

Charging Regimes for Interconnection Services

Future Options and Potential Outcomes

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Abstract: Over the last few years, many discussions have centred around the issue of interconnection rates and their economic impact on the market. Interconnection charging in Europe is still based mainly on the calling party pays (CPP) principle combined with element based charging (EBC). Due to the convergence of the classical PSTN/ISDN and the IP world to next generation networks (NGN), the different charging principles and systems are being reviewed to determine the optimal solution for the future.

In its working program for the year 2008, the Austrian Regulatory Authority (RTR) launched an industry working group on charging principles and systems for wholesale services. This paper highlights some of the central issues of the discussions that have taken place and contains the authors' views and conclusions.¹ Further, the paper identifies possible charging systems, as well as economic assessment criteria for these systems and how the different charging systems may be evaluated with respect to those criteria.

Regarding the usefulness of industry working groups, the work has shown that these lead to a higher degree of transparency between regulator and market players as well as a better understanding between the market players themselves. The main drawback is that working groups are time consuming and that it is almost impossible to agree on meaningful outcomes.

Regarding the assessment of the charging models it was possible to derive a set of 10 criteria according to which charging systems can be evaluated. There was a rather broad consensus on the delineation of charging models as well as the economic criteria. When it comes to the results of the evaluation, the discussions brought forward very controversial views amongst the participants. No common views could be achieved on which the charging model fulfills the defined criteria in the best manner.

Key words: Interconnection, NGN, charging principles, CPP, Bill&Keep.

¹ For results of the working group, please see <http://www.rtr.at/de/tk/AbrechnungssystemeVL>

■ The working group in Austria

At the end of 2007, an industry working group was established in Austria to deal with the current charging regime for wholesale services. The reason to establish the working group was to be able to debate long-term developments outside regulatory (dispute) procedures. The goal of the working group was to work towards a common position or at least a joint understanding of the market players regarding potential future charging systems and principles.

Participants of the working groups were the regulatory authority as a host as well as the operators, industry organisations (associations) and also consultants, and advisors to operators.²

The working group started with a meeting on Bill&Keep at the end of November 2007. Since then, 13 meetings have been held, the last on the 28th January 2009.³

In the working group, there was a broad consensus on the delineation and definition of the charging regimes. Further, outcomes were derived for the criteria, which should be used to evaluate the charging regimes. When it comes to the evaluation of the charging regimes, though, the working group could not agree on the assessment of the charging regimes. Hence, regarding the evaluation of the models, this paper primarily represents the views of the authors considering the discussions within the working group.

■ Possible charging regimes identified

More than ten different charging models were identified. Beside the current CPP/CPNP regime with LRAIC regulation for termination rates currently applied by the authority, the following regimes were included in the analysis.

² In the course of the project – as a documentation of the discussion was desired – SBR Juconomy Consulting supported the RTR as co-authors for the documentation of the discussion.

³ A list of the meetings and the presentations can be found on the homepage of RTR, see footnote 1. Also the final report (in German) has been published there.

Enhancement of the current LRAIC methodology

Currently in Austria, termination rates are calculated on the basis of Long Run Average Incremental Costs (LRAIC) of an efficient operator. The result from previous proceedings has been that Telekom Austria in fixed termination markets and mobilkom in mobile termination markets have represented the efficient operator in the respective markets. Up until the end of 2008, according to a decision of the regulator (Telekom-Control-Kommission; TKK), the former asymmetric mobile termination rates were regulated to a reciprocal level by using a glidepath, by which the smaller operators' rates were gradually reduced to the rates of the most efficient operators (mobilkom). From 1st January 2009, the rates should, according to this decision, be symmetric.⁴ Within the working group, the following alternatives to modify respectively to enhance the current regime based on CPP/EBC and LRAIC as cost standard were discussed:

- LRAIC where the efficient costs are determined for each operator based on his individual costs. This would lead to different interconnection rates for each operator, based on operator specific parameters including e.g. size of the operator, spectrum allocation, network topology, etc.
- A unified LRAIC determined for all operators. This could be the LRAIC of an average operator or a hypothetically efficient operator.⁵ The last approach refers to the costs of an operator with a normalized size, e.g. for a market of 4 mobile operators, the market size of this hypothetical/theoretical operator would be 100% divided by 4 operators equalling 25% and the resulting figures in terms of size, traffic etc. would be applied to determine the costs.
- Changes of the cost accounting standard in the sense that the fixed cost accounting standard is applied to mobile termination and vice versa. At the time being there are some differences between those standards (e.g. where the access network is not considered in the cost accounting model for fixed termination it is in the cost accounting model for mobile termination rates).
- A unified termination rate for fixed and mobile operators based either on the fixed or on the mobil termination rate.

