

Router Interconnection and Leased Line Provisioning

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Solutions for interconnecting Routers and Other Multiplexing / Networking products over Leased lines with last mile access using Copper or Optical Fiber circuits

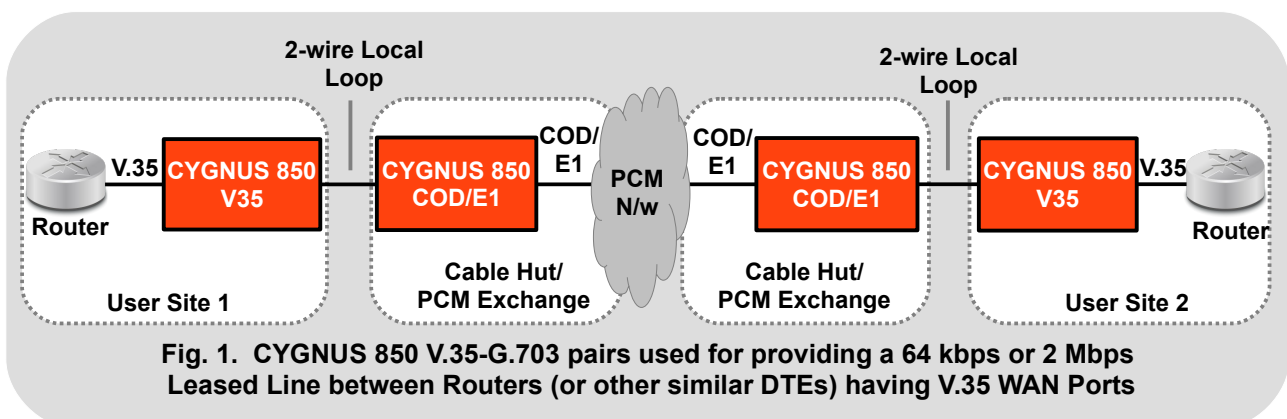
A. Interconnecting Routers with 64kbps/2Mbps leased line and Copper Circuits in last mile.

Large and medium organizations such as Railways, banks, etc., have online applications that are geographically distributed. Indian Railways applications such as Passenger Reservation System (PRS), Unreserved Ticketing System (UTS), Freight Operations Information System (FOIS) use leased lines to interconnect routers, data multiplexers etc. The leased lines could be from Railtel, or from BSNL or other private service providers. In either case the service provider's trunk network terminates not at the user site, but at the cable hut (for Railtel) or at the telephone exchange (for BSNL/other service providers). Leased line modems are typically used to extend connectivity from there to the user equipment over existing telephone copper wiring. Leased line speed could be 64 kbps or 2 Mbps.

64 kbps modems, 2 Mbps modems and LAN extenders have traditionally been seen as separate products, both by users and manufacturers. Cygnus however realised that all three products require a copper pair to be driven, and differ only in their user interfaces. It took the innovative approach of designing a single box that uses G.SHDSL (a standard line driving technology) to drive the copper pair, but has changeable modules on its DTE (i.e., user-side) interface. Various DTE modules have been designed, allowing the box to be used as a 64 kbps modem, 2 Mbps modem or LAN Extender. This approach has following benefits:

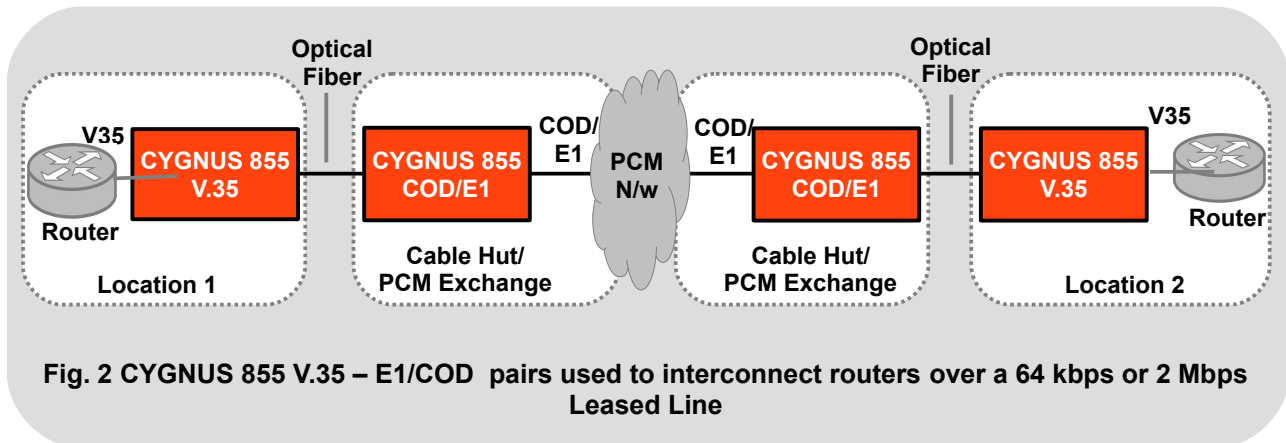
- There is no need to buy new modems when moving from a 64 kbps line to a 2 Mbps line (or vice-versa). The old modems can still be used simply by changing the DTE interface module. This protects investments already made in the modems.
- Models with different DTE interfaces can inter-work, allowing innovative, new solutions.
- 64 kbps modems, 2 Mbps modems and LAN Extenders can all be procured as a single inventory item. Staff training, spares planning and maintenance logistics are also simplified.
- G.SHDSL's feature of higher range at lower speeds, is available on all products. Driving range on 0.5 mm diameter copper pair can vary from about 6 km at 2 Mbps to more than 10 km at 64 kbps.

Fig. 1 shows a typical application of CYGNUS 850 modems used for connecting routers at different locations over a leased line. The modem interfaced to the service provider's network can have either 64 kbps co-directional G.703 or 2 Mbps G.703 (E1) interface. The modem at user premises has a V.35 interface configured for 64 kbps or 2 Mbps, as required.



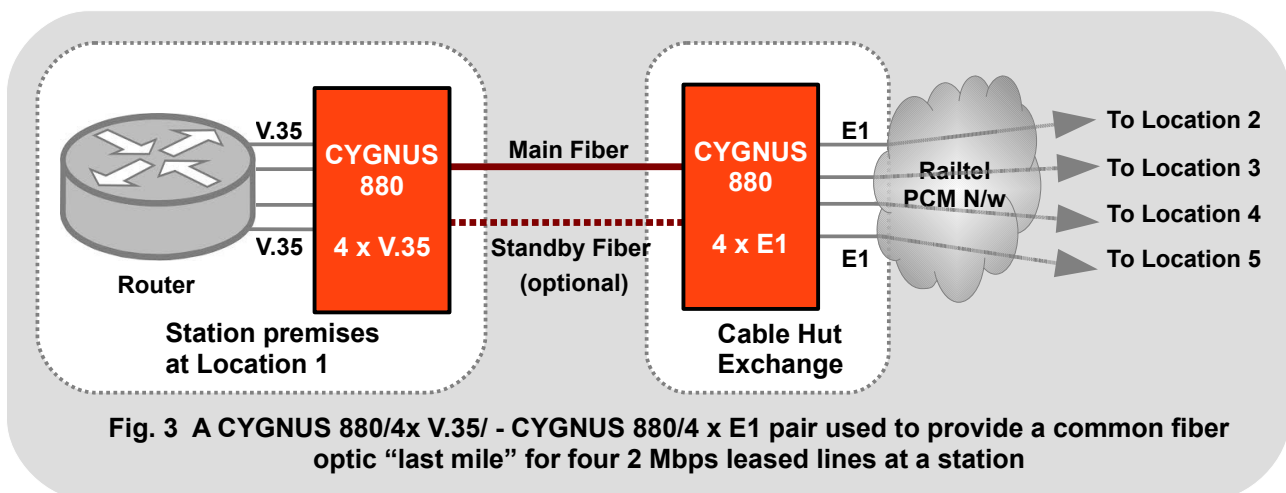
B. Interconnecting Routers with 64kbps/2Mbps leased line and Optical Fiber in the last mile.

