Calculation of the costs of efficient provision for some electronic communications services provided at the wholesale level in Romania

ETHERNET BACKHAUL MODEL DOCUMENTATION

ANCOM

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VERSION FOR CONSULTATION

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Summary

0 Context and objectives

0.1 Regulatory context

According to ANCOM's President Decision No. 653/2010, significant market power (SMP) operators on the fixed market have the obligation to provide backhaul Ethernet services at efficient cost-oriented tariffs.

The goal of this document is to describe the cost model used to calculate the cost of the Ethernet backhaul service. This document does not discuss the regulated prices that will be set on the basis of costs, as these regulated prices will be subject to a second consultation document. This document is divided into 3 sections:

- The first section lists the unit costs and inputs used by the cost model (see section 1),
- The second section details the cost calculations carried out (see section 0),
- The last section details the efficient cost of providing the services (see section 3).

In the next paragraph, the Ethernet backhaul service and its components are described.

NB: the model and its results highly depend on the results of the fixed core model. The latter being reviewed in parallel, it is important to keep in mind that any change to this model will affect the Ethernet backhaul cost model.

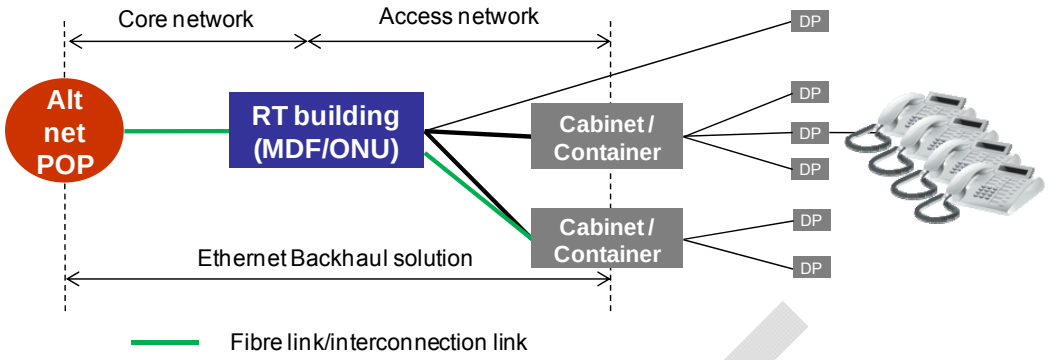
0.2 Ethernet backhaul description

Pursuant to the deployment of DSLAMs at the cabinet or container for the purpose of the implementation of FTTC/ADSL and FTTC/VDSL by Romtelecom, competitors may need to get a Ethernet backhaul solution to be able to deploy their own DSLAMs/MSANs and compete with Romtelecom.

Such a solution typically includes (see figure below):

- Fibre link from the Cabinet/Container to the Romtelecom's building to which the fibre of the cabinet is connected to;
- Core network capacity between this latter building and the point of presence (PoP) of the competitor.

Figure 1 – High level description of the Ethernet backhaul service



Source: TERA Consultants

The following figure details the components of the offer. The components of the Ethernet backhaul service are:

1 Part from the point of presence of the alternative operator to the Romtelecom's building ODF to which the cabinet is connected to. This part uses only the fixed core network of Romtelecom.

2 The part linking the ODF at Romtelecom's building to the ODF at Cabinet/Container. This corresponds to a fibre link laid in a trench.

3 The additional required equipment in Cabinet/Container is made of:

a. 1 Ethernet switch;