⁴ The decision was suspended by a Higher Court. TKK is currently working on a new decision on mobile termination rates.

⁵ The cost of most efficient operator is the approach currently applied in Austria.

Bill&Keep

Bill&Keep⁶ is a charging regime which does not foresee outpayments to the operator of the called customer, i.e. no termination rates. This means that the network operators have to cover the costs of termination by other means than wholesale charges. Variations of Bill&Keep exist, such as e.g. COBAK (Central Office Bill&Keep) which foresee interconnection payments for transit services.

Capacity based interconnection pricing

Capacity Based Charging (CBC) for interconnection is a charging regime by which charging takes place according to either ordered or effectively used interconnection capacity. Capacity Based Charging can come in two different variations:

- *CBC with pre-booking*: In this case the fees are determined according to the ordered network capacity. Usually, either the number of dedicated links, the number of interconnection links or ports is used as the charging unit. The key aspect is that the actual usage does not have an impact on the interconnection payments made. Capacity Based Charging in this design allows for the largest possible certainty about forecasting and network planing but it also implies some degree of risk for the buying operator with respect to inefficiency or limitation, e.g. the buying operator has to pay if it orders too much capacity. If too little capacity is ordered, it may be difficult to get additional capacity at short notice. Retrading of capacity may help to reduce such problems.

- *For CBC without pre-booking*, fees are determined on the basis of the actually used network capacities for interconnection in a defined period (e.g. in peak-time). The charging unit thereby is the transmission capacity required in the peak time in kbit/s, Mbit/s or Gbit/s correspondingly. This design of the charging regime is feasible for services for which the capacity requirements are difficult to forecast. The supplier of such a service may face some difficulties due to lack of planning.

⁶ The request to introduce Bill&Keep by one of the mobile operators in a dispute procedure in 2007 was one of the motives to initiate the industry working group.

Volume based charging

With volume based pricing operators compensate each other not on the basis of measured minutes but based on the data volume exchanged. The unit which is paid for depends on the granularity of the volumes of data (MB, GB, etc.).

Interconnection prices based on different quality of service

This charging regime implies that interconnection prices differ according to quality parameters, such as e.g. delay, jitter, latency etc. (JAY & PLÜCKEBAUM, 2008, p. 13). In voice communications it is, at least internationally, a standard to pay different prices for different quality classes of transmission. This regime could become even more relevant in the future involving a general trend towards multiple service networks with services requiring different QoS. This charging system allows differentiated pricing at the wholesale level according to the quality offered.

IP peering

The term peering describes voluntary, non-regulated interconnection relationships between two or more independent IP based networks for the mutual hand-over of data traffic. Thereby, it is not required that the data traffic exchanged originates from one of those two (inter)connected networks directly. It is also possible to exchange data traffic which one of the participants has received from third parties (e.g. based on another interconnection relationship).

Peering originates from the interconnection of IP based networks of internet service providers. Regarding peering, different interconnection scenarios with respect to charging can be mentioned:

- *Settlementfree Peering*: The exchange of data traffic takes place for all involved parties without charging of fees for the exchange of traffic.
- *Paid Peering*: At least one of the involved networks enables peering only against payment. This regime will be used especially where networks with asymmetrical data volumes plan to conduct peering or in a situation where one of the parties involved enjoys a kind of dominance on the market which allows to charge for data traffic in a peering scenario.

- *Hybrid models*: In these models both paid and settlement free peering applies. Thus, settlement free peering is only agreed for the portion of traffic which is symmetrical. Asymmetric traffic is then charged for.

Another type of interworking in the Internet, besides peering, is *transit*: A network uses the transit offered by a third network in order to send and receive traffic to/from other networks. Transit arrangements are based on service level agreements and they are not free of charge.

The features of peering are characterized by voluntary arrangements and mutual benefit. A regulatory obligation, e.g. a remedy, would counter this general idea. As soon as one of the networks involved does not see the benefit of peering any longer it will start – depending on the contractual situation – the process of depeering. The importance of peering is increasing due to the growth of relevance of internet service providers for the exchange of traffic. Also due to the parallel existence of IP and telephony "worlds" the application of different charging models which are rooted in these different network designs (e.g. peering in the IP world vs. CPP in the telephony world) have been discussed.