Optical Fiber has several advantages over copper in data communications applications, such as higher range, high data throughput, immunity against electrical interference, etc. CYGNUS 855 entry level Fiber Optic Modem provides standard modem-like functions to user devices over optical fiber media. It can carry a user data channel across optical fiber, much like traditional DSL leased line modems do on copper media. CYGNUS 855 can be ordered with V.35, E1, 64K codirectional G.703 (COD) and other DTE interfaces. Fig. 2 shows a pair of CYGNUS 855 units providing “last mile” connectivity for a wide-area leased line. The modem pair is used for extending the V.35 WAN port of a Router at station premises to E1 or 64k COD port of a TDM/PCM network at the exchange or cable hut. A range of 15 km can be achieved using single mode fiber with the CYGNUS 855 Fiber Optic Modem.



The large bandwidth of optical fiber is effectively exploited by Cygnus 880 Multiport Fiber Optic Modem, which provides multiple independent channels for simultaneously transporting data from several user devices over the same fiber. It can optionally be ordered with a hot standby fiber link. It is configured via DIP switches and through commands (including diagnostic commands) given from a console port. Facility for centralised monitoring using SNMP and Telnet is also available as an option.

Fig. 3 shows a pair of CYGNUS 880 units used for carrying four E1 channels to user premises from a service provider’s network termination point (such as a Railtel cable hut) as part of PRI (Primary Rate Interface) circuits.

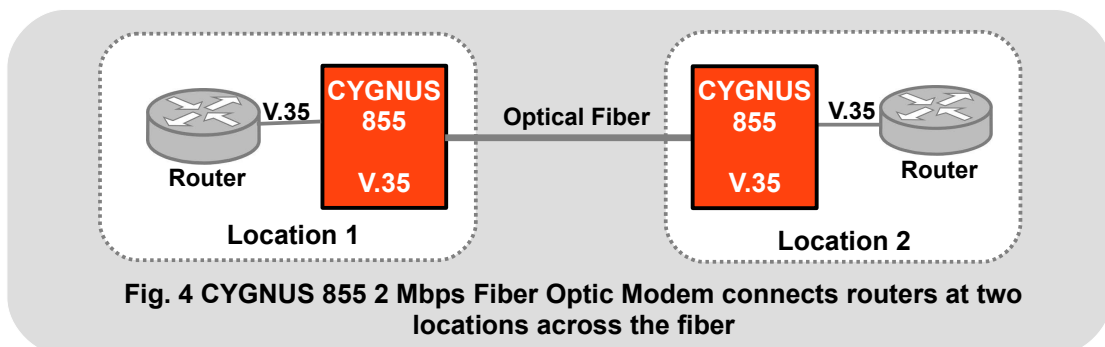


For user devices the CYGNUS 880 offers two types of facilities:

- It can provide multiple (up to four - depending on the ordered configuration) “data channels” for transport of data between a pair of locations. Data enters one CYGNUS 880 unit on a particular DTE port, and is delivered at the other end on the corresponding data port of the CYGNUS 880 unit there. DTE interface on data channels can be V.35, 64 kbps COD, E1, RS232, Current Loop or Ethernet. The maximum throughput on a data channel depends on the DTE interface type - V.35 and E1 interfaces top out at 2 Mbps. For user devices connected to “data channels” the CYGNUS 880 pair not only offers bit transport between the two locations but can also provide interface conversion - e.g., data entering through a one unit through its V.35 interface can be delivered by the other unit through an E1 interface (this is the typical “last mile” of a leased line)
- In addition to “data channels” the CYGNUS 880 pair can also be ordered with a separate, simultaneous Ethernet “bridging channel” across the optical fiber. Depending on the ordered configuration the throughput on the “bridging channel” can be either 12.5 Mbps or 40 Mbps. A 4-port Ethernet Switch is provided as the user interface on the bridging channel

