routing using RIP1.
- *Cisco routers* – At the communications hub and at remote RTU and hilltop sites to facilitate the IP routing required for satellite and backup communications.
- *Arcom embedded PCs* – The RTU hardware on which Logica's software runs.
- *Elcon/Pepperl+Fuchs Intrinsic Safety barriers* – Connected to the Arcom embedded PC using Profibus to facilitate connection to all plant and instrumentation.
- *Bulgin power supplies* – Provides power and battery charging capabilities at RTU and hilltop sites.

- *Yuasa batteries* –Transco have found batteries to be the most reliable power backup method.

Main communications hub



The Ulysses communications hub.

Gilat's Skystar Advantage VSAT network offers advanced features that ensure maximum performance:

- Concurrent protocol support
- Multicast service
- Integrated voice/fax capabilities
- Efficient space segment utilization
- Superior reliability
- Rapid deployment
- Low power consumption

The Skystar Advantage network consists of a hub, satellite channel and remote VSATs. The hub consists of an RF terminal (RFT) and baseband equipment. The baseband includes a Hub Satellite Processor (HSP) to control the satellite transmission, a Hub Protocol Processor (HPP) to interface with the customer's data equipment, an optional Hub Voice Processor (HVP)

for voice interfaces, and an optional video encoder.

An advanced, user-friendly Network Management System (NMS) provides centralized monitoring and control, statistics, alarms and events, network configuration and report generation.

Remote installations

There are several generic types of remote installation each with different requirements and equipment. In general though each remote installation provides:

- Continuous monitoring of plant using IS and NonIS barriers via Profibus.
- Local control using IEC1131 applications
- TCP/IP communications through UHF radio or ethernet communications to satellite

Data is collected by the Front End Processors (FEPs) for presentation to the central computers typically once a minute. Equipment is managed and reconfigured remotely from the main communications hub or from any suitable point in the network.



A remote installation.

On some sites, the RTU is connected to other equipment such as Programmable Logic Controllers (PLCs) or Flow Computers so that data from these devices can be transported over the same communications channels.

A remote VSAT terminal consists of a small (0.96m) outdoor antenna, an Outdoor Unit (ODU) and an Indoor Unit (IDU).



Remote VSAT equipment.

Main benefits of Ulysses

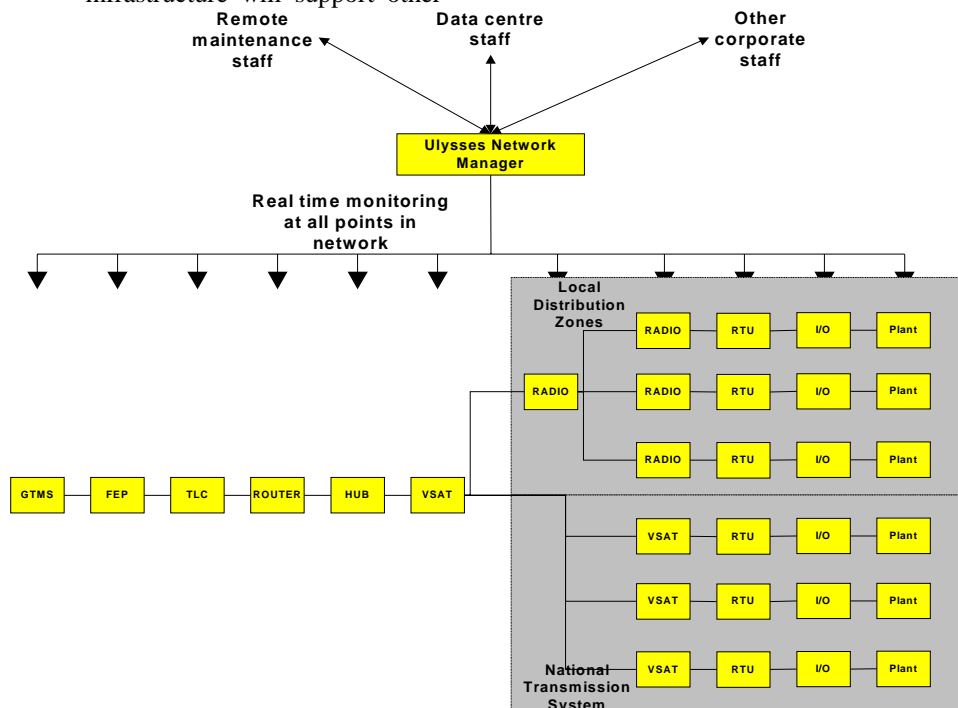
The introduction of the new Ulysses communications infrastructure and RTU equipment will provide Transco with significant benefits:

- Standardisation of equipment will reduce maintenance costs and the proliferation of spares
- TCP/IP communications everywhere will increase flexibility and readily allow the reconfiguration and modification of the system to meet new requirements
- Enhanced network management to improve the time to locate faults in the system
- The use of satellite technology will significantly reduce communications charges
- The new communications infrastructure will support other

services should these require communications

Ulysses network management

One of the benefits of Ulysses will be a greatly enhanced network management capability. Currently, Transco staff are limited to status information on equipment at the data centres. When a fault occurs, it is difficult to pin-point where in the network it might be: it could be the instrument or plant, the RTU, the radio or the leased line. The introduction of Ulysses will help to improve Transco's first visit fault repaired statistics.



The Ulysses network manager.

The Ulysses TCP/IP network brings with it a status monitoring capability

allowing Transco staff to probe the equipment at each key stage. Now when a fault occurs, staff at the data centre, on

the company network or working remotely can quickly locate the cause of the fault to a particular unit and then set out to repair that particular fault taking the appropriate spares.

The future of Ulysses

Transco are already working on other phases of Ulysses to gain further benefits. Work includes:

- Development of new advanced computer systems to collect data from RTUs
- New business applications to utilise the data collected
- New on-site processing facilities

In addition, Transco's communications hub gives them an almost unique ability to offer cost effective satellite services to other UK users. Transco, Gilat and Logica are currently developing these services.

Further information

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