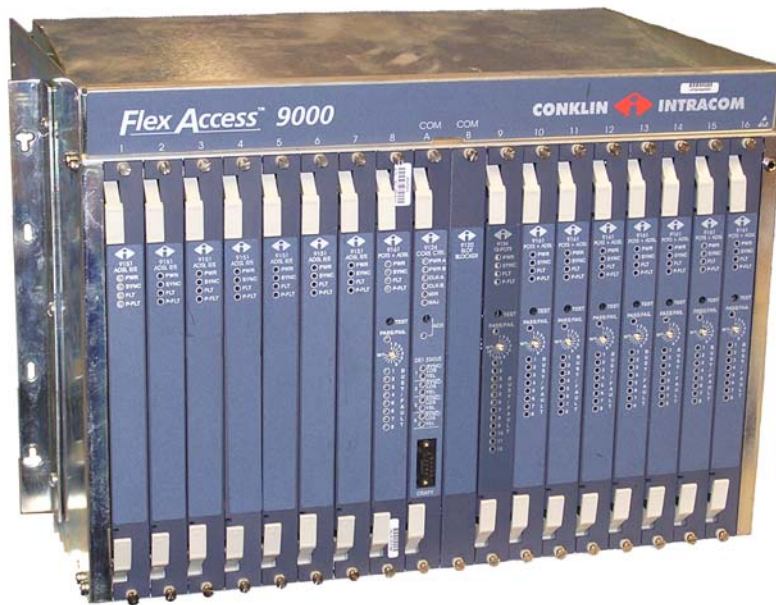


# FlexAccess 9000

## General Description



## Multi-Service Access Platform

## Table of Contents

Overview.....	3
ADSL Deployment Dynamics.....	3
<i>FlexAccess 9000</i> Solution Specifications.....	4
<i>FlexAccess</i> Applications.....	6
ADSL Range Extension.....	7
Operation.....	7
Broadband micro-DLC.....	8
Operation.....	9
<i>Narrowband micro-DLC</i> .....	9
Operation.....	10
<i>FlexAccess</i> System Description.....	10
COT shelf.....	10
Common Cards.....	11
Controller/Network Interface Card.....	11
COT Application cards.....	12
ADSL R/E Application card.....	12
Broadband micro-DLC Application card.....	13
Narrowband micro-DLC Application cards.....	13
Repeaters.....	13
Subscriber/Remote Terminals and NIDs.....	13
ADSL R/E Subscriber Terminals.....	14
Broadband micro-DLC Subscriber Terminal.....	14
Narrowband micro-DLC Subscriber Terminals.....	14
4 POTS Add/Drop Subscriber Terminal.....	14
Management Software.....	15
<i>FlexAccess</i> Differentiators.....	16
General.....	16
ADSL Range Extension.....	16
<i>FlexAccess</i> vs. other ADSL Range Extension Systems.....	17
<i>FlexAccess</i> vs. remote DSLAM.....	18

## **Overview**

### **ADSL Deployment Dynamics**

One of the most significant driving forces in the access network is the revenue potential from broadband services. In recent years a variety of technical, economic, and political barriers have adversely impacted broadband network build-out speed.

A key factor is that a vast majority of traditional ADSL deployment is limited to 12-15 kft from the closest DSLAM in the CO or DLC, placing a very substantial percentage of customers out of ADSL service range. Loop impairments due to cable plant condition, bridge taps, noise and crosstalk severely limit the reach and performance of ADSL, even at distances within CSA. Given that approximately 50% of all customers are more than 12 kft from the Central Office and over 13% are further than 18 kft away, it is clear that an ADSL range extension solution is imperative in order for operators to offer ubiquitous broadband to their customer base.

Providing ADSL service in lower population density areas has proven to be an economic challenge, due to the lack of an appropriately sized solution. The existing solutions, such as NGDLCs or cable additions/replacements require significant capital investments; and traditional loop extension devices significantly increase cost per port, which increases the return on investment period and becomes an additional deployment barrier.

Telcos are looking for technology that will allow them to economically deliver ADSL to all customers including those outside the CO or DLC serving areas.

