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Sharing infrastructure, how to proceed

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Keywords	electronic communications, access regulation, infrastructure sharing, NGA
Abstract	NGA investments request several forms of infrastructure sharing due to the high level of investments, their efficiency vary dramatically following circumstances and areas. The right choice is a key feature to facilitate infrastructure competition. The purpose of the paper is to compare the different available architectures.

1. Introduction

Telecommunications (then essentially fixed telephony and leased lines) have long been a public monopoly. It was generally considered that it was a "natural" monopoly, a situation in which it was more efficient to have one company in the market rather than several.

The 90's saw the gradual opening of the telecommunications sector to competition. The milestone was reached on 1 January 1998: all telecommunications services were liberalized.

The two successive regulatory frameworks had the objective to incentivize infrastructure investments to replicate the success of the mobile competition, the success of a competitive operator would depend of his degree of independence from the incumbent.

However the investments for the access infrastructure become huger – even for the mobile business – and the requirements for Return on Investment become higher and quicker. To invest for the limited customers' base of a single operator become more difficult, in particular in less dense areas.

A lot of consulting companies have published studies demonstrating this point for fibre investments; there is divergence of point of view about the more efficient technology and topology and about the position of the break-even point, but in any case it exists such point. For mobile operators, the signature of different agreements RAN sharing between competitors proves that the infrastructure sharing is a necessity in some circumstances.

We must point an important difference between fix and mobile infrastructure:

- Mobile access networks are dimensioned in function of the traffic (with an lower limit for coverage), thus with a low level of unused capacity; the sharing gives only volume effects' sparing
- Fix access networks are dimensioned in function of coverage; thus any passed home not customer is an used investment; the unit investment cost per connected customer increased with the number of infrastructure in competition; sharing gives a higher usage of the infrastructure and lowers the unused capacity.

2. Forms of sharing

2.1. Unbundling

This type of sharing is well known and do not request further explanation. Unfortunately, technological progress in FTTC, some topology in FTTH and closure of local MDF make the unbundling more complex, even impossible. In particular, BEREC has reviewed the consequence of vectoring in FTTC on regulatory measures. Unbundling gives to Alt Net a large independence without to need to replicate the costly passive infrastructure.

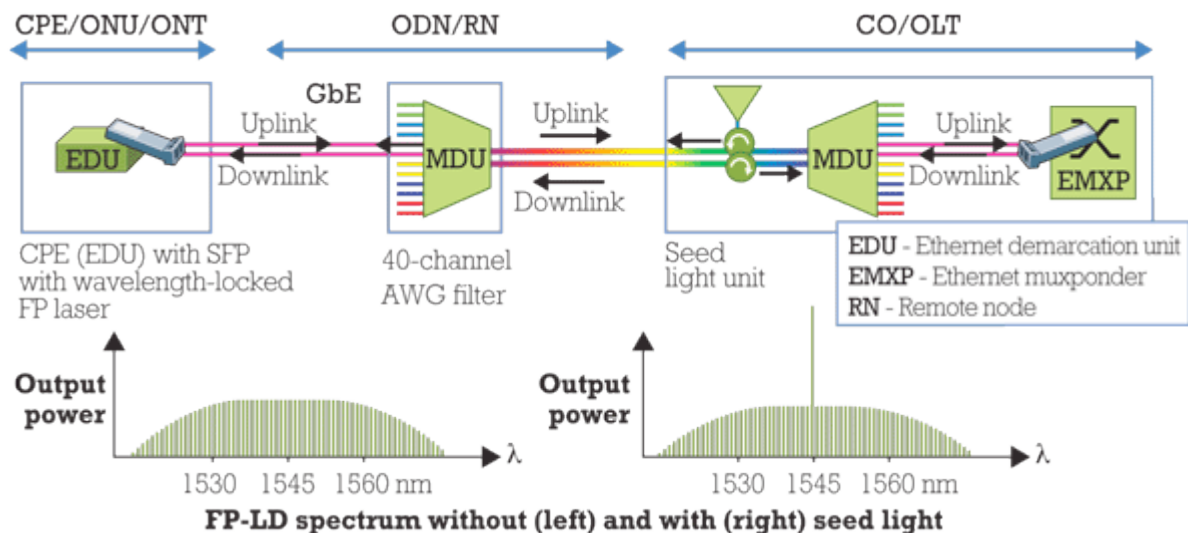
Un bundling is basically the renting of a wireline dedicated to a single user, the location of the point where unbundling can be provided move closer to the end user for most of the technology with the consequence that investments are growing and scale effect decreasing.

2.1.1. Central office

The historical point of unbundling is the Central Office (CO) where tens of thousands lines are accessible. The equivalent in cable network is the headend but no dedicated lines are available at these points.

