

Reducing DLC Maintenance Costs

- Although tens of thousands of legacy DLC systems remain on old and fragile copper T1 facilities, addressing the steadily increasing maintenance costs for these systems is a challenge:
 - Subscriber landline base is declining
 - Upgrade to NGDLC is uneconomical
 - Transition to broadband platforms at remaining DLC sites is often low priority
- Pulsecom O3-12D1DN OC3-to-DS1 units used for cell site backhaul provide a solution:
 - Leverage new fiber facilities
 - Free up DLC T1 spares to largely pay for fiber conversion
 - Simple and fast installation
 - Often provide better remote diagnostics

Current Status

By 1995, most Digital Loop Carrier systems (DLC) being installed were based on fiber-fed Next Generation Digital Loop Carrier (NGDLC) technology. In addition to higher bandwidth for services like DS1 and DSL, fiber-fed NGDLC helped resolve on-going maintenance issues with copper-fed DLC systems.

Tens of thousands of legacy DLC systems remain in service, all at least 15 years old and many connected to the network with often much older copper spans. Truck rolls have become common to patch, splice and change T1 or HDSL pairs to sustain service, but as POTS moves to wireless and VoIP, it has become increasingly difficult to justify the expense of NGDLC fork-lift change outs.

The challenge is one of maintaining a dwindling number of DLC wireline circuits supported by increasingly fragile copper spans. Repairs are more frequent, costs are becoming larger and, with fewer and fewer landline subscribers, it may no longer be possible to offset maintenance expenses with subscriber revenues.

The declining number of landlines also makes the cost of NGDLC upgrades impractical. Since customers still served by legacy DLC systems are generally in thin route areas, conversion to

newer technologies is often cost prohibitive or deferred until more pressing network needs are addressed.

A Strategy

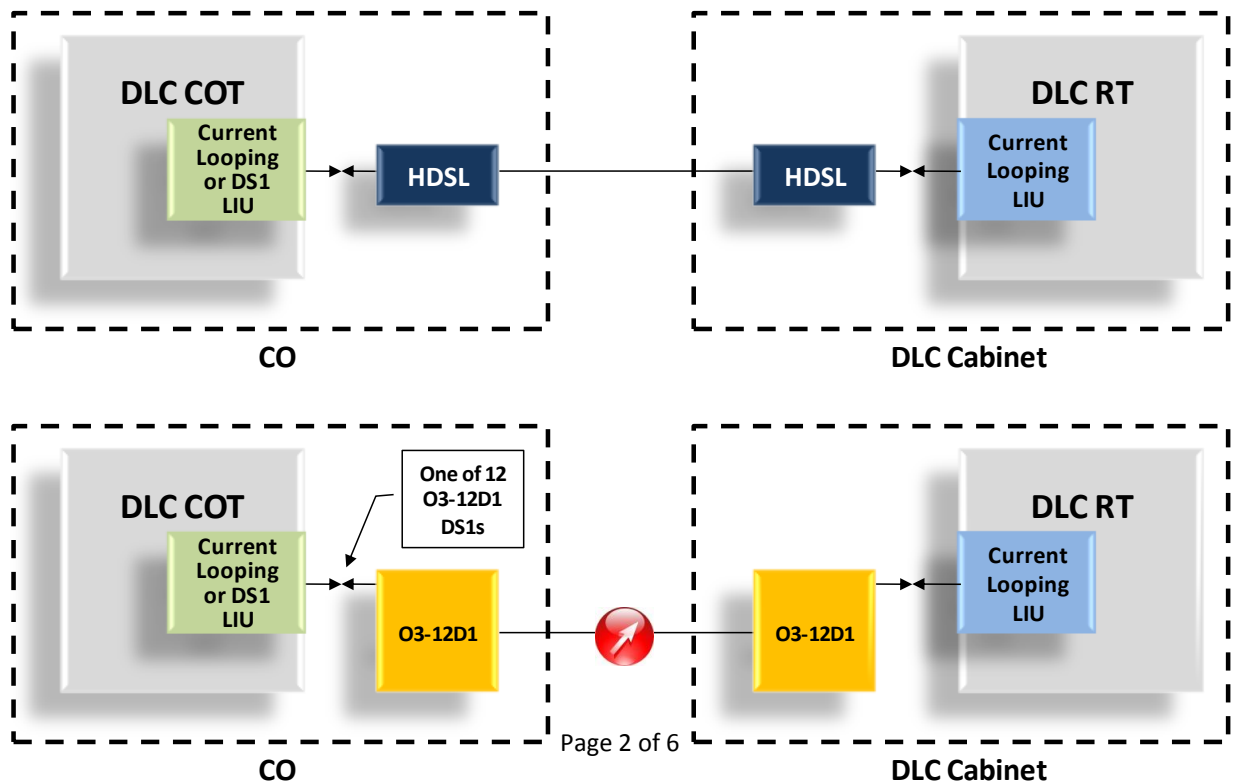
Fiber facilities are increasingly common. Even in relatively thin route areas, efforts to increase cell tower bandwidth have placed fiber near or in DLC cabinets, and many DLC cabinets support DSL with optical backhaul.