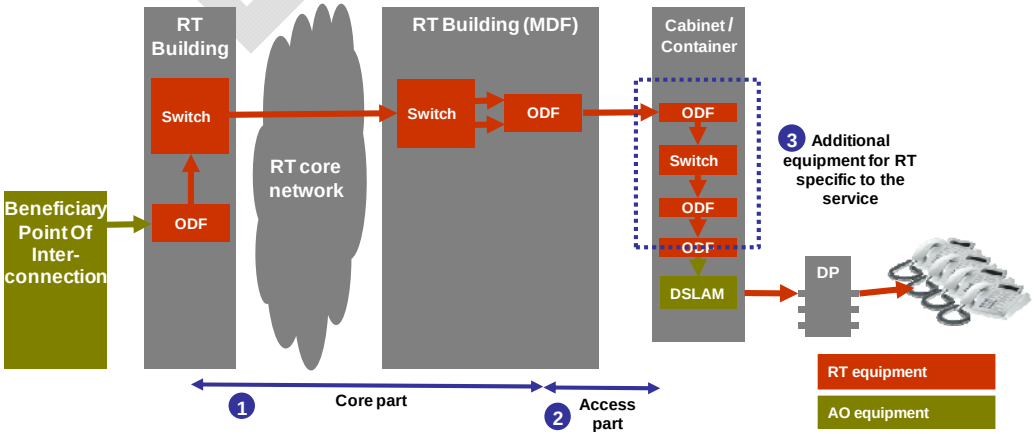
b. 2 ports for the ODF;

c. 1 aggregation port for the switch;

d. 1 service port for the switch;

e. 2 patch cords between the switch and the ODF;

Figure 2 – Components of the Ethernet backhaul service



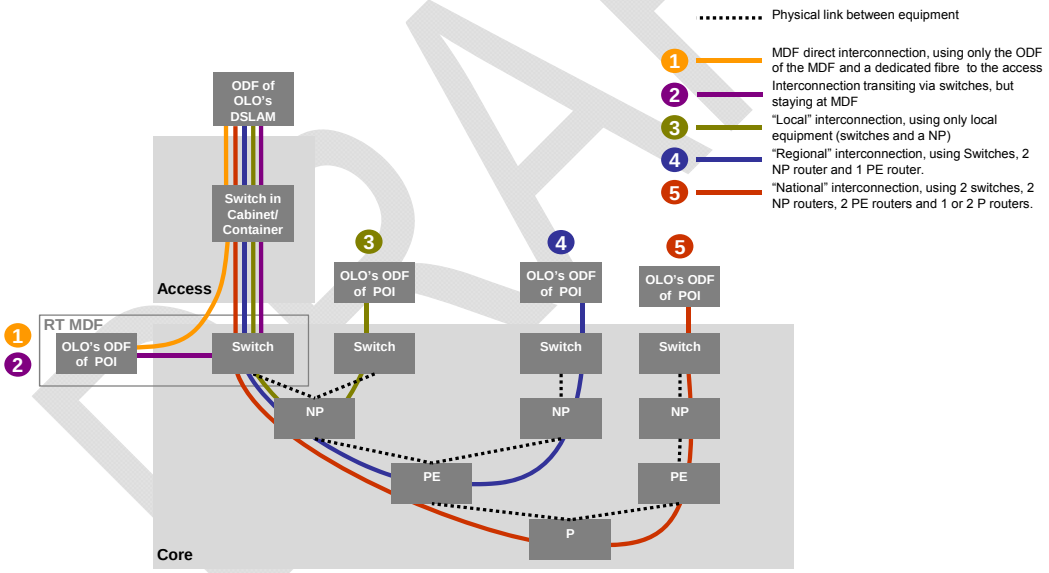
This description is based on the document “Backhaul Ethernet – service description” provided by Romtelecom.

The Ethernet backhaul cost model is calculating the cost of all the components described above.

Depending on where the alternative operator is interconnected to Romtelecom’s network and especially on how far it is from the cabinet/container where it has installed its equipment, the Ethernet backhaul service will use more or less of the core network. As a consequence, the Ethernet backhaul service has been split in five services depending on the level of interconnection of the operator. The closer the alternative operator is interconnected to its equipment in the cabinet/container, the lower the Ethernet backhaul price it will pay will be.

