BUREAU VAN DIJK

Fixed Interconnection

Cost Modelling Solutions

The Fixed IC Environment

Introduction

Fixed Interconnection is seen as a key element for creating competition in the telecommunications market. It allows new market entrants to access end-users of the incumbent operator on a basis that will promote investment, diversification of services and market growth in the telecommunications services sector. Decisions taken by operators or national regulatory authorities (NRA) with regard to interconnection are therefore of utmost importance to the development of the national telecommunications market.

Pricing for interconnection services is without doubt one of the most critical issues in the debate between NRA's and the incumbent operators. The European Commission's Recommendation on Interconnection, part 1[1], which is used as a guideline for interconnection pricing within the EU as well as in numerous countries outside the European Union, recommends the use of long run average incremental costs as the most appropriate basis for determining interconnection tariffs and hence meeting the requirements needed to develop a competitive telecommunications market.

[1] Commission Recommendation 98/195/EC of 8 January 1998 on Interconnection in a liberalised telecommunications market. Part 1 - Interconnection Pricing. (OJ L 228, 15.08.1998, p.30), amended 29 July 1998

[2] Adopted on 8 April 1998

[3] FDC is also often referred to as Fully Allocated Costs (FAC)

Part 2 of the same Recommendation[2] deals with Accounting Separation and Cost Accounting systems for the implementation of interconnection obligations with particular regard to the principles of transparency and cost orientation.

The European Interconnection Recommendation has led to the development of several costing models, developed by both incumbent operator and NRAs, in order to determine accurate cost based interconnection charges. Under the recently approved new EU regulatory framework for interconnection, these issues remain crucial, since the NRAs will receive more autonomy in their decision making process.

The implementation of these models can be based on several different approaches, each approach having its specific advantages and disadvantages. The Bureau van Dijk Management Consultants have acquired during the recent years a profound knowledge and broad experience with regard to the development of such models and the assistance of operators and NRA's with their interconnection decision process.

Different Modelling Approaches

Interconnection models can be roughly classified into two categories: top-down models and bottom-up models.

Top-down models

Top-down models use the financial accounts of the operator as a starting point. The concept of top-down models has evolved significantly during the last five to six years and the operators and NRAs that wish to implement a top down model have to consider carefully which approach they will choose in order to develop a regulatory cost model.

The most straightforward approach to build a top-down model is the fully distributed cost method (FDC)[3]. With this method, all costs are

allocated to the different services of the operator. FDC can be implemented using historical cost accounting (HCA), i.e. based on actual historical figures derived from the financial statements, or using current cost accounting (CCA). Under CCA, a revaluation of the historical asset prices and their corresponding operating costs is carried out to reflect the costs an operator would have if it were to procure or construct and maintain these assets at today's prices.

A fully distributed cost approach does not question the (in)efficiency of the operator. There is however general concensus in the EU countries that interconnection tariffs should reflect the costs of an efficient operator. To take into account the possible efficiency gains, FDC is not very suitable and other theoretic approaches have been developed of which the *long run average incremental cost* method (LRAIC) is widely accepted.

Long run average incremental costs assume that only the extra cost of providing certain services or traffic (=increment) should be taken into account. It is very common to define this increment as the total amount of voice telephony services. Moreover, LRAIC assumes a cost structure of an efficient operator. This means that efficiency gains that could be realised by the operator within a long term perspective, should be modelled and reflected in the cost results.

Bottom-up models

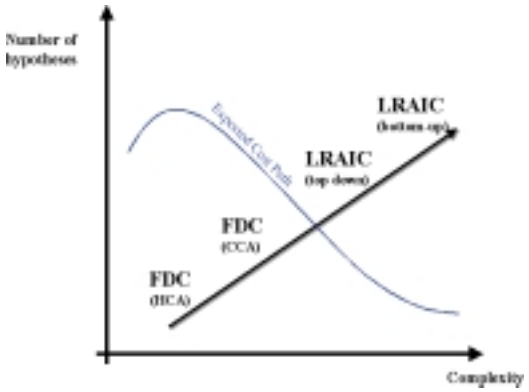
A completely different approach is provided through the use of bottom-up models. Bottom-up models start by modelling the technical infrastructure of the network. This can be the actual structure of the operator (*scorched node approach*) or a completely newly designed network, as if the operator were to build an entirely new network today (*scorched earth approach*). Often however, the current network structure is taken as a starting point for optimisation; this approach is called a *modified scorched node approach*.