To overcome the cost of repairing aging copper facilities and free up resources for pressing network needs, a proven and cost effective strategy is to use the same solution used today for cell site back haul and DSL backhaul for “DLC backhaul”.

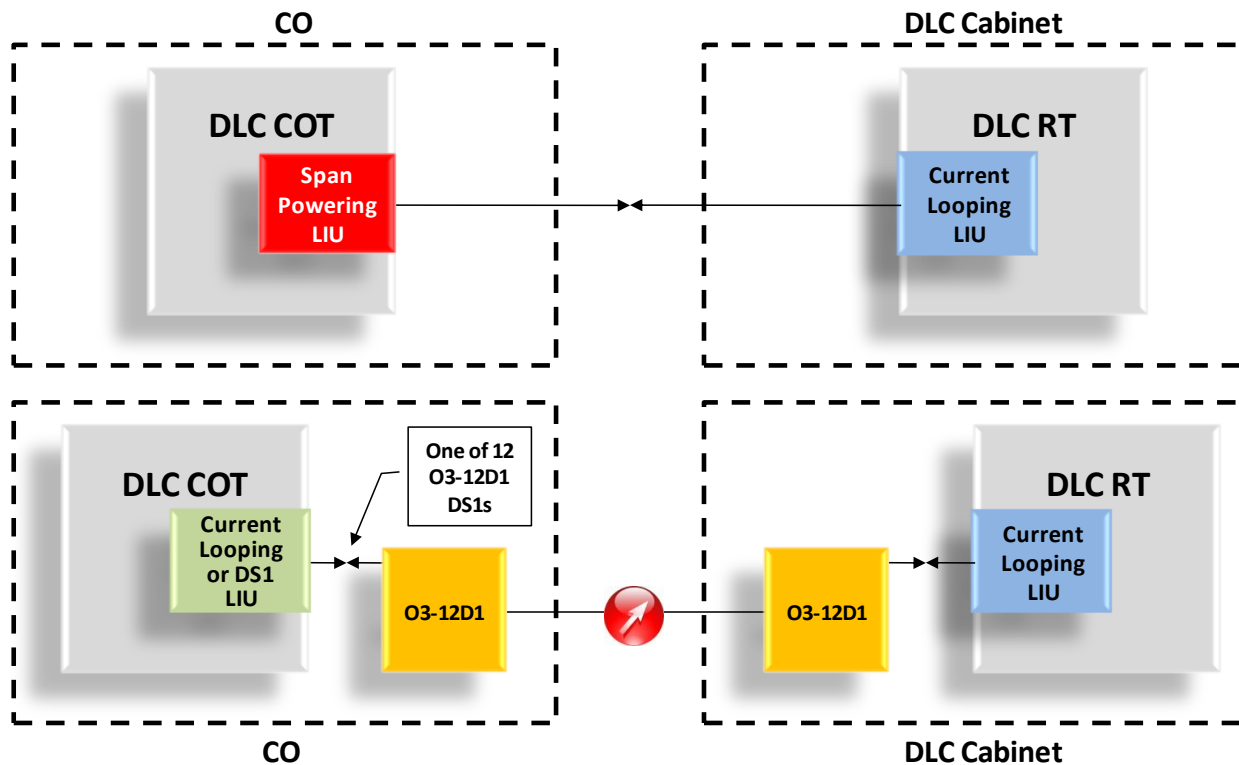
Miniature and cost-effective Pulsecom OC3-to-DS1 and OC3-to-DS3 units such as the O3-12D1DN and O3D3-MO have been used extensively for reliable backhaul. Many DLC cabinets already house these units or already have mountings that can accommodate these all-in-one plug-ins. With fiber in the same vicinity or within a DLC cabinet, cutting copper spans over to fiber to resolve maintenance issues can be as simple as plugging in a couple of O3-12D1DN units and making a few DS1 and fiber connections.

