

# Leased Line Replacement

## Introduction

Recent innovation by the telecoms providers, mean that the core or back haul networks will be replaced with a network of interconnected routers. This update program is often called the 21CN project. In effect all the various systems currently used by the telecoms providers and all the different telecoms services will be amalgamated into one IP based network.

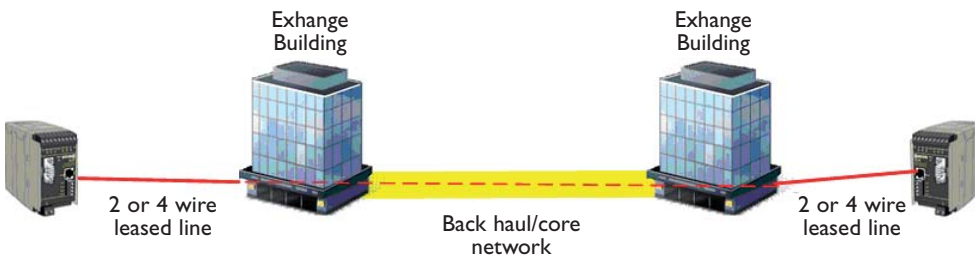
The move from the traditional telecoms core networks to a system totally based on IP is acting as a catalyst for change across the whole of the industry and the types of services that will be provided in the future. The traditional analogue leased line services do not fit well into the new infrastructure and use up a lot of resources that, from the telecoms providers point of view, could be better employed. From the corporate customers view there is an economic case for changing the way that "point to point" or "point to multipoint communications" are approached. The traditional analogue leased lines are costly to maintain and rent from the telecom providers. The alternative ADSL, 3G, GPRS services are more cost effective and offer higher bandwidths. There is also a case for future proofing any new installation, by installing an IP based solution from the outset, even though the devices on site may be based on legacy RS-232 or RS-485 serial communications.

The net effect of the upgrading of the back haul networks will be a drive by the telecoms providers to move customers from traditional leased line services such as EPS-8, 21, 22, 23 and multidrop leased lines EPS -42 and EPS-45, towards alternative solutions. This white paper will attempt to list the viable alternatives and suggest the most cost effective and flexible way forward.

## Traditional Leased Line

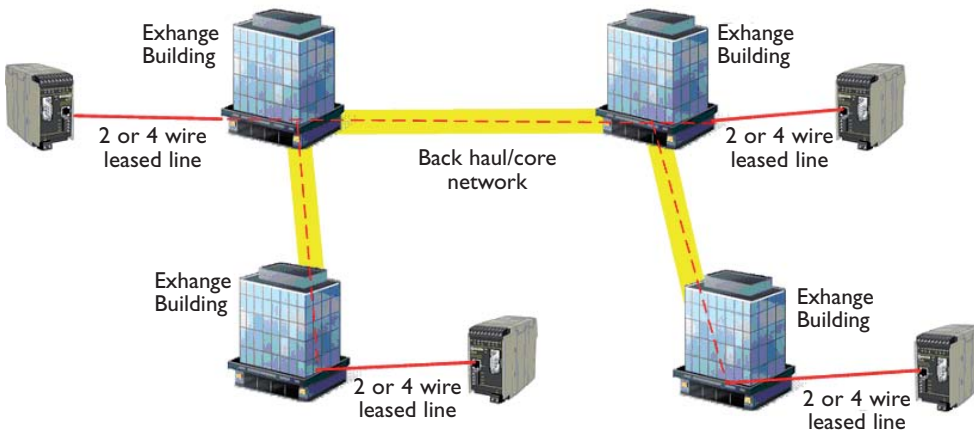
The leased line or point-to-point service from the telecoms providers, effectively provides a dedicated connection between two sites. The circuit can be presented as either a 2 or a 4 wire presentation. The presentation is largely irrelevant to most line modulation standards as they will operate in full duplex on a single pair. The exception being V.23 1200/1200 where it is necessary to split the transmitter and receiver onto two separate pairs of wires, to achieve full duplex communications.

## Point-to-point leased line



The multidrop or point-to-multipoint leased lines EPS-42 & EPS-45 effectively provides a point-to-multipoint connection or a master slave arrangement. Data sent from the master site is passed over the BT infrastructure to a number of end destinations or slave sites the returning messages would in turn send a message back to the master.