Networks architectures providing such access are:

- Legacy copper network ADSL/SDSL without any vectoring for frequencies below 2 MHz in the network
- FTTH Point to Point
- FTTH WDM-PON (dedicated allocation of wavelength), to do not confuse with NG-PON2 (see supra):

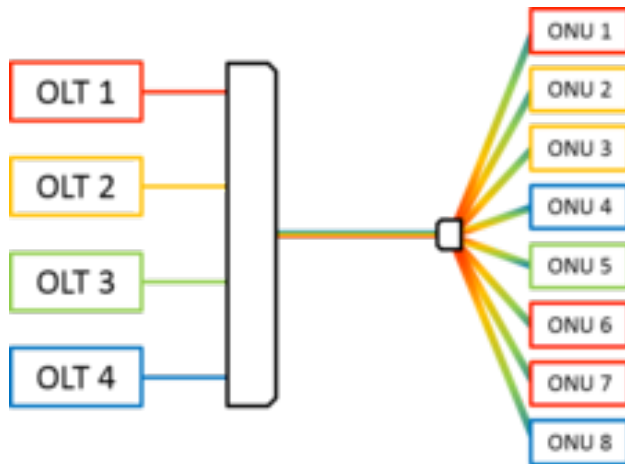


2.1.2. Curb

The following point for unbundling is the curb where a few hundreds lines are accessible. The equivalent cable network is the hub (with more end-users than the curb) but no dedicated lines are available at these points

Networks architectures providing such access are:

- Legacy copper sub-loop VDSL without vectoring
- FTTH GPON
- FTTH NG-PON2 (dynamic allocation of wave-length):



These unbundling's request the possibility for alternative operator to install in street cabinet or in manhole their own VDSL DSLAMs or PON splitters.

The main costs is the backhaul to these points and thus duct sharing and/or dark fibre from Central Office is required.

2.1.3. Distribution points

The following point for unbundling is the curb where a few tens lines are accessible. The equivalent cable network is the optical node (with more end-users than the curb) but no dedicated lines are available at these points

Networks architectures providing such access are the same that at the curb with shorter lines, for legacy copper, G.Fast is also usable at this point but G.Fast uses allways vectoring and the unbundling becomes de facto impossible.

Requirement for street cabinets, manholes are backhauling are the same.

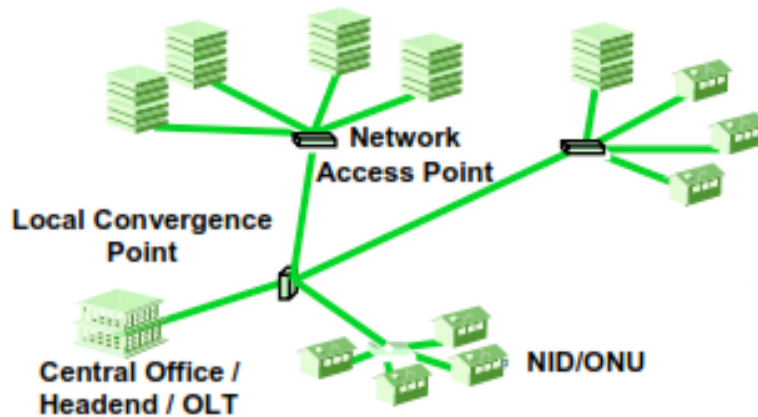
2.1.4. Front door

The point to access to the end user is "Front door" (sometime called Network Access Point), just before the building, in fact the drop cable/fibre. Typically the access is limited to 4 lines. The equivalent point in the cable networks is the tap and is the alone point where the coax is dedicated to a single end-user.

It is no more really unbundling because the number of access points is very high and thus very expensive to access. But the drop cable/fibre can be a barrier when the owner refuse new works at home and can be seen such a significant barrier when the cost is multiply by the number of

households. Access to these points is a remedy compliant with the directive to decrease investment's cost of very high broadband.

It must also be noted that aerial deployment of GPON can restrict access of fibre networks to these points such for the cable networks. To reduce the number of fibres to be install (e.g. for weighth problems) a first splitter (typically 1:16) is installed at Curb or Distribution point and a second one (typically 1:4) at Front door, giving such architecture:



2.2.Frequency unbundling

The frequency unbundling authorize the services of two different operators at the same end user on a single line. The well-known case is the shared pair where the SMP operator provide PSTN on the low frequencies (up to 4000Hz) and the alternative operator provide broadband on frequencies above.

Another case could be on the cable but two main problems prohibit this type of solution:

- Generally cable operator uses the major available frequencies for the retail end-user, available channels are not sufficiently numerous to deploy an equivalent offer and increasing the bandwidth of the cable is an expensive solution, not reasonable to impose in a SMP case
- Unbundling frequencies is easy for the television (analogue and digital) but more complex for broadband because the frequencies implemented usable in CMTS are limited, in particular for upload, reducing performances for both operators

2.3.Bitstream / VULA

The second regulated product is bitstream / VULA (Virtual Unbundling Local Access). Borders between them are vague, in most countries bitstream is a basic product but in some ones, bitstream is more.

VULA has been preliminary defined as a temporary solution for the case where fibre unbundling should be difficult (GPON is often viewed as difficult, and for some people, impossible to unbundle), the time that investment authorize the unbundling itself. It is became a “substitute” with the new

list of relevant market including VULA as part of market 3a (local access) and no more as a remedy for the case where unbundling is impossible.