Another advantage of this approach is the ability to free up DLC span-powering LIUs and/or HDSL plug-ins. Since these units are often subjected to OSP lightning surges, the need to purchase maintenance spares is on-going. Each O3-12D1DN replaces up to twelve (12) HDSL NIUs or expensive span-powering LIUs to offset the cost of the optical unit.

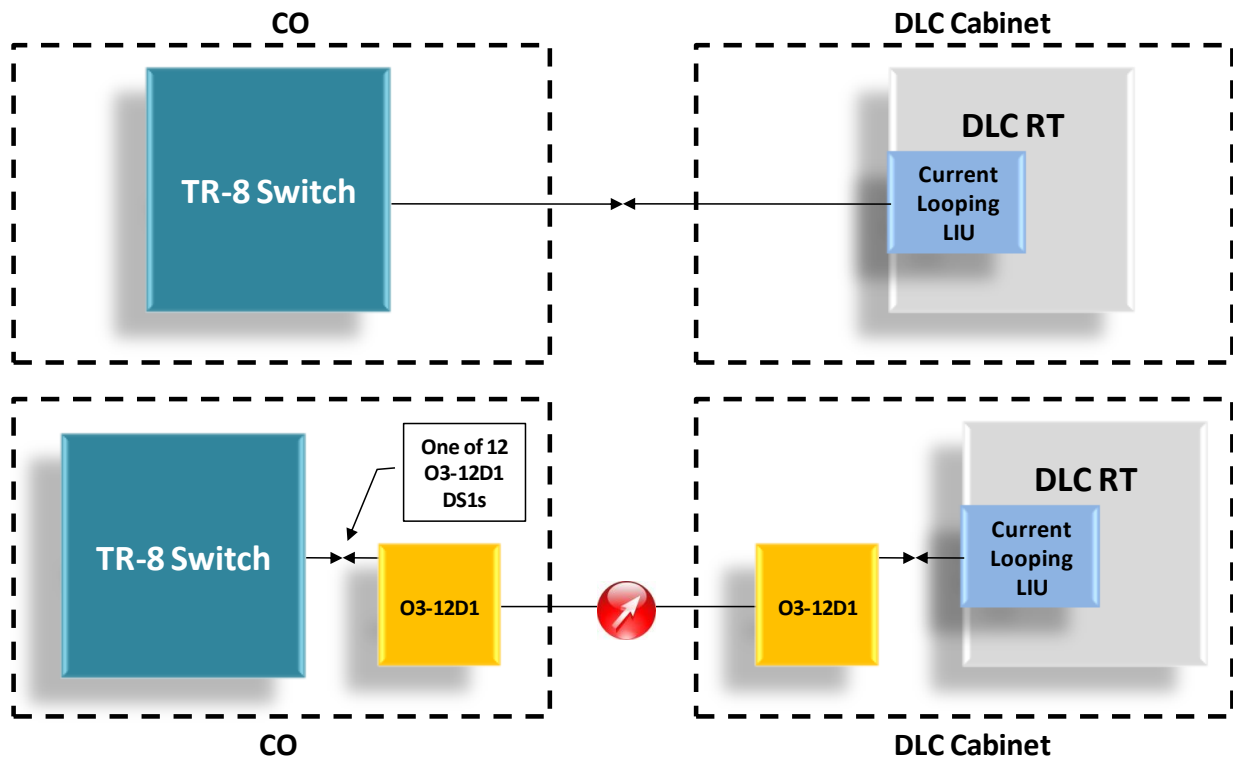
The diagram below shows a copper-to-fiber conversion for an HDSL-based system.