Once the (optimal) technical structure of the network has been modelled, the financial cost of providing services on this network can be calculated and tariffs can be set. The use of these models will enable operators and regulators to take well-thought out interconnection decisions.

Selecting the Appropriate Approach

Different modelling approaches can lead to considerably different results. The figure below illustrates the approaches discussed above. Fully distributed cost methods usually result in simpler models, but higher interconnection costs than those that are calculated by LRAIC top-down models. Calculations of bottom-up models, depending on the definition of the increment, usually result in relatively low costs, but are often more difficult to construct.

The choice of the appropriate approach is linked tightly to the competitive situation of the domestic telecommunications market and the goals the operator or regulator wishes to pursue. Tariffs in markets that have been liberalised only very recently, are often based on top-down FDC calculations.



The implementation of FDC relates closely to the internal cost accounting systems of the operator and can thus be implemented fairly fast. Moreover, the results of top-down FDC models can easily be reconciled with the financial accounts of the company.

A LRAIC-approach can be implemented by adapting FDC top-down models or by developing separate bottom-up models. These models are often used in combination with the

results of a top-down FDC model. The operator or regulator however has to bear in mind that the results of the LRAIC-calculations are not always directly appropriate to set tariffs: LRAIC-calculations could result in tariffs that do not necessarily stimulate investments or that do not enable the incumbent operator to recover its costs. LRAIC results are however often used to set price caps.

One should not forget that it is always important to consider the impact of the tariffs on the development of the market, as well as the impact on the operator's ability to continue its operations. The Bureau van Dijk Management Consultants have the required experience and knowledge to assist operators and NRA's with these considerations.

Presentation of the Bureau van Dijk Fixed IC Modelling Solutions

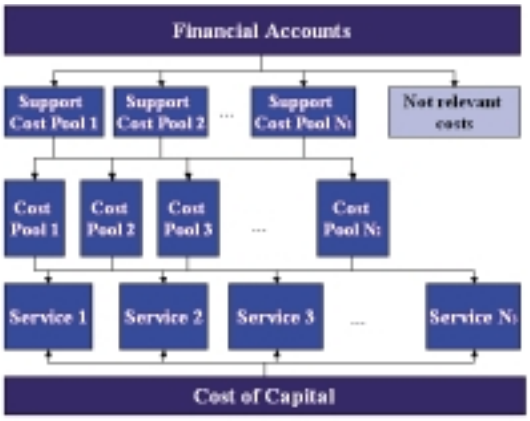
Bureau van Dijk Management Consultants have many years of experience in the development of top-down and bottom-up models that concern a wide range of interconnection services. In 1996 already, Bureau van Dijk developed its first top-down FDC model for the Belgian regulator. Today, several models are actively used to support operators and NRA's in taking some of their most important decisions, i.e. the setting of interconnection tariffs.

The BvD Top-down Modelling Solutions

Bureau van Dijk Management Consultants have developed several top-down models for interconnection. Bureau van Dijk's consultants have worked during different phases of the liberalisation process, and fully realise the impact of external and internal specificities on the modelling process. Because of this, Bureau van Dijk's top down modelling approach allows a large degree of parameterisation.

The parameterisation of a top-down model depends largely on the organisation and structure of the incumbent operator, national accounting standards and the surrounding regulatory environment.

The general structure of a top-down model to determine the costs of Services 1 to N can be illustrated as follows:



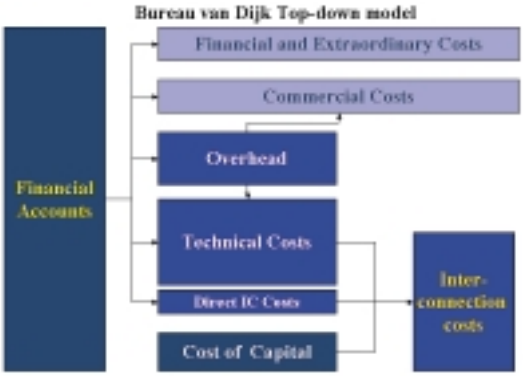
Starting from the aggregated financial accounts, the costs are allocated to the different services of the company by means of several cost allocation steps. Costs that are not relevant for the Services are eliminated.

In the following paragraphs, an example is given of how the Bureau van Dijk top-down model was parameterised for the Belgian regulator.