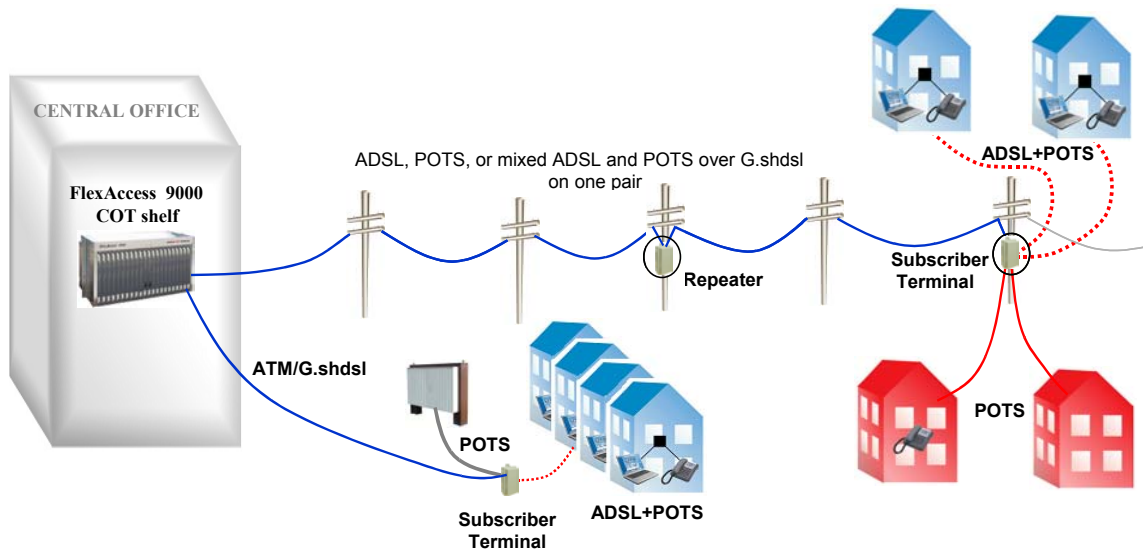
## ***FlexAccess 9000* Solution Specifications**

The ideal solution to overcome the broadband deployment barriers discussed in the previous section should have the following characteristics:

- Must place the “DSLAM” as close to the subscriber as possible in order to achieve high bit-rate service (1.5 Mb/s downstream, 512 kb/s upstream)
- Utilize a transport to bring the ATM traffic to the “DSLAM” that is less susceptible to loop impairments, noise, etc.
- The transport must be capable of being repeatered in order to reach even the most distant customers
- The “DSLAM” must be span powered in order to be able to be placed anywhere in the most cost effective manner
- The proposed system must provide solutions to all deployment barriers from a single platform
- Must be cost-effective
- Must offer ADSL transparently to the end user, using the same ADSL CPE as standard CO based DSLAM solutions
- Must offer solutions beyond those of just ADSL service expansion; pair-gain of other services must be an integral component

The CONKLIN *FlexAccess 9000* platform is designed to meet all of the above specifications and overcome these deployment barriers.

The *FlexAccess 9000* is an advanced multi-service access platform designed to enable the provisioning of broadband data and voice services to all customers independent of their distance from the Central Office or the DLC. While the *FlexAccess* can be deployed economically within a typical urban/suburban CSA, the platform economics excel in lower density areas, or where loop extension and/or pair gain is required.



The *FlexAccess* system consists of:

- a) Small span-powered Subscriber Terminals (STs) that function as micro DSLAMs and micro-DLCs
- b) Repeaters
- c) COT shelf that provides interfaces to the voice and data networks, houses a variety of application cards, and is responsible for overall system management functions. The application cards initiate span-powered, broadband, and multi-service transport links to the Subscriber Terminals using G.shdsl technology.

*FlexAccess* is typically deployed with the COT shelf located in a Central Office or remote location (vault) and a number of STs connected to the COT shelf in “star” configuration with up to 16 repeatered transport links.

*FlexAccess* also acts as the aggregation device, up to 128 ADSL customers could be served on up to a four T1 IMA ATM or a 10/100 base-Tx Ethernet network interface.

The standardized G.shdsl transport was selected for the *FlexAccess* platform because it demonstrates:

- High tolerance to loop impairments
- Superior spectral compatibility
- Increased reach and bandwidth in repeatered applications
- Rate flexibility
- Suitability for multi-system deployments