The following figure details the five services modelled by the Ethernet backhaul model:

Figure 3 – Five services modelled in the Ethernet backhaul model



Source: TERA Consultants

The first service uses:

- at the cabinet, a connection from the ODF of the OLO’s DSLAM to the Romtelecom’s switch;
- at the cabinet, Romtelecom’s switch;
- a dedicated link from the Romtelecom’s switch at the cabinet to Romtelecom’s ODF at Romtelecom’s building (MDF);
- a patch cord from Romtelecom’s ODF to OLO’s ODF at the MDF.

The second service uses:

- at the cabinet, a connection from the ODF of the OLO's DSLAM to the Romtelecom's switch;
- at the cabinet, Romtelecom's switch;
- a shared link from the Romtelecom's switch at the cabinet to Romtelecom's switch at MDF including 2 ODF ports and 2 patch cords;
- a capacity of Romtelecom's switch at MDF;
- a dedicated link from Romtelecom's switch at the MDF to OLO's ODF via a patch cord.

Services 3 to 5 uses:

- at the cabinet, a connection from the ODF of the OLO's DSLAM to the Romtelecom's switch;
- a shared link from the Romtelecom's switch at the cabinet to Romtelecom's switch at MDF (including two ODF ports and two patch cords), then
    - Scenario 3 uses a local leased line to OLO's ODF of Point of Interconnection;
    - Scenario 4 uses a regional leased line to OLO's ODF of Point of Interconnection;
    - Scenario 5 uses a national leased line to OLO's ODF of Point of Interconnection.

NB: the service can also be provided at the Distribution Point instead of the cabinet/container.

Another approach has been implemented in the model where the cost of each network element is calculated separately and where the alternative operator, depending on what it needs for Ethernet backhaul, will have to sum the cost of the different elements of network (approach "a la carte"). 5 elementary costs are here identified:

- For the access part (which cost also depends on the speed and on whether the alternative operator wants to get access to a DP or a PCP) :
    - Direct link from Cabinet/Container/DP to OLO's ODF located at the MDF (no additional core element required);
    - Shared link from Cabinet/Container/DP to OLO's ODF located at the MDF but going through the switch at the MDF (no additional core element required);
- Direct link from Cabinet/Container/DP to the closest MDF (additional core element required).For the core part (to be added in case the "Direct link from

Cabinet/Container/DP to the closest MDF" is used) which cost depends also on the speed required:

- Switch-NP segment;
- NP-PE segment;
- PE-P-P segment.

1 Inputs of the Ethernet backhaul service

1.1 Introduction

Considering the components of the Ethernet backhaul service (core part, fibre link, elements at the cabinet/container), the inputs of the model are of 3 types:

- Inputs from the fixed core model. Indeed, the fixed core model developed in parallel to this model and which is described in the document "Calculation of the costs of efficient provision for some electronic communications services provided at the wholesale level in Romania – FIXED CORE MODEL DOCUMENTATION" published by ANCOM calculates the cost of all the elements of the core part:
    - ODF and Ethernet switch to which the alternative operator is connected to,
    - Capacity in the network between this Ethernet switch and the Romtelecom's building to which the cabinet/container is connected to (including fibre, trenches and electronics).

  As a consequence, a cost per Mbps will be extracted from this model as an input to the Ethernet backhaul cost model.
- Inputs from the fixed access model developed in 2010. Indeed, the fixed Ethernet backhaul service uses fibre cables installed in trenches located between a Romtelecom building and a cabinet/container. The cost of the infrastructure of this part of the network has already been calculated in the fixed access network. As a consequence, cost of trenches and length of network can be used to derive inputs for the Ethernet backhaul cost model.
- Additional unit costs for elements installed at the cabinet/container.

More details are provided in the next sections.