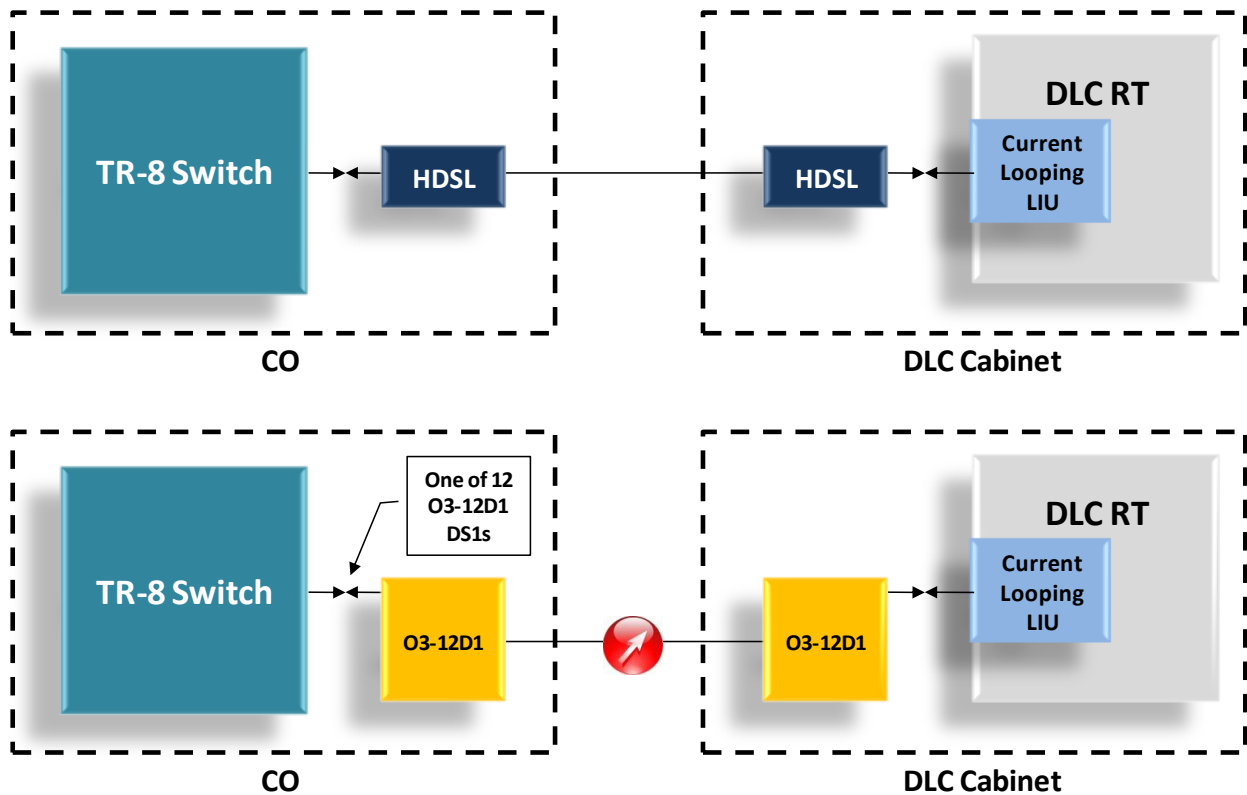


This diagram shows the conversion for a T1 span system.



The following two figures show similar conversions if the DLC RTs are operated in Integrated mode.





NGDLC Applications

Because NGDLC systems support DS1 drops, they may face similar maintenance issues even though they are optically fed. On one hand, the problem is less severe because it involves a single subscriber rather than the operation of the entire RT. On the other hand, subscriber drops are generally not protected so a copper loop problem creates an out-of-service condition. Use of the “downsized” O3-4D1B or O3-4D1L3B cards, which each provide 4 DS1s over fiber, are a better fit for this application as a means to help eliminate truck rolls. In this case, diagnostic capabilities will likely be similar because T1 NIUs with good maintenance capabilities are often already in use at subscriber sites.

Installation

O3-12D1DN units are available in 400-mechanics, ordering code O3-12D1DN, to simplify cabinet and CO placement. This unit can be provisioned as a CO-side unit or an RT-side unit so, for example, O3-12D1DN units can be provisioned for RT for optical connection back to O3-12D1DN unit in a CO, CEV or hut. If shelves are not available, the Pulsecom 2O3D3-19A REVB 19”/23” rack mounted 1 RU shelf (1.75” high) is available. The 2O3D3-19A REVB has two Type 400-mechanics card slots. All of this equipment is climate hardened for GR-3108 Class 3

applications with operating temperatures of -40°C to +70°C and requires either -48Vdc or 24Vdc power. Including the 203D3-19A REVB shelf, allow 15W per O3-12D1DN plug-in.