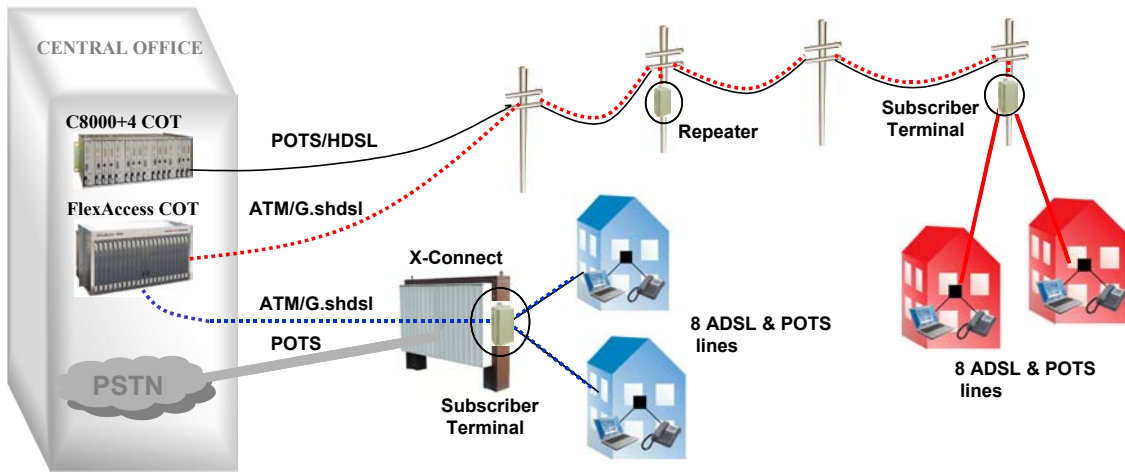
## ***FlexAccess* Applications**

The variety of application cards, span-powered STs and long reach repeatered transport provide unparalleled service flexibility. *FlexAccess* enables the telco to reach in the most cost effective manner small to medium size groups of customers, located anywhere between 0 and more than 100 kft from the Central Office. Within this distance range, the *FlexAccess* system is capable of delivering up to 2.0 Mb/s downstream rate standard ADSL, or POTS, or combination of ADSL and POTS to any individual customer. Between the COT and each ST, a single copper pair is utilized to transport multiple and mixed services, thus enabling resource sharing among multiple customers.

Descriptions of the current *FlexAccess* applications are provided in the sections below:

- a. ADSL Range Extension (ADSL R/E)
- b. Broadband micro-DLC
- c. Narrowband micro-DLC

## ADSL Range Extension



This application is aimed at cost effectively extending ADSL reach to all customers who have so far been either experiencing low speeds or denied service due to the quality of their loop or their distance from the Central Office or DLC. The *FlexAccess* will enable these customers to receive high speed ADSL (at least 1.5 Mb/s downstream, 512 kb/s upstream).

In this application, the *FlexAccess* COT is equipped with the Controller/Network Interface card and ADSL R/E application cards. Each ADSL R/E application card is linked with an ADSL Subscriber Terminal (ST) that can be attached to the side wall of a Cross-Connect, DLC, NGDLC, ONU; or mounted next to it for example on the adjacent power pole. Through the use of Repeaters, the ADSL ST can be placed tens of kft away from the CO next to an existing *C8000+4* or other Small Digital Loop Carrier (SDLC) ST to provide ADSL service to these SDLC subscribers. Only a single copper pair is needed to connect the COT shelf with the ADSL ST.

The ADSL ST acts as a span powered remote mini-DSLAM.

### Operation

The traffic from the central office ATM switch or DSLAM, or Ethernet access point, is received by the Controller/Network Interface card and transported over the backplane to the ADSL ST through the COT ADSL R/E application card. The application card generates a 512 kb/s to 2.048 Mb/s symmetric G.shdsl transport link.

For this application the POTS traffic is assumed to be delivered to the subscriber in a number of ways:

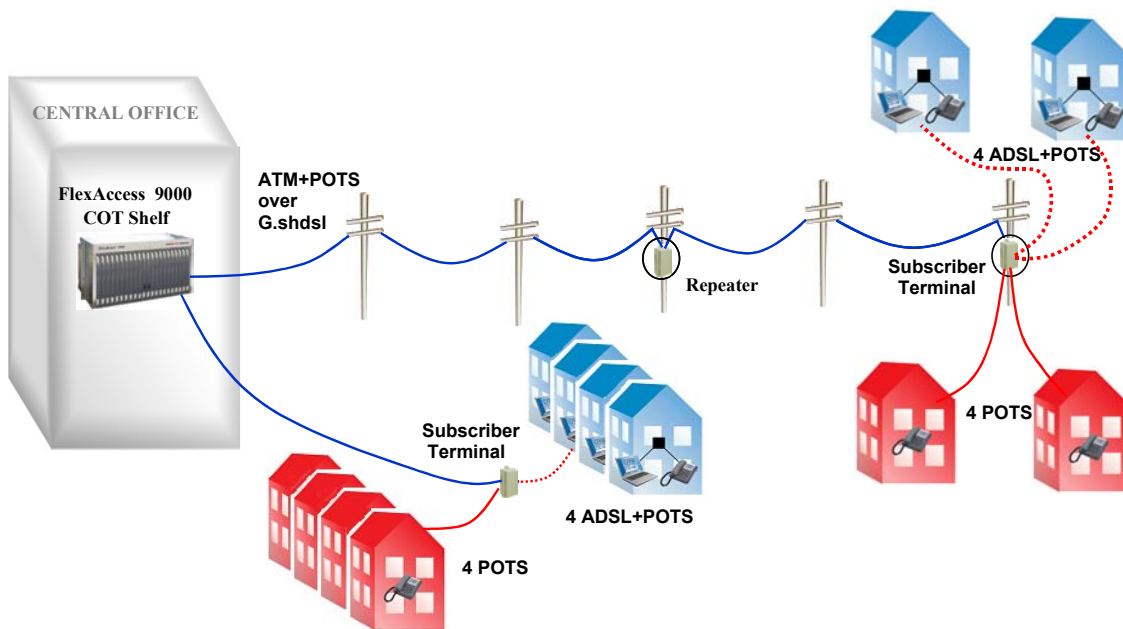
- From the Central Office voice switch via a Cross-Connect
- From a DLC/NGDLC
- From an Optical Network Unit (ONU)
- From a C8000+4 or other vendor SDLC subscriber terminal

The POTS traffic from any of the above components is routed into the ADSL ST, which already contains the appropriate splitters, to provide multiple ADSL and POTS service lines.

Through the use of *FlexAccess* G.shdsl repeaters, the ADSL service can be extended by up to 85 kft and 115 kft for eight ADSL and four ADSL drop STs respectively (19 ga).

Example: using *FlexAccess* ADSL R/E and 26AWG copper pair, the ADSL service could be delivered approximately 20kft from the Central Office/DLC without a repeater, and 30 kft with the use of one repeater.

## Broadband micro-DLC



This application can be used to provide both feeder and distribution relief based on the ability to transport both broadband data and multiple voice channels on one copper pair with the advantage of range extension capabilities – one copper pair can be used for up to eight POTS and 1 Mb/s of data transport with four ADSL drops for a distance up to 70 kft (19 ga).

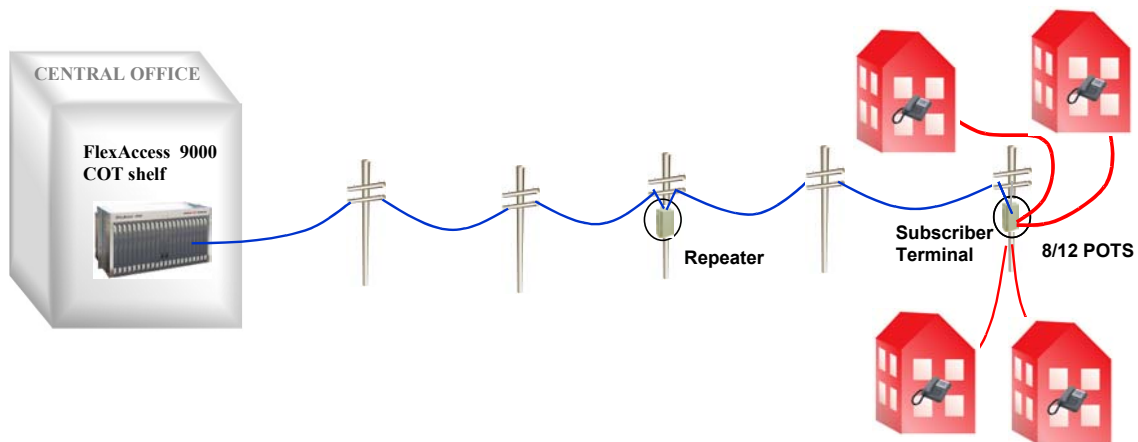
In this application, the *FlexAccess* COT is equipped with the Controller/Network Interface card and Broadband micro-DLC (8 POTS + 4 ADSL) application cards. The application card is linked to the Broadband micro-DLC ST using a span-powered 1.5 Mb/s G.shdsl transport over one copper pair. The line can be repeatered, as required.

### **Operation**

The traffic from the CO ATM switch or DSLAM, or Ethernet access point, is received by the Controller/Network Interface card and transported over the backplane to the Broadband micro-DLC application card. Up to eight TR-057 POTS lines are also connected to this application card. The card merges the data and voice traffic on the G.shdsl transport and transmits it to the Broadband micro-DLC ST. From the Broadband micro-DLC ST, four POTS lines and four ADSL+POTS lines are provided. In this application, the ADSL rate can be up to 1 Mbps downstream and 512 kbps upstream.