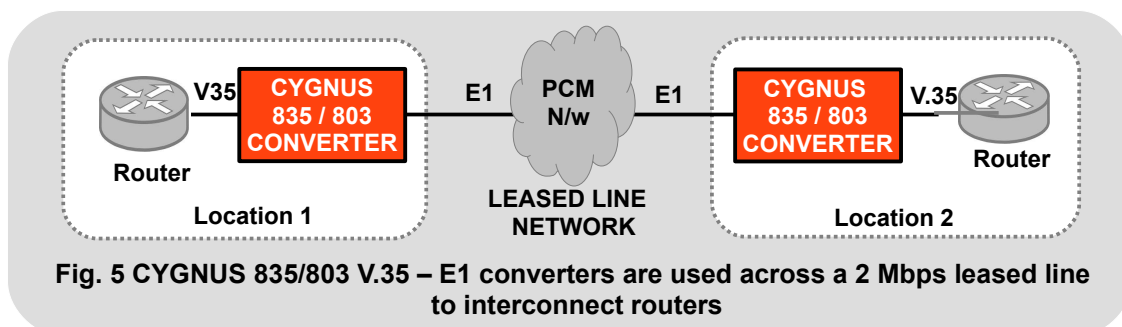
C. Interconnecting Routers on Optical Fiber

Due to the large range of optical fibers it is possible to consider using it for direct interconnection of router located some distance apart. CYGNUS 880 or CYGNUS 855 fiber optic modems can be used to interconnect routers directly over Optical Fiber using their V.35 WAN ports, for distances extending to 15 km or more. Fig. 4 shows the setup using CYGNUS 855 modems. A similar connection can be made using CYGNUS 880 multiport Fiber Optic Modem and upto four 2 Mbps links can be created between the routers over the single Fiber Optic Link.



D. Interconnecting Routers using E1-V.35 Converters

If the 2 Mbps E1 interface of the leased circuit is available close to the user device, there is no need to establish a last-mile copper or fiber path between the leased line access point (e.g., cable hut). However interface conversion from V.35 to E1 may still be required. Fig 5 shows how CYGNUS 835 or CYGNUS 803 E1 to V.35 converter may be used in such case.





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E. Special Note on interconnecting Cygnus's Multiplexing and Networking Products

CYGNUS has developed a number of Multiplexing and Networking products such as its Next Generation Multiplexer, Bridging Terminal Servers, Networking Terminal Servers, JTBS Linker, YTSK Linkers etc. These products mostly have V.35 interfaces for interconnection to each other but can also come with interfaces such as E1. All these products can be interfaced to G.shdsl Modems, Fiber Optic Modems and Converters for the required speeds and interfaces allowed by the products and provided by the Modems or Converters. Following table gives a summary of their applicability for interconnection using Cygnus's Modems and Converters.

CYGNUS Products to be Interconnected	Applicability for using following CYGNUS Products for providing interconnection		
	CYGNUS 850 G.shdsl Modem	CYGNUS 855 / 880 Fiber Optic Modem	CYGNUS 835 /803 Converters
CYGNUS 421E JTBS Linker	Using V.35 interface, speed upto 64 kbps	Using V.35 interface, speed upto 64 kbps	Using V.35 interface, speed upto 64 kbps
CYGNUS 711L YTSK Linker	Using V.35 interface, speed upto 2 Mbps	Using V.35 interface, speed upto 2 Mbps	Using V.35 interface, speed upto 2 Mbps
CYGNUS 711 Next Gen Multiplexers	Using V.35 interface, speed upto 2 Mbps	Using V.35 interface, speed upto 2 Mbps	Using V.35 interface, speed upto 2 Mbps
CYGNUS 843R / 843RE Bridging Terminal Server	Using V.35 interface, speed upto 2 Mbps	Using V.35 interface, speed upto 2 Mbps	Using V.35 interface, speed upto 2 Mbps
CYGNUS 842 Ethernet Bridge	Using V.35 interface, speed upto 2 Mbps	Using V.35 interface, speed upto 2 Mbps	Using V.35 interface, speed upto 2 Mbps
CYGNUS 1121 Networking Terminal Server (NeTS)	Using V.35/E1 interface, speed upto 2 Mbps	Using V.35/E1 interface, speed upto 2 Mbps	Using E1/V.35 interface, speed upto 2 Mbps
CYGNUS 1102 / 1103 Router	Using V.35/E1 interface, speed upto 2 Mbps	Using V.35/E1 interface, speed upto 2 Mbps	Using E1/V.35 interface, speed upto 2 Mbps

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