Basic principles of the top-down model

The top-down model developed for the Belgian regulator, in close collaboration with the Belgian incumbent, is based on a Fully Distributed Cost methodology under Current Cost Accounting (FDC-CCA). The model is built in complete concordance with the EU guidelines as well as the best practices principles defined by the independent regulators group (IRG). The basic assumptions that have been used to build the model are the following:

Fully Distributed Costs: With a Fully Distributed Costs methodology, all operating costs from the financial accounts are allocated to the different services of the operator. The Bureau van Dijk top-down model, developed for the Belgian regulator, does not take into account the Financial and Extraordinary costs as they appear in the financial accounts: financial costs are replaced by the introduction of a 'Cost of Capital', extraordinary costs are disregarded, as they are not relevant to the interconnection service.



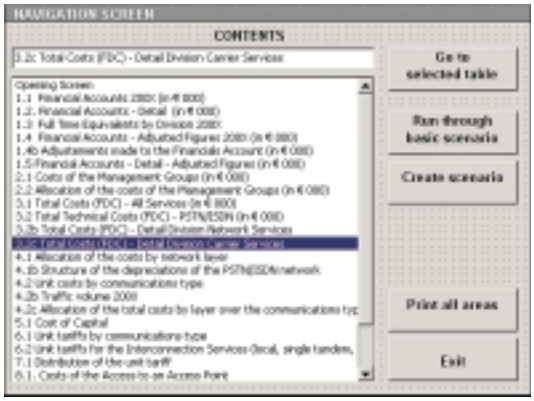
All costs are allocated in full accordance with the principle of cost causation. This means that costs are allocated to those services that actually cause these costs. Therefore, the costs are divided in a number of categories: a distinction is made between costs that are directly and indirectly attributable to services, and the non-attributable costs.

Direct costs can be directly allocated to a specific service; e.g. costs related to the establishment of interconnection agreements are direct costs for the interconnection services. Costs that have no causal relationship with any service, i.e. non-attributable costs, will be allocated in a very general way. For the indirectly attributable costs, specific cost drivers have to be identified. These cost drivers can be fairly general (e.g. traffic-volume, full time equivalents) or very detailed (e.g. routing factors). A better identification and quantification of the cost drivers requires the development of separate (Activity Based) Analytical Costing-models within the company. By doing so, the development of a top-down model led to a better understanding of the cost structure of the company and of the profitability of each of its products.

Current Cost Accounting: The Belgian top-down model is parameterised to provide HCA as well as CCA-tariffs. The introduction of Current Cost Accounting first requires a revaluation of the assets of the operator. In a next step, the corresponding operating costs will be revised as well. Information on the volume and age of the assets, as well as financial and technical depreciation periods, modern equivalent assets, current prices, etc. have to be collected and its appropriateness has to be evaluated. Based on the quality of the information, the actual Current Cost Accounting revaluation methodology can be fixed. The CCA-costs as defined in the Belgian top-down model are already a fairly good reflection of the LRAIC-costs. Still, the introduction of efficiency factors is needed to move to a model that is completely compatible with the LRAIC approach. These efficiency factors were however not quantified for the Belgian incumbent operator as the regulator has decided to determine LRAIC interconnection costs based on a bottom-up model.

Structure of the model

The Bureau van Dijk top-down interconnect model can be parameterised using Microsoft Excel™ software. The well-ordered user-interface facilitates an easy understanding of the model's numerous functions.



The model contains two modules. A first module deals with the determination of the terminating and collecting tariffs. The second module is developed to fix the tariffs for Access to Access points, Interconnect links etc.

The cost allocation process

The final objective of the cost allocation process is to identify those costs that relate to the interconnection services. The Bureau van Dijk top-down model for the Belgian regulator starts by re-establishing the link between the financial accounts and the organisation of the company. The total number of entities of the company is then divided in commercial divisions, technical divisions, and support divisions. First, all costs

related to the support divisions ('overhead costs') are split over the commercial and technical divisions. As no commercial costs are allowed in the Belgian interconnection tariffs, all costs related to the commercial divisions can be disregarded. In a second step, all direct interconnect costs are identified and allocated directly to the interconnection services. The cost allocation process can now focus entirely on the indirect costs of the technical divisions.