Once a cabinet mounting location has been determined, DS1s are connected by using a faceplate stub-ended cable. For the O3-12D1D use an AMP-MBL/U50S25 cable.

O3-12D1 units are not compatible with line powering LIUs such as the Series 5 AUA62. These LIUs must be rolled out of service as circuits are cut over to fiber and replaced with either current looping or DS1 LIUs.

During installation, the T1 spare that is common practice with copper fed DLC systems is used to minimize disruption. Roll the spare line to the optical facility first, and then roll the remaining T1s one-at-a-time so that circuits are at most momentarily interrupted. Finally, collect the idled equipment such as HDSL cards for return to inventory.

The chart below summarizes compatible (DS1 and current-looping) and non-compatible (current sourcing) LIUs for use during a copper to fiber transition.

System	DS1 LIU Model	Description	OK to use?	Replacement for use with O3-12D1
Litespan 2000	T1U	Single T1 channel unit	Yes	
	DS1U	Single T1 channel unit (SLC-96)	Yes	
	ADS1U	Single T1 channel unit (Async)	Yes	
	AT1U	Powering T1 channel unit	No	T1U
SLC® Series 5	AUA61	Line Interface Unit (T1)	yes	
	AUA64	Looping Line Interface Unit (T1)	yes	
	AUA62	Powering Line Interface Unit (T1)	No	AUA61 or AUA64
SLC®-96	WN2	Line Interface Unit (T1)	Yes	
	PWN2	Line Interface Unit (T1)	Yes	
	WN4	Powering Line Interface Unit (T1)	No	WN2 or PWN2
FDLC	FC9601LN21	Looping Line Interface Unit (LIU2)	Yes	
	FC9611LN21	Looping Line Interface Unit (LIU2)	Yes	
	FC9611LN33	Looping Line Interface Unit (LIU2)	Yes	
	FC9601LN31	Line Interface Unit (LIU3)	Yes	
	FC9611LN31	Line Interface Unit (LIU3)	Yes	
	FC9611LN33	Line Interface Unit (LIU3)	Yes	
	FC9601LN11	Powering Line Interface Unit (LIU1)	No	LIU2 or LIU3
	FC9611LN11	Powering Line Interface Unit (LIU1)	No	LIU2 or LIU3
FC9611LN13	Powering Line Interface Unit (LIU1)	No	LIU2 or LIU3	
ISC 303	Y4098A1-V01AA	Looping Line Interface Unit (T1)	Yes	
	Y4098A1-V02AB	Looping Line Interface Unit (T1)	Yes	
	Y4098A1-V02BC	Looping Line Interface Unit (T1)	Yes	
	Y4098A1-V03CD	Looping Line Interface Unit (T1)	Yes	

OAM

O3-12D1DN units have built-in NIUs with AIS, AIS-CI, RAI, RAI-CI and NPRM/SPRM diagnostics as well as support of in-band remote loopbacks. As a result, the new optical DLC backhaul may provide superior maintenance and network sectionalization capabilities compared with the copper-based equipment being replaced.

Future Considerations

When it's time to convert to Ethernet, the O3-12D1DN unit is plug-compatible with Pulsecom's O3-12D1G which manages 8Gb of native Ethernet bandwidth to deliver optical GigEs, electrical 10/100/1000BT Ethernet drops and 12 DS1s. The plug-in replacement instantly provides a high bandwidth trunk and/or configures the RT to support full rate GigE services.

Conclusion

Declining landline demand, thousands of thin route legacy DLC systems and aging copper T1 feeders have resulted in high maintenance costs and an increasing amount of repair resources to support fewer and fewer circuits. A resolution based upon replacing DLC with NGDLC is not economical and migration to newer broadband services is often low priority.

The same Pulsecom O3-12D1DN OC3 to 12 DS1 units used to provide optical DS1 backhaul for cell site upgrades provide an answer. These self-contained units install quickly, leverage existing or nearby fiber facilities, are largely paid for by freeing up DLC spares and the resulting optical "DLC backhaul" circuits have remote diagnostic capabilities often superior to existing capabilities.

About Pulsecom

Part of \$3B Hubbell Incorporated (NYSE: HUB.A, HUB.B), Pulsecom has designed and manufactured network innovations in the United States for almost 50 years. Pulsecom optical access equipment has proven to be more reliable, more cost effective and better able to leverage existing infrastructure, and miniaturization has led to more nimble installations and optimized network architectures.