Example: using *FlexAccess* Broadband micro-DLC function and 26 AWG copper pair, the 1 Mbps ADSL service with POTS could be delivered approximately 20 kft from the Central Office/DLC without a repeater and 30 kft with the use of one repeater.

### **Narrowband micro-DLC**



This application provides up to twelve POTS on one copper pair to distances up to 130 kft. It can be implemented either for feeder/distribution relief or as a span-powered narrowband micro-DLC serving in a cost effective way small groups of customers.

In this application, the *FlexAccess* COT is equipped with the Controller/Network Interface card, and the Narrowband micro-DLC application card. Each application

card is linked with a Narrowband micro-DLC ST with one copper pair. The line can be repeatered, as required.

## **Operation**

The COT application card receives TR-057 POTS lines from the voice switch and generates a span-powered, 784 kbps G.shdsl transport for up to 12 voice channels. The G.shdsl line is terminated at the Narrowband micro-DLC ST where individual POTS lines emerge for delivery to the end customers. The ST supports up to 1200 Ohm drops and drop-side testing on all channels.

## **FlexAccess System Description**

*FlexAccess* is comprised of a COT shelf, common cards, application cards and the field units that include repeaters and subscriber terminals.

Each shelf houses a number of application cards, such as ADSL Range Extension, ADSL+POTS, and POTS. It also houses a common card which can be either an ATM or Ethernet Controller/Network Interface card.

Application cards receive traffic from the backplane and accept POTS directly from the voice switch (TR-057). They generate G.shdsl transport with data, voice, or mixed data and Voice traffic. The application card also provides span power for all field units.

The G.shdsl transport is terminated at the remote Subscriber Terminals. The ST extracts voice and data and generates individual ADSL, POTS or ADSL+POTS lines to be delivered to the end customer.

Repeaters are used to extend the G.shdsl transport to the Subscriber Terminals.

The *FlexAccess* network can be managed using local RS232 access, or remotely via in-band ATM or Ethernet network using Command Line Interface (CLI), GUI based *FASTCraft*, and Conklin-Intracom BBMS element manager software.

## **COT shelf**

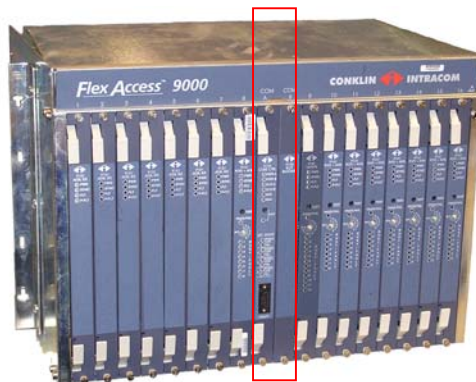
The 19" COT Shelf mounts in either 19" or 23" relay racks. Each shelf is 10 RU high including a fan tray assembly. The shelves accommodate sixteen (16) application cards and a common card that is installed in one of the two middle slots. A high speed ATM multi-drop backplane connects the common card slots with all the other service card slots. This high-speed connection enables delivery of the entire bandwidth to any service slot.

Each application card slot has a 25 pair AMP-Champ connector for POTS lines from the voice switch; and wire-wrap terminals for out-going G.shdsl and optional Express Power pairs.

The common card slots, located in the center of the shelf, have wire-wrap connectors for ATM transport interface and alarm contacts. Ethernet connections are made through the Common card's front panel.

Redundant -48 Vdc power connections are provided and are common to all the cards in the shelf.

## Common Cards



COT Shelf - Common Card Slots

Each shelf houses a controller / network interface common card for bandwidth management, communications, and maintenance of the application cards and the field units.

### Controller/Network Interface Card

This card is required for any broadband data or combined POTS and broadband data applications.

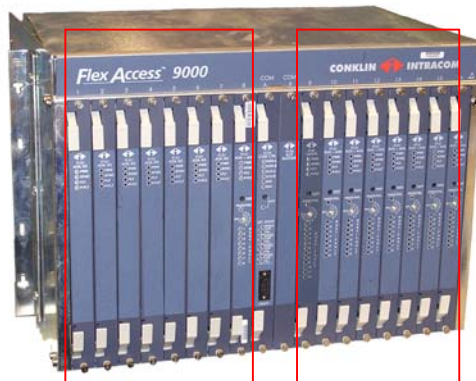
This card performs all the alarm functions in addition to full DSLAM capabilities. It receives the traffic from the ATM or Ethernet network, provides switching and QoS, and distributes the traffic through the high speed backplane among the application cards in the shelf.