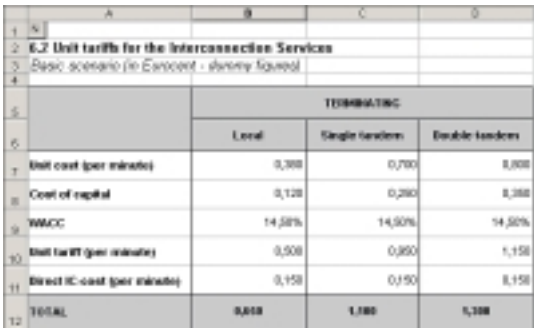
The remaining volume of costs is first allocated to the different network layers. The total cost per network layer can then be allocated to those communications services that make use of the respective network layers by using the traffic volumes and the routing factors.

All consecutive allocation steps can be perfectly parameterised to ensure a perfect mapping with the underlying economic and technical reality.

Calculating the final interconnection cost

In order to obtain a good indication of a reasonable level for the interconnection services, a cost of capital has to be added to the operating costs of the financial accounts. This cost of capital is determined by multiplying the weighted average cost of capital by the mean capital employed.

Finally, the average cost per minute is split in a set-up and a duration cost and a differentiation is made for the tariffs for the peak and off-peak periods by using a tariff gradient.



6.7 Unit tariffs for the Interconnection Services

Basic scenario (in Eurocent - dummy figures)

	TERMINATING		
	Local	Single tandem	Double tandem
Unit cost (per minute)	0,300	0,700	0,800
Cost of capital	0,120	0,250	0,350
WACC	14,58%	14,50%	14,50%
Unit tariff (per minute)	0,500	0,950	1,150
Direct IC-cost (per minute)	0,150	0,150	0,150
TOTAL	0,650	1,100	1,300

Importance of customisation

The above description of the top-down model developed for the Belgian regulator, illustrates how a general model needs to be adapted in order to reflect the specific situation of the operator and its national environment. A large degree of interaction between the different parties involved is therefore an absolute requirement. Bureau van Dijk Management Consultants therefore stress the importance of substantial face-to-face communication with people from both the regulator and incumbent operator when parameterising the model.

Although customisation always remains an important issue, the efforts to customise a bottom-up model are much smaller. This modelling approach is described in the following paragraphs.

The BvD Bottom-up Modelling Solutions

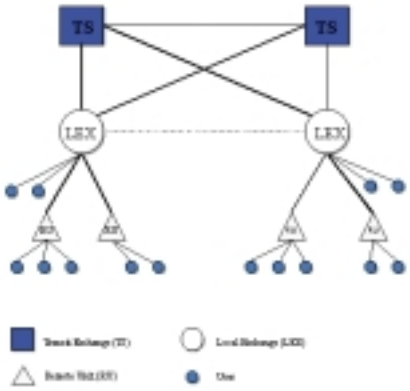
The consultants of Bureau van Dijk have acquired a profound knowledge in assisting telecom operators and NRAs in their interconnection negotiations. To improve the quality and consistence of the decision making process, Bureau van Dijk Management Consultants have developed an adaptable LRAIC bottom-up model which calculates costs and tariff ranges for several telecommunication services. The model can easily be parametrised to reflect the unique nature of any operator and takes into account the unique structure of the operator's network.

Basic principles of the bottom-up model

The Bureau van Dijk bottom-up model is a Total Element Based Long Run Average Incremental Cost model (TELRAIC). The model is built in complete concordance with the EU guidelines as well as the best practices principles defined by the independent regulators group (IRG). The basic assumptions that have been used to build the modelled are the following:

Total Element Based: The technical part of a telecommunications network can be described as a collection of switching and transmission equipment that constitute transmission links and switching nodes, also called elements. When setting up a call (voice or data), it uses a certain amount of these elements, defined by the routing tables.

The figure below illustrates this schematically. Calls are initiated at end-user's terminal equipment. The data flows e.g. over the tranmission links to the local switches (LEX), sometimes using a transit switch (TS), back to the local switch, and finally arrives at another end-user's terminal equipment.



To calculate the (simplified) cost of such a call, it is sufficient to know the total cost of each of these elements[4], and the total volume of the calls that passes through each element. The costs are calculated by the Bureau van Dijk model. The volumes can be either the actually technically measured volumes or theoretical values. By dividing these two factors, an element usage cost is calculated.

The main advantage of working with element-based cost models is that it provides an excellent transparent view on the cost structure of the technical network. It is also very helpful to simulate the impact of technical optimisation schemes on the cost structure of the network.