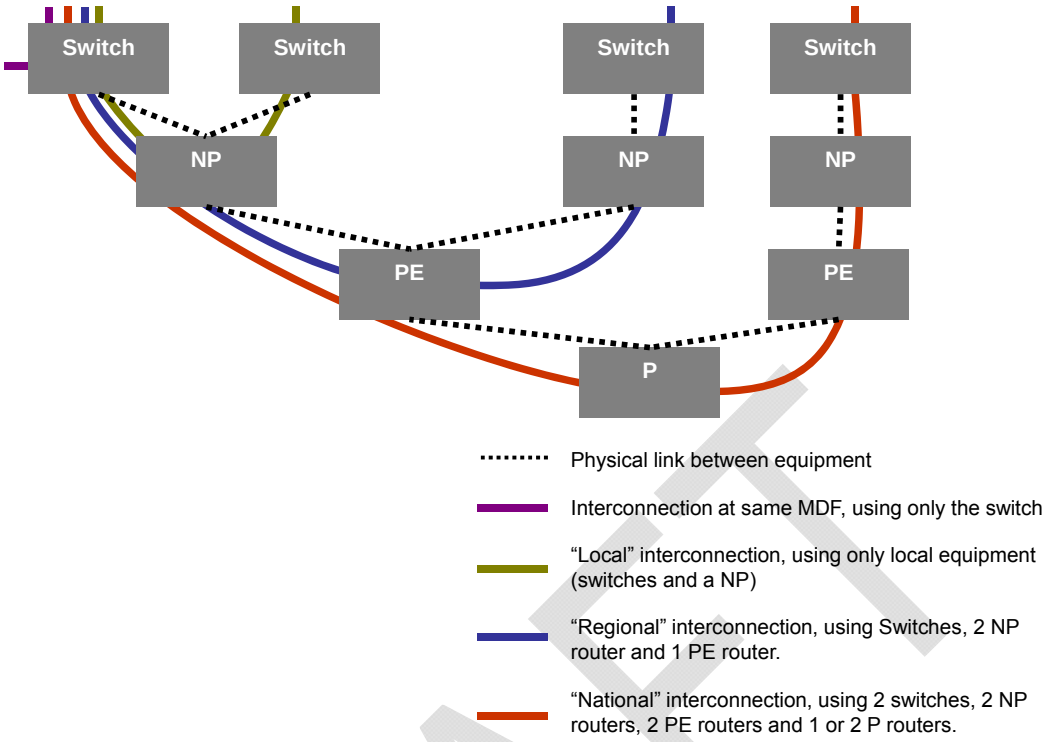
1.2 Core part of the Ethernet backhaul service

Between Romtelecom's building where the Beneficiary is interconnected to and Romtelecom's building providing access to the Cabinet/Container, the Ethernet backhaul uses capacity of the fixed core network. The cost of this capacity is established in the fixed core model. It is calculated taking into account the equipment required at different levels, in order to evaluate the costs of leased lines/capacity using different levels of the network. Such a cost includes all costs from the ODF where is plugged the beneficiary PoI to the remote ODF at Romtelecom's Building. In fact the capacity necessary on the core network for the provision of the Ethernet backhaul can be viewed as an MPLS/Ethernet leased line.

However, the cost of this capacity of the core network depends on several factors:

- First of all, the cost depends on the capacity required. The fixed core model can calculate a cost per Mbps and therefore, the cost varies in proportion to the traffic (10 Gbps will cost 10 times higher than 1 Gbps). However, a gradient can be applied to this unit cost, but as gradients are pricing tools, they are not discussed in this document and will be discussed in the second national consultation.
- Second, the cost depends on the types of equipments that the traffic generated by the Ethernet backhaul service is crossing. In other words, it depends on the location on the one hand of the DSLAM of the beneficiary and on the other hand of the PoP of the beneficiary. For example, the cost of the capacity will be lower if only NP routers are crossed compared to a situation where NP and PE routers are crossed. Four categories of costs can be calculated in the fixed core model (see figure below):
    1. Capacity needed only at the MDF (using only the local switch)
    2. Capacity needed staying local (using equipment up to the NP router);
    3. Capacity needed going up to regional (using equipment up to the PE router);
    4. Capacity needed going national (using equipment up to the P router);

Figure 4 – Possible traffic flows in the core network for the Ethernet backhaul service



Source: TERA Consultants

As a consequence, the cost of the core part of the Ethernet backhaul service shall be expressed in €/Mbps/year and can be of 4 types. Please note that the cost calculated for interconnection at Romtelecom building (MDF) only takes into account the switch cost, but not ODFs and patch cords costs which have to be added.