The two versions of the Controller/Network Interface card are available; the ATM card receives four T1 IMA traffic from the ATM network via the wire-wrap terminals on the shelf backplane, the Ethernet card receives traffic via the RJ45 connector on the front panel. Both units output data to the backplane onto high-

speed data bus, from which it can be accessed and forwarded by the appropriate application card.

Both Controller/Network Interface cards have an RS232 connection on the front panel for local craft interface. The Controller/Network Interface card also incorporates an SNMP and TL-1 agent that communicates through an in-band channel with the remote management system.

## **COT Application cards**



Application cards accept the data cells from the backplane and POTS lines from the voice switch and generate span powered G.shdsl transmission with data and voice traffic.

The *FlexAccess* includes the following application cards:

1. ADSL Range Extension (R/E)
2. Broadband micro-DLC (ADSL+POTS)
3. Narrowband micro-DLC (POTS)

### **ADSL R/E Application card**

This card can be used for ADSL range extension, ideal for ADSL from ONU, or cross-connect applications. It mates with a four or eight ADSL port Subscriber Terminal.

This ADSL R/E application card accepts data from the backplane and places it on a 512 kb/s to 2.048 Mb/s G.shdsl transport. The G.shdsl line's output from the COT shelf is wire-wrap terminals on the backplane, to the MDF and then to the appropriate OSP line that connects to the remote ADSL Subscriber Terminal.

## **Broadband micro-DLC Application card**

This card can be used as a span powered Broadband micro-DLC. It matches an 8+4 POTS+ADSL Subscriber Terminal.

This application card accepts up to eight TR-057 POTS lines from the voice switch via the AMP Champ connector on the backplane and 1 Mbps data from the backplane. The card places the data and voice traffic on a 1.5 Mbps G.shdsl transport. The G.shdsl line's output is to wire-wrap terminals on the backplane, from which it can be wired to the MDF/cross-connect for transport to the Broadband micro-DLC Subscriber Terminal.

## **Narrowband micro-DLC Application cards**

These cards are used for applications such as POTS range extension or pair gain and connect to the four, 8 and 12 POTS Subscriber Terminals.

The POTS Application card accepts the TR-057 POTS lines from the voice switch via the AMP Champ connector located on the backplane and generates a 784 kbps 12-channel multiplexed voice G.shdsl transport. The G.shdsl line's output is to wire-wrap terminals on the backplane, from which it can be wired to the MDF/cross-connect for transport to the POTS Range Extension Subscriber Terminal.

## **Repeaters**

The repeaters regenerate the G.shdsl line. All the repeaters are span-powered from the Central Office.

The repeaters are packaged in a 15.1"H x 6.5"W x 4.5"D outdoor enclosures (except for 439 size plug-in cards) with gas tube protectors for incoming and outgoing lines in the enclosure base and electronics in the removable lid.

Single or dual repeaters for regeneration of one or two G.shdsl lines are available. These repeaters are common for all applications.

## **Subscriber/Remote Terminals and NIDs**



The Subscriber/Remote Terminals terminate the G.shdsl transmission line from the Central Office and act as remote DSLAMs, or broadband/narrowband micro-DLCs. All the field units are span-powered from the Central Office.

The “micro” size Subscriber Terminals (STs) are packaged into the same form and size enclosures as the *FlexAccess* repeaters, with protectors in the base and electronics in the removable lid. Similarly to the repeaters, they are span-powered from the Central Office.

### **ADSL R/E Subscriber Terminals**

The ADSL R/E ST matches the ADSL R/E application card in the *FlexAccess* COT shelf. The eight ADSL ST terminates the 512 kb/s to 2.048 Mb/s G.shdsl transmission from the COT shelf and generates up to eight individual ADSL lines for delivery to the end customers.

These subscriber terminals include POTS splitters, hence any standard POTS from other systems, such as ONUs/DLCs/Cross-connects and CONKLIN’s *C8000+4*, can be merged with the ADSL at this terminal for delivery to the end customer.

### **Broadband micro-DLC Subscriber Terminal**

The Broadband micro-DLC ST matches the Broadband micro-DLC application card in the *FlexAccess* COT shelf. This ST terminates the 1.5 Mbps G.shdsl transmission line and generates four POTS and four POTS+ADSL individual lines for delivery to the end customers.

Drop-side testing is provided for all eight POTS channels.