"Pure LRIC" according to the EU draft recommendation

This charging regime ⁷ is based on the EU draft recommendation. One of the central points of the new "pure LRIC" approach is the definition of "incremental cost". The definition used in the recommendation is based on the economic concept of avoidable cost. According to the recommendation the service increment "termination" should be the last increment of the cost regime and only those costs should be considered which are explicitly caused by this service increment (or can be avoided if external termination was not provided). Since non-traffic sensitive cost (e.g. non-traffic driven coverage cost) should not be considered, the costs of termination come close to the economic concept of long run marginal cost.

Whereas the current LRIC methodology is more or less a fully distributed cost approach the concept of "pure LRIC" comes closer to the concept of real marginal cost pricing.

⁷ Reference is made to the commission's proposal, see:
http://ec.europa.eu/information_society/policy/ecomm/library/public_consult/termination_rates/index_en.htm

The working group also looked at two other charging systems – marginal costs and competition in termination markets (see KRUSE, 2006; DE BIJL *et al.*, 2007) which are not discussed in detail here.

■ Relevant criteria for assessing different charging regimes

This section discusses which criteria are relevant for assessing and analysing the different charging regimes with respect to the goals and aims of regulation (maximizing consumer and producer welfare). The criteria were developed by the working group and reorganised/restructured and analysed in more detail throughout the discussion process. In total, a set of ten criteria was investigated and they are largely in conformity with the criteria mentioned in the statement of the European Regulators Group in their comments on the EU Commission's draft recommendation on termination rates.⁸ The criteria being analysed are the following:

- *Are competition problems solved?* "Excessive prices" (e.g. as a result of the existence of termination monopolies) and "market foreclosure" were defined as the major competition problems.

- *Are externalities considered?* The working group focused on the consideration of call externalities and whether the charging models and systems take that into account.

- *Does the charging regime set incentives for efficient investment?* Such efficient investment can be assumed to exist if the charging regime displays the correct signals for investment, when the costs and the risks of investments into infrastructure are being covered and when there is confidence in the stability of the charging principles for a longer period of time.

⁸ In June 2008 the EU Commission published a (draft) recommendation for public consultation on termination rates which foresees a number of far reaching measures to bring down mobile and fixed termination rates. In its response, the group of European Regulators (ERG) discussed the criteria for assessing different approaches to termination regulation and mentioned (1) allocative efficiency, (2) cost recovery, (3) symmetry, (4) competition, (5) consumer benefits, (6) promotion of efficient investment (e.g. productive and dynamic efficiency), (7) consistency across number states, and (8) ease of implementation/regulatory burden as important criteria an efficient charging regime should fulfill, see: http://erg.ec.europa.eu/doc/publications/consult_term_rates/erg_08_31_rev1_resp_publ_cons_term_rates.pdf. On this matter also see for example STEELE, 2008; MARCUS, 2008a.

- *Does the charging regime set incentives for efficient network usage?* Sub criteria are whether the charging regime leads to an efficient allocation of supply and demand. Further questions were: (1) Are there risks of an over- or under-usage of the networks through the charging regime and (2) Are the prices covering the costs of network extensions in the long term?

- *Are there any arbitrage possibilities due to regulation with regard to the charging regime?* The question can be assessed by looking at three specific aspects: (1) Does the regime set incentives for inefficient routing (tromboning/refiling)?, (2) Is arbitrage avoided in combination with specific technical measures? and finally (3) Would the introduction of the charging regime in only a limited number of countries or specific market segments lead to arbitrage possibilities?

- *As a sixth criterion, transaction costs were analysed with regard to the implementation of a new charging regime.* Thereby, the amount of required additional investments due to the introduction of a new charging regime (e.g. new billing systems) including depreciation of existing systems were regarded. Further, the costs of regulation, the requirement of international standardisation in advance of the implementation and the negotiation costs were regarded as important aspects of this criterion.

- *Are there any outcomes on the legal certainty with regard to the implementation of the charging regime?* Thereby, financial impacts of a court decision requiring a roll-back to the current system either before or after the introduction of new charging regime was looked at. Also the possibilities to retroactively correct payments already undertaken were assessed as important because carriers would like to avoid that a court decision with retroactive effect on the payments already done would lead to a chaotic situation.

- *Does the introduction of the charging regime cause disruptive effects and compatibility problems?* Criteria assessed were (1) disruption on the retail level, (2) disruption on the wholesale level, (3) compatibility of the charging regime with regimes in other parts of the world.

- *Is the charging regime future proof?* This ninth criterion covers five aspects: (1) the flexibility with respect to future market developments and technological changes, (2) the adaptability of the charging regime in case of changes of the market environment, (3) the period for which the charging regime can be applicable, (4) the compatibility with next generation networks and next generation access, and (5) the consideration of technological neutrality.