Definition of the “local access” is so difficult with evolution of networks and closures of Central Offices that BEREC have defined a more general term “Layer 2 Wholesale Access Product” with two types of handover points (closer as possible of end-user for local and regional) with less features required at regional points only to encourage investment up to the “local” handover (all features are possible from both handover points).

Furthermore, the main case is no more the fibre but the copper due to the vectoring problem. Vectoring request that the DSLAM measure disturbance of all the VDSL lines of the subloops. Standardization does not include any mechanism to connect different DSLAM to communicate this measure (where real time is an absolute requirement). Work on such feature start after deployment and has been dropped by ITU before to arrive at a solution. Italian regulator have impose such mechanism MOV (Multi-Operator Vectoring) but the result is a national standard not published due to the fact that operators estimate that VDSL 35 MHz not vectored is so performant that VDSL 17 MHz vectored and that resources should be best used to develop MOV for G.Fast.

VULA cannot be seen as a substitute for unbundling, it is really a fallback solution when unbundling is impossible. The difference with physical unbundling are:

- Alternative operator does not climb the ladder of investment (no investment in access equipment’s)
- Alternative Operator dos not have free choice of the capacity of the equipment and of implemented feature
- Alternative operator have no direct control on management of the equipment for installation and repair
- Sometime the rates are not flat and depends of the requested throughput and capacity, that is not the case for physical unbundling

2.4.Duct sharing

Most of regulators have imposed remedies of duct sharing as ancillary services to unbundling or by national law, Commission should like to extend this obligation to all owner of ducts (and thus also to non-telco companies). It permits to avoid a lot of civil works costs, however some difficulties occur for implementation:

- The available capacity does not match necessary with an efficient topology for a new access network
- The available capacity is limited with the risk to serve only the first ones that request capacity
- The SLA of non-telco owner of ducts can be incompatible with the demand of telcos

2.5. Sharing civil works

Sharing civil works is recognized as an important source of cost saving. It is implemented by the obligation for any operator to inform his competitor of any works and to propose to participate. A best way is to implement such obligation as urbanistic rule applicable to all utilities and telcos. It permits to share other civil works such the modernization of water ducts.

The main disadvantage is that cost sharing is proportional to the sections of the different participants with the result that the new entrant pay the same amount that the incumbent for a lower market share, it can be seen as a subsidization of incumbent by its competitors. To decrease this distortion, a way should be to impose to the first mover (thus the operator that estimates that it exists a viable business case with civil working for himself only) to invoice to competitors incremental costs with complementary payment in function of the gain in market share of each competitor. It should balance civil engineering costs in the time in function of scale effect of each operator.

2.6. Co-investment

Co-investment is a step after the sharing of civil works because it does not concern passive infrastructure only but also active one: there is an agreement between parties for a common development planning at mid and/or long term. The works are allocated between parties that invest each in areas with a swap agreement of capacities between these areas. Such agreement can be interpreted as cartel and thus request preliminary legal inquiries to be sure to avoid any complaint afterwards.

Another type of co-investment is to share the costs of investments and each party have the right to use a certain capacity with only maintenance costs as recurring fee. Such objective can also be achieved by IRU (Irrefragable Right of Use) that is also considered as an asset for the company.

2.7. Wholesale passive infrastructure company

The step further is to create a company that invest only in passive infrastructure (including building for colocation, street cabinets, manholes, ...) to rent it to all operator under non-discriminative form. This company can be a public one (mainly created by local authorities), private one (e.g. Reggefibre before to merge with KPN) or an association between several telcos (in this case, the possibility of cartelization complaint must be analyzed).

In Belgium, the statute of agreed cooperative is particularly well adapted at such association. International networks SWIFT and SITA are located in Belgium to beneficiate of this one:

- Variable capital: easiness to join and to leave
- Parity – or limitation – of voting rights: no dominant partner
- Return on capital in two parts:
 - Fixed fee in percentage of invested funds (maximum 6%)

- Variable fee (in function of benefits) in function of turnover of the cooperator: de facto cost oriented furniture
- Activity limited to provide services to cooperators: each of them can offer wholesale services to non-cooperators without the risk of conflict of interest with the cooperative

3. Conclusion

The future of the European Telecommunications request first to invest in increasing throughput capacity of the access networks. It is easier for cable industry because the last mile can be upgraded easily and civil works are limited to fibres requested to reduce the number of home passed per coaxial segment. Incumbent and Alt Net must invest in fibres up to the end users. Depending of situation (existing ducts, density of home passed, ...), investments request very different financial capacities with a large scale or Return on Investment, sometime negative. We must also take into account that finance are not unlimited and available to invest everywhere in Europe, only the most rentable areas will be equipped. It is thus important to open a maximum of alternative investments and, for European authorities, to avoid too strict view of cartelization and public aids.

The next for European Telecommunication is to have a sufficient flexible way to finance requested investments and to minimize infrastructure investments for the benefit of services investment to avoid to pass the major part of added value to OTT providers, that are most American.

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