1.3 Fibre link between the MDF and the cabinet/container

In order to provide a high speed connection to the Cabinet/Container, a fibre link has to be established. It is assumed that Cabinets/Containers which provide the service are already equipped with a DSLAM by Romtelecom. A fibre cable is therefore already installed. Only the cost of the additional fibre pair used in the already deployed cable between Romtelecom's building and the cabinet/container needs to be taken into account.

This cost has been established on the basis of the 2010 fixed access network cost model which provides the cost of an 8-pair fibre cable. From this cost and considering an utilisation ratio for the fibre cable of 15% (meaning that 15% of fibre pairs are used in this cable), a cost per fibre is calculated. This cost per fibre is uplifted to account for joint costs (this doubles costs, according to TERA expertise). As the prices of the 2010 fixed access network are for the year 2010, they are increased by price trends for cable and installation of cable to get today's prices.

The fibre cable is installed in trenches and ducts which already exist.. Trench and ducts costs are fully recovered by the Local Loop Unbundling (LLU) prices calculated by the 2010 fixed access network cost model. As a consequence, any trench cost should normally not be considered relevant for the calculation of the fixed Ethernet backhaul cost between the cabinet/container and Romtelecom's building.

However, the model has the functionality to take a share of trench cost into account. In this case, rather than to allocate 50% of trench costs to fibre and 50% to copper (since both fibre and copper use the same trench), it is proposed to allocate trench costs based on the space occupied by fibre and copper cables. In this case, because 8 pairs fibre cable are significantly smaller than main copper cables of 500-1000 pairs, an estimation of 15% of the cost would then be attributed to fibres.

The cost of trenches is already calculated in the 2010 fixed access model. The average cost for a link MDF building – cabinet can be extracted from the model and adapted to today's prices.

Depending on the geotype considered, the average length of a link MDF building-PCP is estimated between ✂ and ✂ meters and the average length of a MDF building-PCP-DP is estimated between ✂ and ✂ meters.

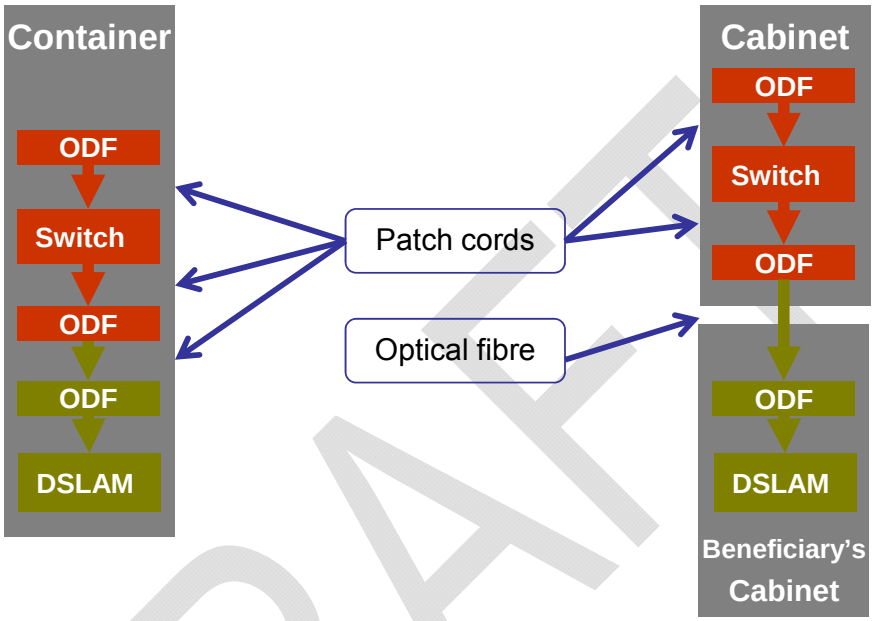
1.4 Costs at cabinet/container

The last part of costs relates to the additional equipment required at the cabinet/container at a PCP or at a DP. Providing an Ethernet access at a cabinet/container implies an Ethernet switch to be installed in the cabinet/container. As described earlier, the different elements needed are:

- Ethernet switches. A model proposed by ANCOM technical services has been implemented. For this switch, ANCOM provided an unit cost on which a 22% installation cost has been added. Romtelecom proposed a sharing usage factor of 50%, which means that half of ports are used by Romtelecom and alternative operators. For the Ethernet backhaul service, one port is needed to connect the alternative operator DSLAM/MSAN and another port is needed to connect to the fibre link. Costs per 1 Gbps or per 10 Gbps link are then calculated.
- At the cabinet/container, 2 patch cords (see figure below) and ODF connections are required.
- Finally, the switch consumes power and requires air conditioning. As a consequence, additional costs need to be taken into account. The power and air conditioning requirements are taken from the Cisco Website and data provided by Romtelecom for the core network. Unit costs come from different sources:
    - The power cost per Wh has been provided by Romtelecom;

- The air conditioning annualized cost (equipment, installation and maintaining) has been evaluated by TERA at 2.4€ per BTU/h;
- The additional power equipment annualized cost (batteries, rectifiers, etc.) has been evaluated by TERA at 0.15€/W.

Figure 5 – Types of equipment needed at the container or at the cabinet for the Ethernet backhaul service



Source: TERA Consultants

For comparability reasons, the model has the functionality to take into account other switch models at the cabinet/container, though some of them may seem disproportionate for the provision of the services.

2 Calculations

2.1 General approach

Based on the inputs described in the previous section and on the different possible configurations for the provision of the Ethernet backhaul service, the model calculates the costs of providing Ethernet backhaul services as follows:

- By multiplying unit costs by quantities of assets needed listed in section 0.2 (number of switches ports, number of ODF ports, number of Gbps, length of trench, length of fibre, etc.);
- By depreciating each investment (see below for the depreciation approach);
- By summing the different components of the Ethernet backhaul service to get a monthly cost for the service.

2.2 Depreciation

Like for the fixed core model, annuities are calculated using the tilted annuity method, by assuming in the formula that the first annual cost recovery is happening one year (in average) after the investment is made.

The formula used is:

$$A_t = I \times \frac{(\omega - p)(1+p)^{t-1}}{1-\left(\frac{1+p}{1+\omega}\right)^n} \times (1+\omega)^{payment\_term}$$

Where,

- A_t is the annuity of year t;
- I is the investment;
- ω is the cost of capital;
- t is the year considered;
- n is the asset life;
- p is the tilt (price trend of the asset in the long term);
- Payment_term is the difference in time between the investment is paid and the first payment is received. When this parameter is set at 0, the formula already includes 6 months of payment terms (equivalent to one year between the first annual cost recovery and investment is made).

Economic asset lives are used in the cost model. Asset lives have been provided by Romtelecom for most of the assets of the fixed core network. Otherwise, data are based on benchmark and TERA's expertise.

- Switches: 12 years
- ODFs: 12 years
- Patch cords: 20 years
- Fibres: 20 years
- Trenches: 30 years

Price trends are used in order to take into account changes in prices. Romtelecom did not provide any information related to price trends. The model therefore based its assumptions on an international benchmark of price trends and other assumptions, consistent with the ones used in the fixed core model.

3 Main results

The annual costs of providing the Ethernet backhaul service depend on:

- Capacity requested;
- Whether a cabinet or a container is considered;
- The distance between the DSLAM and Romtelecom's building (which depends whether the place considered is a PCP or a DP and on the geotype considered)
- How far the fixed core network is used.

As explained in section 0.2, another approach has been implemented in the model where the cost of each network element is calculated separately and where the alternative operator, depending on what it needs for Ethernet backhaul, will have to sum the cost of the different elements of network (approach "a la carte"). The results of the cost elements are listed in the table below:

At this stage of the consultation process, the model results themselves are not relevant.

4 Illustrations table

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