The tenth and final criterion was summarized as "*ensuring of sustainable competition*" and provides an integrated assessment of all previous criteria. Thereby, the subcriteria looked at here were inter alia, if the charging regime ensures efficient market entry, if it avoids hampering of competition between fixed and mobile network operators as well as between small and large operators, if it ensures an efficient amount of investment and to which extent flanking regulatory measures are required.

■ Evaluation of the charging regimes

In this section the evaluation of the first nine criteria is described as a short summary. The tenth criterion is described in the last section because this criterion was seen as the outcome of the other nine criteria.

The working group achieved no consensus between the market participants on the results regarding the evaluation of the systems. Therefore, the results presented below contain the view of the authors only – based on contributions to the discussion.

Firstly, the alternatives of *enhancement of the current LRAIC methodology* are discussed (see Table 1).

The second regime evaluated was *bill&keep*. Regarding the competition problems (1st criterion), the termination monopoly will remain, but as there are no tariffs, there are also no price-induced competition problems. Other competition problems such as foreclosure or scale- and allocative inefficiencies will most likely be of no issue (GALLO, 2008).

Regarding call externalities (2nd criterion), these are better reflected as in the current regime, but it is difficult to say if the allocation of costs between caller and called-party is regarded in an optimal way reflecting the distribution of the utility a call accrues to the calling and called party (in case of two symmetric networks the called party would roughly bear half of the costs).⁹

⁹ For call externalities and the allocation of costs of the call between the calling party and the called party, please refer to GALLO, 2008.

Table 1

Criterion	Alternatives to the current regime
1. Are competition problems solved?	As all alternatives are based on the CPP principle, the monopoly problems remains and the risks of foreclosure will remain, too (*). It is likely that there are better incentives for efficiency when identical LRAIC are applied for all operators (especially when the efficiency standard is defined by the benchmark of a hypothetical operator) than when there are individual LRAIC for different operators. This might reduce competition problems as all operators are forced/have an incentive to be efficient.
2. Are externalities considered?	Due to the fact that the CPP regime remains, the call externalities will remain, too (GALLO, 2008, pp. 36f). For the alternatives for which not all costs are included in the cost standard, the costs are slightly better allocated between the caller and the called party than otherwise. This applies for the fixed network cost models, because the costs for the access part are not included in the interconnection charges.
3. Does the charging regime set incentives for efficient investment?	The evaluation of this criterion was very difficult because wholesale prices create different incentives for incumbents and alternative operators and for complementary and alternative investments. With operator specific LRAIC including all costs, the risks faced by the operators are smaller and hence, the incentives for investments are greater. Due to the fact that the implementation of these alternatives implies only smaller changes to the current regime, the implementation would not create negative incentives as there would be a perception of stability due to the limited degree of change.
4. Does the charging regime set incentives for efficient network usage?	Due to the fact that the cost drivers are more or less replicated by the charging regime, the risk of inefficient usage is limited leading to a positive evaluation of this criterion.
5. Are there any arbitrage possibilities due to regulation with regard to the charging regime?	The alternatives induce problems with arbitrage to a limited extent as the cost drivers are more or less replicated by the charging regime. Regarding mobile services though, there could be arbitrage possibilities as there is a large difference between marginal costs and LRAIC. This could lead to significant differences between on-net and off-net tariffs, which has been the main reason for introducing SIM Gateways.
6. Transaction costs with regard to the implementation of a new charging regime.	These costs are low as the differences to the current regime are rather small (VOGELSANG, 2006, p. 56). The costs of regulation will remain, though. On the other hand, the costs of negotiations between the operators are reduced as most issues are clarified by regulation.
7. Are there any outcomes on the legal certainty with regard to the implementation of the charging regime?	There is a more or less positive evaluation of this criterion because even if the courts would prohibit the new charging regime after the implementation, a return to the current regime is possible.
8. Does the introduction of the charging regime cause disruptive effects and compatibility problems?	One can conclude that the problems with disruption increase the bigger the changes to the tariffs are. If, for example, the mobile cost accounting model was applied to fixed networks, prices for off-net calls to fixed networks would significantly increase.
9. Is the charging regime future proof?	All systems are based on minute based charging which might become obsolete in the future due to the introduction of packet based switching (VOGELSANG, 2006, p. 55). On the other hand, these systems are still flexible and enable e.g. differentiated pricing according to quality of service and premium services.