Long-Run: When parametrising the model, a time horizon has to be chosen that reflects the period under which all cost become variable. This should allow the operator to achieve an optimised network situation. The impact of the time horizon is considerable: a too short time span does not leave sufficient freedom for efficiency gains. However, when looking too far in the future, the risk of developing a cost model that makes too many assumptions with regard to future technologies, has to be kept in mind. It is therefore important that the time horizon and the different technological implications of this choice, are discussed in detail before the actual parametrisation of the model takes place.

Average Incemental: The Bureau van Dijk model, in its default mode, defines the increment as the totality of all PSTN/ISDN services. Common costs are thus allocated to all these services on an average basis. However, the Bureau van Dijk model allows parameterisation of the increment. This means that the model allows 'what if' simulations by changing the increment from e.g. the totality of services to one specific service. These kinds of simulations are extremely valuable when defining price caps. Moreover it provides operators and NRAs with a profound insight of the impact of different allocation rules for common costs on the full cost structure of the operator's telecommunication services.

Costs: The Bureau van Dijk bottom-up LRAIC model not only determines the technical network costs. All operator's other cost that contribute to the provisioning of the modelled services are taken into account in the model. Three important information sources are used to collect this information: financial information from the operator's accounts, international benchmarks from other operators and national benchmarks that contain information from competing operators. The high level of detail of the Bureau van Dijk model guarantees that all cost categories are included in the model, which results in a realistic cost structure of the operator's services.

(Modified) scorched approach: The Bureau van Dijk bottom-up model can calculate tariffs based on *a scorched node approach*, where the network structure of the incumbent does not differ from the real network structure. However, the model has several optimisation modules to calculate *modified scorched node* tariffs, which take into account a technical network optimisation.

[4] In practice there are other considerations such as the split between peak and off-peak that have an important impact on the costs of a call

The model, in its standard version, does not provide *scorched earth* calculations, i.e. calculations based on a completely new redesigned network. If these calculations are required, the Bureau van Dijk Management Consultants will present a separate module to obtain scorched earth results.

Structure of the model

At the heart of the Bureau van Dijk bottom-up model lies a Microsoft Access™ referential database. The use of standard software tools guarantees a complete compatibility with the Microsoft Windows™ operating system.

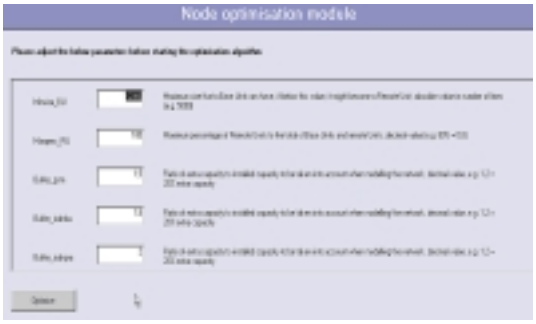
The model contains two technical databases and a cost database. The structure of the technical databases is illustrated by the figure below.

The first technical database models the technical network, i.e. the switching and transmission elements. The second technical database is automatically generated as a result of the automated optimisation procedures. It contains the structure of the theoretically optimised network. The degree of optimisation can be defined and is dependent on the preferred approach, i.e. scorched node or modified scorched node.

Parametrising the model

The initial technical database contains, in its default mode, a complete list of each network node that is needed for the provision of the services that are to be modelled. For each node, a wide range of data can be stored in the database, e.g. the number of PSTN/ISDN lines installed, the number of PSTN/ISDN lines actively used, the number of busy hour call attempts (BHCA), … The level of detail of this technical database can be easily adjusted to the needs of the operator or the NRA.

Once the initial technical database has been modelled, the optimisation process can start, in order to create a technical structure of an efficient telecom operator. The optimisation algorithms recalculate required hardware capacities for the switching and transmission network, taking into account the provisions for possible market growth or decline within the strictly defined time horizon. Next, under the modified scorched node approach, the algoritms optimise the structure of the network by consolidating local exchanges to remote exchanges where appropriate.



The figure above shows an optimisation input screen in the Bureau van Dijk bottom-up model.

Calculating the technical network costs

When the optimisation process has been ended, an 'optimised' database, containing the same level of detail as the original database, is automatically generated. This database contains all the information necessary to calculate the required numbers of all the different elements that are needed to provide the modelled services. The use of this second detailed database facilitates the transparency of the optimisation algorithm and guarantees a much simpler reconcilation process, since the operator and the NRA can refer at any time to the database to look at the impact of the decisions made when optimising the network.