## Multidrop leased line



## Alternative Connection Technologies

The available replacements broadly break down into two basic categories conventional voice band technology and IP based (ADSL/3G/GPRS) technologies.

### Voice band replacement technologies;

Featureline Corporate

### IP based technologies;

ADSL 2 & 2+

3G/HSDPA

GPRS

There are a number of future enhancements on the near horizon such as SHDSL, VDSL, LTE, HSUPA but these technologies all use IP as the core or addressing protocol so the techniques described for IP based technologies can be applied to these future enhancements.

### Analogue based Replacement Technologies.

If the requirement is only to replace a serial connection to a legacy device such as an older style RTU, IED, PLC or Outstation with no Ethernet IP connectivity then the following analogue services could be considered. If there are future requirements for IP connectivity due to an asset replacement program then jump to the next section "IP solutions"

#### BT Featureline

Featureline Corporate, groups together a number of telephone numbers into a user group, much the same as the extension on a telephone exchange. The fixed annual rental will allow any number of calls to be made at no extra cost as long as the destination of the call is within the user group. Using a Westermo TD-36, TR-36 or TD-36-485, a permanent connection between two telephone numbers within a user group can be established. This is possible due to the functionality built into the Featureline service and the flexibility of the Westermo modems to automatically detect and re-establish a dropped connection due to interruption of service such as an automatic line test. The TD-36 and TR 36 modems also support a quick connect mode which will allow the modems to re-negotiate a connection in 8 seconds, once a break in service has been detected and a new call initiated and answered. In principle this solution is cost effective and easy to implement, however there is still something of a grey area regarding BT's fair use policy on Featureline service.

#### Point-to-multipoint replacement

BT in the past has provided a point-to-multipoint leased line arrangement. There have been many names for this service but currently the most commonly known is the EPS-42 circuit. The telecoms providers are actively moving away from providing this type of leased line arrangements. There is currently no direct analogue replacement technology. The effective replacement is an IP based solution.

## IP Based Replacement Solutions

On the surface it would seem that it would not be possible to replace a slow serial/analogue based system with one based on the latest IP technology. This is not the case. There are a few rules to follow but essentially serial devices can easily be migrated onto an IP based solution without the need to change software at the remote device or the central SCADA, DCS or control system. This is an area where Westermo is a specialist in managing the transition from legacy to IP based solutions.

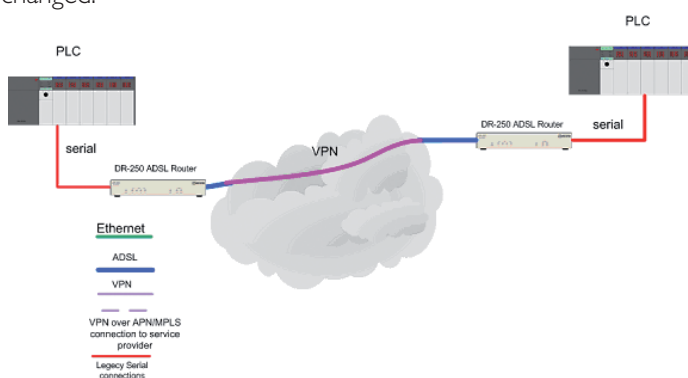
The direct wired replacement service for Leased Lines would be an ADSL or broadband “Wires Only” connection. The reference to “Wires Only” refers to the ADSL provision which should not include a router from the service provider. The routers provided are often not up to industrial application, requiring mains power or use unreliable blister pack power supplies. They are rarely able to cope with extremes or are able to dissipate enough heat in a confined space, such as unventilated control panel or instrument rack.

It is possible when moving to an IP based solution to do away with the need for copper pairs and move to a 3G or GPRS based solutions or even a hybrid of the two. A description of this can be found later in this document.

The main issue when looking at an IP router based solution is how to interface between the legacy serial protocols and IP. The legacy devices will still need a 25 or 9 way serial connection to interface to the IP network. The Westermo DR-250 ADSL2+ and the MR series routers are equipped with a 25 way serial port. This port can be used to connect directly to the RTU, IED, Outstation etc. The way that the serial port is interfaced to the IP network is outside the scope of this document. A future white paper will cover this issue in greater depth.