The outcomes of bill&keep were assessed as rather negative when it comes to the incentives for efficient investments (3rd criterion). As the actual costs are not covered by wholesale tariffs, the operators cannot be sure if they are sufficiently compensated for costs and risks. Further, the introduction of the regime will have disruptive effects with negative consequences for the confidence of the investors. The conclusions regarding this criterion were very heterogeneous in the working group, e.g. due to the hot-potato-dilemma and the actual relevance of wholesale revenues for investment decisions (there was no consensus if there is any relevance at all) (GALLO, 2008, p. 42).

Regarding the efficient network usage, the evaluation was negative, e.g. due to the lack of pricing signals on the wholesale level, the hot-potato-dilemma and the lack of financial compensation for the services (VOGELSANG, 2006, pp. 67f). Reasons can be found for a negative evaluation of bill&keep according to the fifth criterion ("Are there any arbitrage possibilities due to regulation with regard to the charging regime?"). There are large arbitrage problems between the markets with bill&keep and the markets outside the regime due to the large differences in prices between bill&keep and the current CPP/EBC-regime.

The sixth criterion (transaction costs) scored relatively positively. The costs of regulation will be reduced because there is hardly any tariff regulation necessary. This does not apply though, if COBAK is introduced, because then there will still be wholesale tariffs (transit) which might be necessary to regulate. Furthermore the NRA has to decide on the points of interconnection for bill&keep. A positive aspect regarding bill&keep is that there is no need for investments into new billing systems.

The seventh criterion (legal uncertainty) can be seen rather neutrally: as long as the current billing systems are kept for a while after the introduction of bill&keep, the introduction can be rolled-back, with no greater problems.

For the eighth criterion (disruption) it is difficult to say for sure if and how there will be waterbed effects and if these are negative effects for end customers and/or operators, e.g. decreasing call tariffs will be viewed positively by the end-users; on the other hand it is questionable whether the called party would accept a fee for receiving calls.

A negative aspect of bill&keep is that it is less compatible with other systems in other parts of the world. This is due to asymmetric financial streams with CPP/EBC-countries.

The regime is future proof (ninth criterion) because it is flexible and can handle different types of traffic (circuit and packet switched networks). Questions arose in the discussions of the working group if bill&keep is able to cope with the future multi-service environment as there might be problems to charge extra for premium services and services with extra high QoS.

The third regime discussed and evaluated was *capacity based ic-pricing*. As with most other systems, the termination monopoly problem remains with this charging regime. Also regarding the second criterion (call externalities), the same situation as for the current regime exists. Due to the fact that the CPP regime remains, the call externalities will remain, too.

Regarding the incentives for efficient investments (criterion 3), these were not assessed because the impact of this charging model on the investment decisions is rather unclear (e.g. what is the impact of wholesale revenues on investment decisions?). Many operators in Austria seem to view it positively that there is a high correlation between the wholesale price and the actual network costs, leading to a situation where costs and risks are considered by the charging regime.¹⁰ This in turn, reduces the overall uncertainty for investors. Also, the changes due to the implementation of the charging regime are relatively small and therefore there is a stability granted to the investors, which can be viewed positively.

The fourth criterion (efficient network usage) was positively evaluated because the charging principles are correlating with network costs, which means that the pricing is incentivizing efficient network usage (VOGELSANG, 2006, p. 60). The correlation between the tariffs and the cost drivers, leads to the conclusion that there are only limited arbitrage possibilities within the same wholesale market (fifth criterion). However, the parallel coexistence with CPP/EBC regimes could probably lead to arbitrage possibilities: this is because the buyers of the wholesale offers would optimize their usage by using both regimes in parallel with the risk that the supplying operators would not cover their total costs. This can (only) be solved by regulation (VOGELSANG, 2006, p. 77).

The conclusions are rather mixed when it comes to the transaction costs (sixth criterion). Capacity-based ic-pricing does not require any investments in billing systems as the current ones can be used. There is also no need for any national or international standardisation. On the other hand, the cost of

¹⁰ This is also identified by VOGELSANG, 2006, p. 60.

regulation will remain and additionally transaction costs are relevant because new contracts have to be negotiated between the operators.

For the evaluation of the seventh criterion the assessment comprised that there could be extensive problems if courts would repeal the decision to change the charging regime *ex-post*, because no accounting data including the amount of minutes is required to charge for the capacities. This problem can be neutralised, if the old billing systems are used as fall-back solutions for the first years after implementation of capacity based ic-pricing.

It is regarded unlikely that the introduction of capacity based interconnection pricing would cause problems related to disruption and incompatibility (eighth criterion) to a large extent. This was concluded because the underlying charging principle is currently used in the end user markets (flatrates) without extensive problems being observed.