### **Narrowband micro-DLC Subscriber Terminals**

The Narrowband micro-DLC STs include the four-channel, eight-channel and 12-channel ST versions to match the 12 POTS Narrowband micro-DLC application cards in the *FlexAccess* COT shelf.

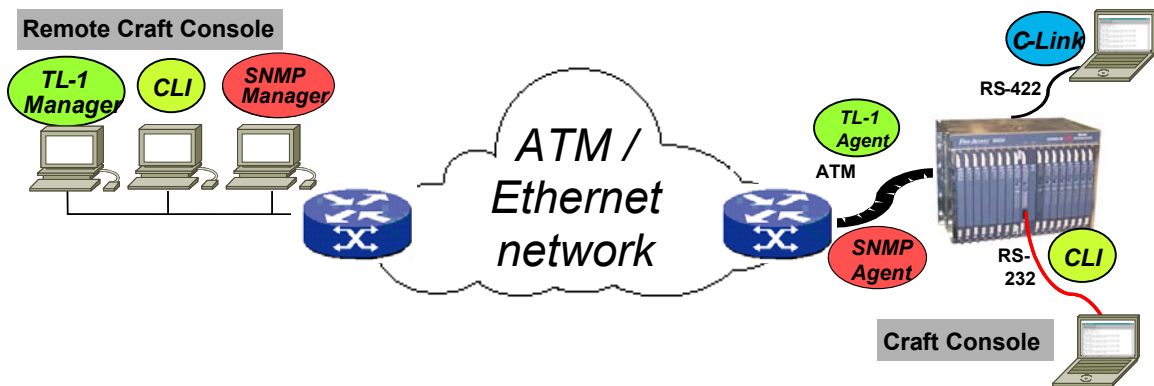
The Narrowband micro-DLC STs terminate 784 kbps G.shdsl transports from the COT shelf for the 12-channel systems, and generate up to 12 individual POTS circuits.

The extended drop units support 1200 Ohms long loops; and drop -side testing is standard on all channels.

### **4 POTS Add/Drop Subscriber Terminal**

This unit supports 12-channel operations and allows add/drop of up to four POTS lines at the intermediate locations between the COT and the final Subscriber Terminal. This is the distributed mode deployment scenario. This ST also acts as a repeater for all “through” channels.

## Management Software



The *FlexAccess* management software provides all the features required to install, configure and operate DSLAM, DLC and transport functions. The key functions are as follows:

- Provisioning of ADSL
- Provisioning of T1 IMA or Ethernet interface
- Making switching connections
- Initiating and monitoring firmware upgrade
- Assigning communication and alarm profiles
- Monitoring IMA/ADSL/ATM/G.shdsl/POTS performance and alarms
- System/Channel/Signal Quality testing
- Configuration of in-band management channel

Similarly to the CONKLIN's *FASTmux* family of products and using common user interface, the *FlexAccess* system can be accessed and managed locally, or remotely using CLI, TL-1 and *FASTCraft* software. All *FlexAccess* management software suites have an access to the same data structures and can perform any installation, configuration or monitoring functions.

The local access is provided via RS-232 port located on the faceplate of the Controller/Network Interface card.

The remote access is available through the in-band Network. The Controller / Network Interface card hosts SNMP and TL-1 Agents. The SNMP agent configures, controls, and reports the status of the system using industry standard and product specific management information bases (MIBs).

The Command Line Interface (CLI) provides local or remote access to the system information using Conklin-Intracom command language.

The *FASTCraft* software provides easy to learn and use, intuitive Graphical User Interface (GUI) and allows also for a local or remote access methods.

Dial-up remote access through the RS-232 port is also possible.

## ***FlexAccess* Differentiators**

### **General**

The *FlexAccess* long reach multi-service system offers low to medium density ADSL R/E, Broadband micro-DLC and narrowband micro-DLC functionality at distances between 0 and 100 kft from the CO. The maximum system capacity on a per application basis is summarized in the table below:

<b>Application</b>	<b>COT Shelf</b>
<b>ADSL Range Extension</b>	<b>128 ADSL</b> subscribers
<b>Broadband micro-DLC</b>	<b>64 ADSL &amp; 128 POTS</b> subscribers
<b>Narrowband micro-DLC</b>	<b>192 POTS</b> subscribers

An important feature of the system is its capability to offer any of these applications from any application slot. In addition, built-in capabilities that enable the platform's evolution to address new emerging services and high speed network interfaces, as well as an extensive product roadmap distinguish the *FlexAccess* as a truly future-proof investment.