The next issue is how to create what will essentially be a secure virtual leased line running over the internet or MPLS network. A MPLS network can be viewed as being a private internet segment that only a limited number of nodes can access. The most secure way to create a connection between two ADSL nodes is to create a VPN (Virtual Private Network). The VPN is in effect the point to point connection between two LAN's. Once a VPN link has been established between the two LAN segments IP packets can pass from one LAN to the other.

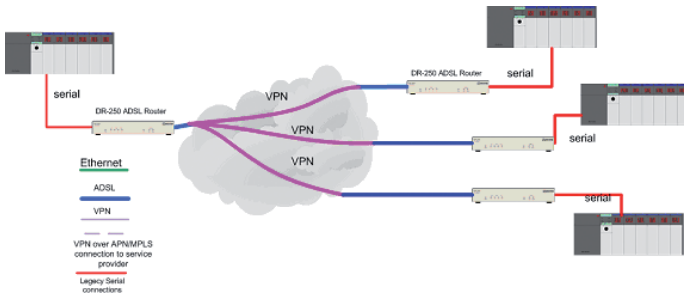
Now that a virtual leased line exists between the sites The serial port on one router can be configured to connect directly to the serial port on the remote router. This is often termed a TCP/IP socket connection or RAW TELNET. Once a connection has been established then serial data received on the local serial port is sent directly to the serial port on the remote router. The devices connected to the serial port are completely unaware that the media between the devices is now an IP based WAN (Wide Area Network) or even that the media has been changed.



There is an additional benefit of changing to an ADSL circuit which is increased bandwidth. The old leased line circuits ran at a maximum line speed of 33600 bps. An ADSL 2+ circuit can operate at speeds of 8Mbit down stream and 1Mbit upstream. This additional bandwidth can be used for other services or IP devices. Where assets are being replaced over a period of time the older Legacy serial equipment can be run in tandem with its Ethernet IP based replacement.

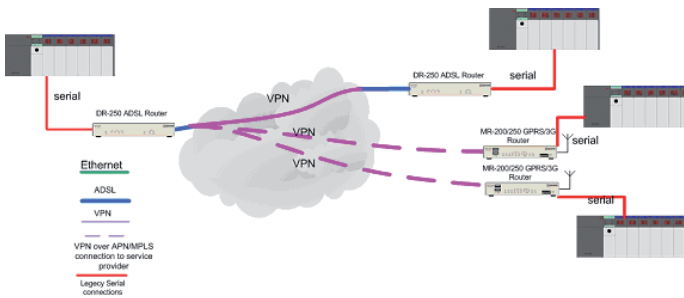
## Point-to-multipoint IP solutions

The IP based solution for Point-to-multipoint leased lines is really an extension of the point to point replacement described above. The main difference is that the master router will terminate a number of VPN's. The Westermo DR and MR series of router have a unique method of mapping multiple remote serial connections to a single serial port on the master router. In a typical Point to multi point replacement system a packet of serial data received on the master router RS-232 port will be relayed to the serial ports on the slave routers. Any response messages from the salve routers will only be seen by the master router:



## Hybrid IP solutions

Once a move has been made towards an IP based solution it is only a short step to being able to integrate any media that can support IP. For example it is entirely feasible to move to a hybrid solution using ADSL, GPRS and 3G all in the same system. This is often a cost effective way of increasing the reach and response of a telemetry system. Installations or site that are too costly or cannot be easily accessed using copper connection, could be reached by GPRS or 3G.



## Conclusion

The upgrading of the telecoms systems around the world is acting as a catalyst for change. There are a number of options in the voice band or analogue traditional networks, but there is a far greater choice of flexibility and opportunity for cost reduction in the IP environment. Once the first steps have been taken towards an IP based telemetry or control network it is a short step to re-evaluation the approach to all the other diverse communications medias and look towards a hybrid system. Far from the need to reduce the number of devices or control system being scanned in real time, the IP based solution give the end users an opportunity to increase the number of real time access nodes and still have the scope to reduce costs.

Westermo is a specialist in the area industrial data communication specifically in the area of serial communication over analogue circuits or migrating legacy serial to IP based Wide area networks.

For more information visit [www.westermo.co.uk](http://www.westermo.co.uk)

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