The charging regime is partially future proof (criteria 9), as it can be used to some extent for NGN/NGA networks; e.g. by using different PoI it is possible to handle different traffic classes with regard to different qualities of service. It is not clear though, how the regime would be able to react to larger changes in the industry.

The evaluation of the next regime, *volume based charging* is to a large extent comparable to capacity-based ic-pricing, although there are some important differences. The evaluation as interpreted by the authors based on the discussions in the working group is shown in the table 2.

The next regime evaluated was the *quality differentiated pricing*. Regarding the first two criteria, the regime was equally evaluated as the current regime (e.g. remaining termination monopoly and call externality problems).

Regarding the incentives for efficient investments (third criterion), no clear conclusions can be drawn (see the assessment of capacity base interconnection pricing). A positive feature of the third criterion is that there is a strong correlation between the charging principles and the network costs, leading to a situation where costs and risks are regarded by the charging regime. This implies that the overall uncertainty for investors is limited. On the negative side, the introduction might create uncertainties and thereby harm the investor's confidence in the stability of the regime - this is because outcomes from the charging regime are difficult to assess beforehand.

Table 2

Criterion	Volume based pricing
1. Are competition problems solved?	The regime is no solution to the termination monopoly problems (cnf. capacity based ic-pricing)
2. Are externalities considered?	The conclusion is that there are no significant differences to the current systems (refer to capacity based ic-pricing)
3. Does the charging regime set incentives for efficient investment?	There were no clear conclusions made concerning incentives for investors. Regarding the expected investor confidence in the charging regime, this was seen as fulfilled. On the other hand, there is a possibility that investors are not compensated for costs and risks, as the correlation between the charging units and the network costs is only partially in place: The charging regime does not reflect peak traffic but average traffic, while network costs are driven by the peak traffic.
4. Does the charging regime set incentives for efficient network usage?	The incentives for efficient network usage are nonexistent, because the correlation between the charging units and the network costs is only partially given (see previous criterion).
5. Are there any arbitrage possibilities due to regulation with regard to the charging regime?	The same conclusions were made as for capacity based ic-pricing: there are limited arbitrage possibilities within the same wholesale market. However a parallel coexistence with CPP/EBC regimes could lead to arbitrage possibilities, which have to be dealt with by regulation.
6. Are there transaction costs with regard to the implementation of a new charging regime?	The same conclusions were made as for capacity based ic-pricing, i.e. the conclusions are rather mixed and there are different views present in the Austrian market regarding the evaluation of this criterion. The regime does not require any investments in billing systems as the current ones can be used. There is also no need for any national or international standardisation. On the negative side, the cost of regulation will remain and additional transaction costs are implied by negotiation costs for new contracts between the operators.
7. Are there any outcomes on the legal certainty with regard to the implementation of the charging regime?	The same conclusions were made as for capacity based ic-pricing: There could be extensive problems if courts would repeal the decision to change the charging regime. The reason is that there is no accounting data including the number of exchanged minutes required to charge for volumes. Therefore, the invoices cannot be produced ex-post based on minutes in case the courts repeal the decision to introduce volume base charging. This problem does not exist though, if today's billing systems are used as fall-back solutions for the time after implementation of volume base pricing.
8. Does the introduction of the charging regime cause disruptive effects and compatibility problems?	The same conclusions were made as for capacity based ic-pricing: There are probably no problems due to the introduction as the underlying charging principle is currently used in the end user markets (e.g. the "fair use" flatrates).
9. Is the charging regime future proof?	The same conclusions were made as for capacity based ic-pricing: The charging regime is probably future proof as it can be used for NGN/NGA networks and it is able to handle different services due to a unified charging unit (e.g. KB/sec) However it is questionable whether this charging model allows to differentiate prices according to different qualities of service. It is not clear though, how the regime would be able to react to larger changes in the industry.

Regarding the fourth criterion (efficient network usage), it was concluded that the quality differentiated prices theoretically lead to better steering towards efficient usage. In reality though, this is not necessarily true due to a number of reasons, including the fact that an incorrect cost standard can be

used to regulate prices and the quality actually provided across several interconnected networks could be insufficient. Further, it is not clear to what extent quality is a significant cost driver, which in turn would mean that quality is not suitable to steer the usage of the networks.¹¹

There was no conclusion regarding the fifth criterion (arbitrage). The reason is that there is no evident correlation between arbitrage and quality differentiation. A problem identified though, is that a parallel coexistence with CPP/EBC regimes would probably lead to arbitrage possibilities, which have to be dealt with by regulation (for the same reasons as for capacity based ic-pricing, see above).