### **ADSL Range Extension**

In order to extend broadband services to remote underserved areas, Telcos currently have a choice to deploy a remote DSLAM, or to add dedicated ADSL range extension hardware in addition to the CO DSLAM. The *FlexAccess* architecture was optimized for flexible low-cost broadband and voice deployment using the latest technology. It complements remote mini-DSLAM deployments and leapfrogs existing ADSL range extension systems by enabling a multitude of new solutions and revenues through reduced deployment cost.

## ***FlexAccess* vs. other ADSL Range Extension Systems**

- One of the main *FlexAccess* differentiators is that it has full DSLAM capabilities with a high speed backplane aggregating traffic, support for QoS, switching, policing, etc. Because of that, the *FlexAccess* deployment *does not* depend on *collocation* with other DSLAMs and it can be deployed in *any* Central Office.
- Furthermore, different profiles and QoS levels can be assigned to different customers through the system and be guaranteed *all the way to the ST*, thus allowing the operator to offer a variety of service contracts at different price levels. Performance statistics on a per ADSL line basis are available, allowing the operator full visibility onto system usage and a operation.
- Since the *FlexAccess* combines both DSLAM and ADSL Range Extension functionality in one box, it is the most cost effective method for ADSL loop extension, as there is no additional cost related to using collocated DSLAM ADSL ports. The choice of standard nT1 IMA ATM or Ethernet network interface eliminates interoperability issues on the network side; and the use of well established ADSL chipsets ensures the interoperability with broadest range of *already used* CPE.
- A very wide variety of options are available for system configuration and management. The system can be managed through CLI, TL-1 and GUI based craft interface applications locally or remotely. The system can also be managed through CONKLIN's BBMS element manager platform that also manages other CONKLIN products.
- The *FlexAccess* software manages not only the DSLAM (and POTS) functions, it also performs monitoring and test functions of the G.shdsl transport, which is necessary to ensure QoS management.
- The *FlexAccess* is a multi-service platform and can be used not only for ADSL range extension and pair gain, but also for voice pair gain, ADSL/DAML, and local ADSL.
- Since the different *FlexAccess* range extension systems use the same transport technology, the number of common elements that can support any *FlexAccess* application is maximized (for example repeaters that can be used in any ADSL, POTS or ADSL+POTS application). This reduces the inventory cost.
- The deployment flexibility is ensured having the variety of span-powered field terminals supporting installations of up to 40 lines at one location.
- A truly unique feature of *FlexAccess* is that it supports mixed services on one copper pair helping to maximize the use of existing plant.

## ***FlexAccess* vs. remote DSLAM**

Depending on a particular network application either the *FlexAccess*, or a remote DSLAM, such as CONKLIN's *FASTmux*, can prove to be a more beneficial and cost effective solution. The key factors that have to be considered to determine suitability of a particular approach are density of subscribers at a specific serving location, distance to the subscribers, availability and cost of local power, distance and access to existing remotes and its resources, if any, and cost of backhaul transport.

The *FlexAccess* cost advantage over a typical remote DSLAM deployment may result from its high level of system integration. The key differentiators that translate into lowering of deployment cost are:

- The *FlexAccess* does not require local power, or battery backup, as all the units are span powered from the CO and rely on the CO backup systems.
- The *FlexAccess* does not require additional transport and powering equipment such as HDSLx cards, CO power cards, shelves and field apparatus cases. The multi-rate and spectrally friendly G.shdsl transport is integrated into system electronics.
- The *FlexAccess* field units do not require additional environmental protection, as they are in small NID-like enclosures that can be easily and quickly installed, or replaced. The replacement of electronics, if required, is done by changing the connectorized enclosure lid without the need to touch the existing wiring.
- Where ADSL has to be provided from multiple remote locations, the *FlexAccess* network architecture offers an additional cost advantage. The *FlexAccess* DSLAM WAN interface, ATM processing functions and related hardware are in one CO location. From there, the *FlexAccess* manages and serves multiple remote terminals that perform just transport and ADSL output functions. By concentrating the WAN and ATM processing functions into a Central Office shelf, the cost per port of deploying ADSL is reduced, and so is the operational expense of managing these systems.
- The *FlexAccess* system integrates line testing capabilities, thus helping to eliminate the need for special test equipment.

In summary, the Conklin's *FlexAccess 9000* system is developed as a cohesive system for the deployment of ADSL to remote subscribers. This integrated solution approach and built-in deployment flexibility allow the carrier to deploy the equipment in the most efficient manner and at the low cost, enabling new revenue streams from the underserved areas.