Liberalizing the Local Loop

The liberalization of telecommunications has not meant a massive appearance of alternative infrastructures that would let the new operators equally compete with the dominant heirs of a past monopoly. Such alternatives as fibre or the radio have proven to be more expensive than expected. This way, the copper local loop continues to be the only massive access technology with capacity to provide both narrow and broadband services.

In this situation, the European Comission, with the objective of creating a true competitive market, approved the regulation for the unbundled access to the local loop (ULL) that would reduce the cost of services like voice or internet access and would also deploy such new applications as the e-commerce and multimedia. The ULL has been applied in the EU since January 1st, 2001.

The ULL opens specific resources of the ILECs (Incumbent Local Excange Carriers) to CLECs (Competitive Local Exchange Carriers), by means of both facilities to use the copper loops and space to install the CLEC equipment. The ILEC must provide topology information on the access network, as well as its physical characteristics. On the other hand, the NRAs (National Regulation Authorities) control the legal rights, obligations and economical issues that mark the ILEC- CLEC relationship.

Several solutions have been implemented in each of the 17 European countries. They are based on three models:

- Bitstream services, where the ILEC provides access through the copper loop and its own backbone in order to link customers with the CLEC applications.
- Unbundling the copper wire, while the ILEC rents all the frequencies to the CLEC.
- Line sharing, where the ILEC keeps the voice band services and lets the CLEC use the ADSL frequencies ones.

In all except the first model, the CLEC needs collocation facilities in the local exchange to

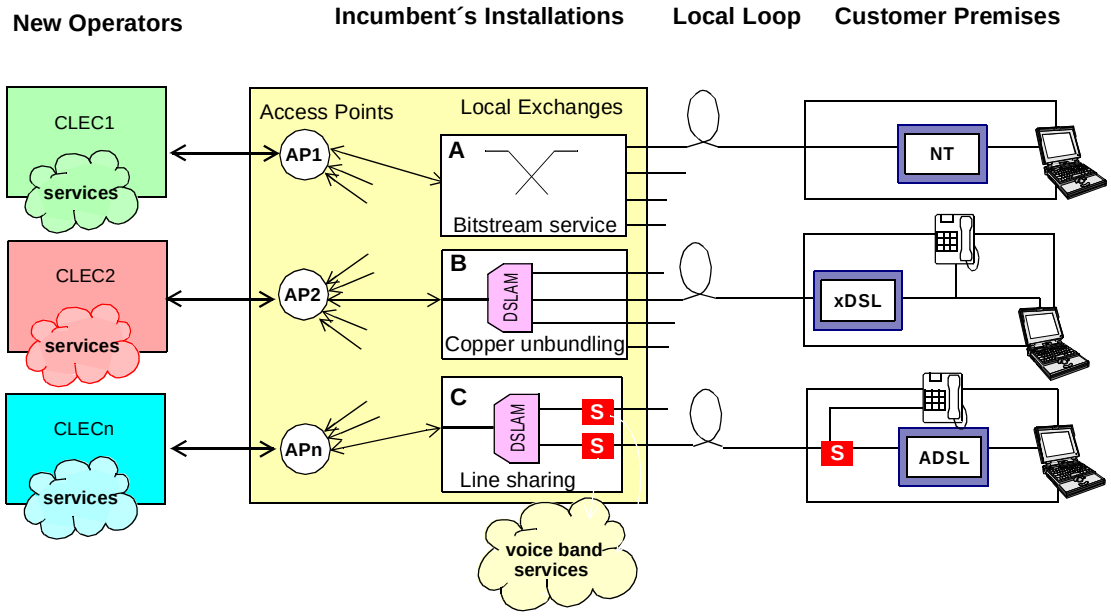

Figure 1 *Coexistence of CLECs and ILEC by means of local loop unbundling*
The local exchange A provides bitstream services the CLEC1 by means of any technology. In B, the CLEC2 rents all the local loop frequencies, while in C, the ILEC maintains the legacy service like voice and lends the ADSL frequencies to the CLEC3.

install network instruments, such as DSLAM, splitters, or switches.