Regarding the transaction costs (sixth criterion), the charging regime was concluded as sub-optimal due to a number of reasons: Investments must be made in billing systems and networks, the increased complexity implies higher costs of regulation, extensive standardisation is required and further costs for negotiation between operators are to be expected.

Regarding the legal certainty (criterion seven), it was among others argued that problems hardly exist because independent of what the courts could decide, the roll back of the systems is possible and the necessary accounting information for a possible retroactive billing based on CPP/EBC is possible too.

The evaluation of the eighth criterion (disruption and compatibility), was rather neutral. Because the tariffs would still be cost oriented, it is likely that the changes to the tariffs would be rather limited. Due to the implementation of the differentiation of the prices, some prices for "premium" quality might rise, though, which could be perceived negatively by the end users. The future proof of quality differentiated pricing was evaluated heterogeneously. From a theoretical perspective the quality differentiated pricing is highly compatible with NGN. However, the flexibility of the regime depends on the way the charging regime is implemented.

The next charging regime, *IP-Peering* is in several aspects comparable to bill&keep. Due to the possibility to implement IP-Peering with Paid Peering for situations with asymmetric traffic, the evaluation is in many aspects more positive than for bill&keep.

¹¹ The cost causation has been discussed by JAY & PLÜCKEBAUM., p. 26ff. Depending on the assumptions for the cost determination, the cost causation could be rather limited (please refer to p. 40).

Regarding the competition problems (first criterion), the termination monopoly will remain as the caller of his operator cannot decide on the termination network to be used. In difference to bill&keep but comparable to the current regime, there is also a risk of price-induced competition problems due to Paid Peering.

Regarding call externalities, these are better regarded as in the current regime, but like the assessment of bill&keep it is difficult to say if there is an optimal allocation of costs between caller and called-party, i.e. because it is not clear if the called party should bear half of the costs in case of two symmetric networks.

When it comes to the incentives for efficient investments it was concluded that the outcomes of IP-Peering are both positive and negative. For instance, inefficient market entries are prevented due to the mechanisms of Paid Peering. Further, paid peering mechanisms imply that the operators are forced to make efficient investments in order to avoid paid peering.

On the negative side, foreclosure could exist due to too high prices for Paid Peering. Another negative aspect is that in the case of Settlement-free Peering the actual costs are not covered in the wholesale markets which could imply that operators are not sufficiently compensated for costs and risks. Further, the introduction of the regime will cause disruptiveness with negative consequences for the confidence of the investors.

Regarding the forth criterion (efficient network usage), the evaluation was negative - mostly due to the lack of pricing signals, the hot-potato-dilemma as well as the lack of cost causation regarding compensation for the wholesale services. These problems are partially solved though due to the mechanism of Paid Peering, punishing inefficient routing.

A rather negative assessment of IP Peering was made according to the fifth criterion (Are there any arbitrage possibilities due to regulation with regard to the charging regime?). Arbitration problems between the markets with IP Peering charging regimes and other markets will probably occur, e.g. due to the large differences compared to the current CPP/EBC-regime.

Regarding transaction costs (sixth criterion) the introduction of IP-Peering will not require any investments in billing systems as the current ones will be used to implement the Paid Peering functionality. Regarding the costs of regulation and negotiations, these will only be slightly reduced compared to the current situation, e.g. due to possible asymmetric traffic and the

implementation of Paid Peering. Hence, the changes to the current regime are rather limited concerning the transaction costs.

The seventh criterion (legal certainty) was evaluated as more or less positive even if the courts would prohibit the new charging regime after the implementation. This is because a return to the current regime is possible as the traffic has to be monitored to determine if there is asymmetric traffic to be billed according to the principles of Paid Peering.

Regarding disruptive effects and compatibility (eighth criterion) it was concluded that there will be substantial changes to the business models (i.e. waterbed effects), but if this would lead to disruptive effects could not be concluded, e.g. because it is difficult to assess ex-ante how operators and end users would react and the business models would change. Regarding compatibility with current systems, this should not be any problem as IP Peering does already exist as a charging regime.

The future proof of IP Peering (criterion nine) seems to be comparable to the current regime and to some extent to the volume based charging model. Due to Paid Peering, the charging regime has to be adopted in the same way as the current regime (see the evaluations of the alternatives to the current regime above).

Pure LRIC was the last charging regime discussed and evaluated. The results with regard to this regime are rather mixed. This charging regime will partially reduce competition problems (the termination monopoly will remain, but due to lower tariffs, the main problems will be less substantial) and it will lead to a better consideration of call externalities as the called party and/or called party network will cover the fixed network costs. It is questionable though if the allocation of costs between caller and called party is optimal.