Once the optimal network structure has been modelled, the technical network element costs can be calculated. Using the cost database of the model, this process is fairly straightforward and completely automated. However, some decisions regarding depreciation methods and periods still have to be made. The figure above represents one of the depreciation input screens of the Bureau van Dijk bottom-up model.

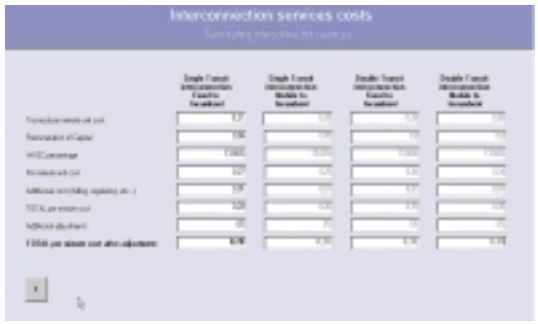
Calculating all other relevant costs

Not only technical costs are calculated by the Bureau van Dijk bottom-up model. All other costs that are not directly related to the technical provision of the network are also added. This calculation uses the cost database as its information source. Examples of these costs include the costs of capital, overhead costs, sales and marketing costs, regulatory costs, …

It is important that these costs are realistic and that they represent a situation that the operator can achieve within the time horizon that was defined. Therefore, different sources such as the financial accounts of the operator, international benchmarks and other national operator's financial information can be used to collect this information.

Calculating the final interconnection costs

When all cost information is combined with the volume data of the operator and the network routing factors for every modelled service, interconnection costs can be automatically calculated. These costs can be expressed in time units (seconds, minutes) or, if required, in capacity units (e.g. cost per Mbit).



Finally, a split between set-up cost and duration costs can be calculated. The Bureau van Dijk model easily allows implementation of the decision rules that are used by the operator or t he NRA to calculate the split between set-up and duration costs. The figure above illustrates a typical output screen of the Bureau van Dijk bottom-up model that gives an overview of the interconnection costs for single transit and double transit PSTN/ISDN services.

Reconciliation with existing cost data

The results of a bottom-up model should not be used without looking with great detail into the results of the model. It is of the utmost importance that a reconciliation with an existing top-down model or the operator's real financial figures is made, in order to analyze the differences that exist between the 'optimal' results of the bottom-up model, and the 'real' cost situation of the operator. If tariffs are based solely on the results of the bottom-up model, they could possibly have an undesirable impact on the telecommunications market or on the operator.

The reconcilation process can be highly accelerated by using the analysis tools of the Bureau van Dijk bottom-up model. The figure

above shows a screen of an analysis whereby the interconnection cost is split in its different components. The desired level of detail can be adapted to satisfy the specific needs of the operator or NRA. This integrated way of reconciling the model ensures a smooth and consistent reconciliation that can be used to take final decisions with regard to the tariff structure of the operator.

Customised Advice

Depending on the specific situation of the incumbent operator and its economic, political and regulatory environment, each modelling approach has its own advantages and disadvantages. The impact of the choice of this modelling approach however is very significant. Therefore, the consultants of Bureau van Dijk Management Consultants assist operators and regulators in making this choice. This allows operators and regulators to achieve their specific goals concerning their interconnect strategy. Moreover, our broad understanding of the economic, financial, technical and regulatory issues, as well as our extensive experience in negociating interconnection tariffs, guarantees a smooth implementation of the selected approach.

List of Abbreviations

BHCA	Busy Hour Call Attempt
CCA	Current Cost Accounting
FAC	Fully Allocated Costs
FDC	Fully Distributed Costs
HCA	Historical Cost Accounting
IRG	Independent Regulatory Group
ISDN	Integrated Services Digital Network
LEX	Local Exchange
LRAIC	Long Run Average Incremental Cost
NRA	National Regulatory Authority
PSTN	Public Switching Telephone Network
RU	Remote Unit
TELRAIC	Total Element based Long Run Average Incremental Cost
TS	Transit Switch

For further information on the presented services and / or on the projects that were realised, please contact Ms. Tine Debusschere, consultant in Brussels (tdb@bvdmc.com) or Mr. Michel Vajou, consultant in Paris (mva@bvdic.com)

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