In some countries, the dominant operator has taken the ULL as an opportunity to increase its benefits, but in most cases, the incumbent and the new operators find themselves in a never-ending chain of conflicts. The incumbent operator can present many obstacles, concerning not only pricing, but also the use of physical space, legacy service requirements, lack of maintenance in shared resources, deficient topology information... After all, they are competitors.

Business Opportunities

The new regulatory conditions, technical information and key applications are the guarantee to reach the original unbundling objetives of fair competition. The CLEC needs the topology information to evaluate the size of the market, the quality of the copper and the service availability, to calculate the costs and the revenue of the xDSL/ATM/IP roll-out. The CLEC must be aware of its oportunities, as not all the installed base is profitable, and past experience proves that only 25% of the LE are cost-effective for the new entrants.

The existing copper loops are extremely heterogeneous, and it is necessary for the CLECs to be able to access the data that shows the state of the operating infrastructure, to have an idea of their business prospects. The physical composition of the loop is defined by means of the cable type, length (short, medium, long or very long) and the grouping of the pairs in bundles (25, 100 or even more).

Once the physical characteristics have been determined, it is necessary to specify the transmission characteristics by qualifying the metallic pair at the level of electric parameters such as:

- Attenuation, as the main factor that limits the wire length. It depends on the signal frequency, for high frequencies it is higher than for low frequencies, producing distortion.
- Longitudinal balance that measures the level of tolerance to external electromagnetic fields.
- Noise, quantified either by its power spectrum or by its RMS value, if the power spectrum is constant over all the frequencies of interest.
- Return loss that measures the capacity of a transmission line to absorb the power supplied by a generator.

This qualification of the installation, independent of the signal travelling in the pairs, can be provided by the ILECs that probably have recent reports including this information. Alternatively, it is possible to program a period of trials, observed by the CLECs, the ILECs and the manufacturers, with the aim of describing the installations by performing these tests on a representative part of them.

Peaceful Coexistence

The local loop unbundling means that different operators should share the same infrastructure to offer various services, which can be divided into two independent groups:

- legacy services, such as voice, ISDN, nx64, Frame Relay, HSDL or analogue Hi-Fi, which are usually provided by the ILEC
- new services, such as internet or e-commerce applications based on new technologies like ADSL over POTS, ASDL over ISDN, or SDSL.

Full coexistence without restrictions is not easy, since an xDSL modem causes interferences in the neighboring loops that may weaken the quality of legacy services and disturb other xDSL services.