Regarding the third criterion (incentives for efficient investments) the evaluation was heterogeneous. It is difficult to assess the outcomes on incentives to invest, as the lower tariffs which are the outcome from Pure LRIC, will benefit some business models and investment while others will suffer. It is clear though, that costs and risks will not be covered anymore by wholesale charges, which produces negative incentives for investors. Regarding the trust in stability of the regime, this will be harmed due to the implementation phase (with disruptive effects) but after implementation, the stability (and therefore also the confidence of the investors) will be increased due to more stable tariffs.

Regarding efficient network usage (fourth criterion) the risk of inefficient usage is limited, leading to a positive evaluation of this criterion. This is because the cost drivers are more or less replicated by the charging regime, which reduces the risks of a sub-optimal usage.

Pure LRIC implies relatively limited possibilities of arbitrage (criterion five) because the prices are set at marginal costs, which limits the margins available for arbitrage caused by on-net/off-net price differentials. On the other hand, if the regime is only implemented within one country, the cross-border price differences will be extensive which might produce arbitrage possibilities.

The transaction costs (criterion six) were evaluated rather heterogeneously. On the one hand, the cost of regulation will be high as new cost models must be developed and implemented. On the other hand, the costs of negotiations between operators will remain low (due to intensive regulation) and there is no need for new billing systems.

Seventh criterion (legal certainty): There is a positive evaluation of this criterion because even if the courts would prohibit the new charging regime after the implementation, a return to the current regime is possible as only the prices will change and not the charging units.

When it comes to possible disruption, the evaluation is complex as the prices will fall (especially for calls to mobile users). On the one hand, this might cause waterbed effects as the operators try to compensate the revenue losses from the wholesale markets. On the other hand the falling wholesale prices will eventually be a benefit for the end-users (i.e for the calling party), as long as they do not suffer too much from the waterbed effects.¹² Hence, disruptive effects might occur, but it is not clear if these will be negative or not for the industry and the consumers. A positive aspect of Pure LRIC is that the EU Commission wants to implement it EU wide, which means that there will hardly be incompatibility problems with a majority of other EU countries.

Regarding the last criterion (future proof), there are no differences compared to the current regime as CPP/EBC where per minute charging remains.

¹² MARCUS (2008b, p. 29) states in his paper that lower retail tariffs will benefit the end users.

■ Summary of the evaluation

In this section, the evaluation of the tenth criterion "establishment of sustainable competition" is presented. No conclusion is made in favour of or against a charging regime though. Instead, as far as possible, the opinions expressed during the discussions have been reflected.

Enhancements of the current LRAIC standard: The variations of these alternatives to the existing regulation seem to differ only marginally, nevertheless different outcomes exist. Of the alternatives, the criteria are fulfilled to a different extent and in different ways, but without any alternative being clearly better than the other.

Bill&Keep and IP-Peering: The implementation of bill&keep implies a lot of changes with respect to current charging regimes. The overall impression is that bill&keep fulfills some criteria quite well (e.g. competition problems and call externalities), but has a tendency to increase the problems with regard to other criteria (e.g. efficient investment, efficient use of network resources). As a matter of fact, bill&keep imposes new questions on which there are no answers or solutions yet. For IP-Peering, these conclusions also hold true, but with the positive possibility to deal with imbalances due to asymmetric traffic between operators which could have positive effects with regard to the criteria efficient investment, efficient use of network resources or arbitrage opportunities.

Capacity-based IC-pricing and volume based charging: These regimes are at an average and their evaluation is quite similar. Although, they might guarantee an efficient amount of investments and do not require extensive flanking regulatory measurements, they might bear a significant risk of distortion of competition especially between fixed and mobile network operators and – to a lesser extent – between small and big operators.

Quality differentiated pricing: The evaluation of this regime is comparable to capacity-based IC-pricing regime, but it leads to higher transaction costs and uncertainties as well as to additional costs in the initial phase. However, it was discussed that this regime might meet the future requirements in a better way, because quality differentiation is presumably going to play a more important role in the future when multiple services with different quality requirements will be implemented.

Pure LRIC: The difficulty of evaluating this regime lies in the the fact that the approach is still to be determined in detail. Besides the fact discussed,

that a lot of efficiency enhancing elements might exist, there is the core problem, that the total cost coverage on the wholesale level is not safeguarded, which has significant consequences for investment incentives as well as the end user tariffs.

Overall, the analysis shows that today's wholesale regimes are under change and that this affects also the charging regime to a considerable extent. Further, a charging regime for wholesale services that is economically favourable to all stakeholders is hard to find because the industry perspectives on possible solutions are very wide and controversial.

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