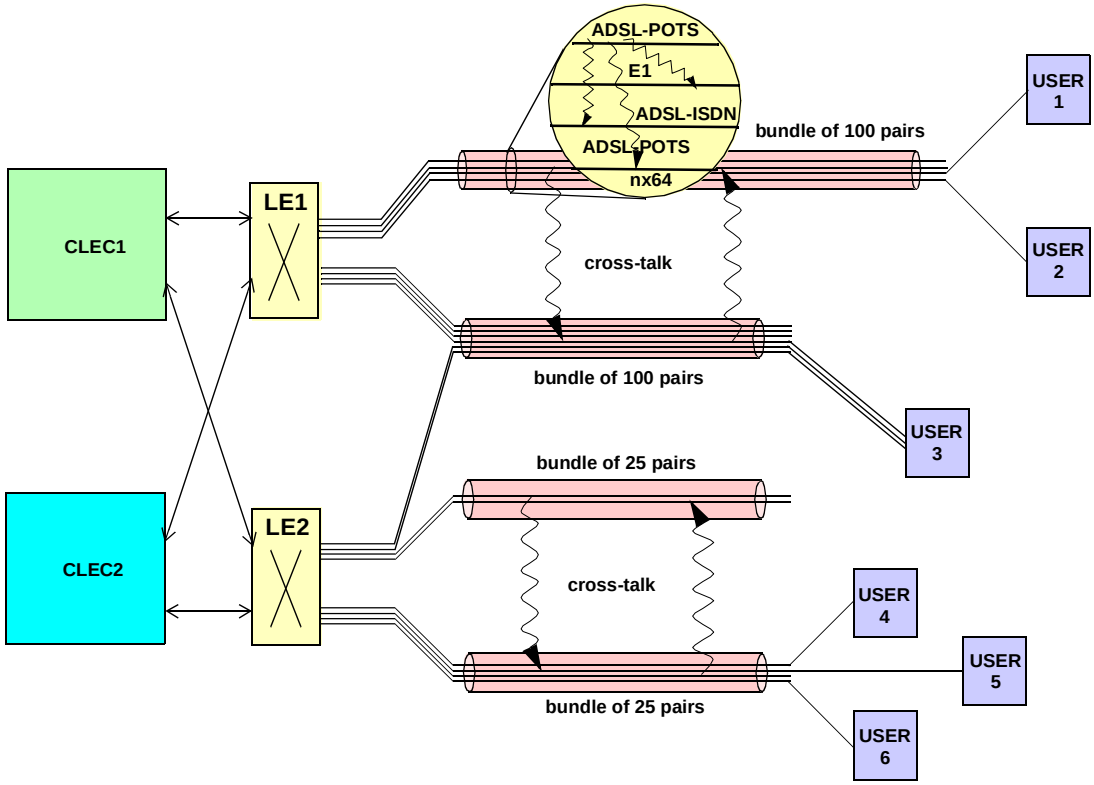

Figure 2 When the pairs are not isolated, they are exposed to cross-talk, the physical phenomenon that consists of the spureous transference of energy from a metallic wire to the adjacents.

Cross-talk is the cause, the spureous transference of electromagnetic energy between pairs, that limits the number of services in neighbouring pairs, and even in adjacent bundles of pairs, lowering the quality of the signals, and producing errors. Obviously, the electromagnetic coupling between pairs of the same bundle is much bigger compared if they are in adjacent bundles.

In practice, the coexistence limits related to cross-talk are expressed based on the degree of penetration of each signal in a determined interfering environment. The degree of penetration of a signal is defined as the maximum number of signals of same type that may occur in an interfering environment, without lowering the quality of service under certain limits defined beforehand. The degree of penetration is of crucial importance for the CLECs in establishing their business perspectives, since it is a parameter that limits the number of the potential users of the CLEC services.

Service Qualification

Several analogue and digital parameters are used to define the quality of the new services, most of them depending on the transmission technology and the application protocols:

- Specific performance parameter for each type of signal. For example, for the signals that use DMT as a modulation, the maximum ascendant and descendant rates are a valid parameter, since these rates depend on the performance of the link measured during the transceiver training and channel analysis procedures in the initialization phase.
- Analogue parameters, such as SNR that you can apply to a wide range of signals. Usually, these are parameters that call for a different performance limit for each type of signal, depending on their robustness when facing interferences.

- Digital parameters, like BER, make it possible to establish, under certain conditions, communal performance limits for a heterogeneous group of signals. This requires that the BER measurement is made not at physical layer, but at higher layers, independent of the physical one. It could be made at ATM level, for instance, as this would also notably simplify the measurement procedure.
- Application performance. Once the network has been installed, it is necessary to check the connectivity and the protocols that manage the service. An IP ping and an FTP would be the most basic test.

What Next?

The regulation of the ULL can only be explained starting from the previous monopoly situation not yet overcome. The new operational environment should be transitory and it should not slow down the development of new, alternative infrastructure that would finally make space for real competition and put an end to the conflicts caused by the local loop unbundling.

While waiting for this new situation to arise, the CLECs and the ILEC must be involved in ULL trials to test the access network, in oder to know the real status of the copper loop. Once the roll-out has been achieved, it will be necessary to monitor the quality of the legacy and the new services running simultaneously. New platforms, based on SNMP, will provide real-time information to both operators, while checking the SLAs (Service-Level Agreements) that regulate the co-existance of the incumbent and new operators.

However, it will be difficult to lease advanced services on a large scale, because the access network is not prepared for it, nor will it always be economically profitable. And if there is a very high demand, new loops should be installed to overcome the limitations.