Ethernet leased lines:

A European benchmark

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1 Introduction

1.1 Context

Since the 2007 version of the European Commission Recommendation on relevant markets[1], National Regulatory Authorities (NRAs) in the EU have been advised, when reviewing the market for terminating segments of leased lines (former market 6), to consider leased lines based on Ethernet as a substitute for traditional interface leased lines based on SDH[2] technologies.

Commercial analysis[3] as well as market reviews undertaken by NRAs in recent years, reveal that the adoption of Ethernet has accelerated[4]. In some countries it is estimated that Ethernet may now account for the majority of leased lines at speeds of 100Mbit/s and above[5], and in Belgium, it has been announced that traditional interface leased lines are being phased out and will be fully replaced with Ethernet[6]. Ethernet in the First Mile (EFM) is also being used to provide leased line services over copper access lines at lower speeds. Although price benchmarks of traditional interface leased lines were produced in the past for the European Commission[7], relatively little comparative information is available about modern carrier-grade Ethernet services.

In the context of the revised Recommendation on Relevant Markets[8], which includes a market for the provision of 'high quality' services for business use (new market 4), we have undertaken a benchmarking exercise to describe the availability, standard prices, terms and conditions for Ethernet leased lines supplied by former incumbent operators in the EU.

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1 EC Recommendation C(2007) 5406 17/12/2007
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:344:0065:0069:en:PDF
2 Synchronous Digital Hierarchy is a standardised protocol that enables the transfer of multiple bitstream synchronously via optical fibre
3 See for example, Ovum Ethernet Service Forecast 2011-18
http://www.ovum.com/research/enterprise-ethernet-service-forecast-report-2011-18/, which projects an annual growth rate of 13.6% for global enterprise Ethernet service revenues, with higher potential in European markets
4 For example, in the 2013 Ofcom Business Communications Market Review (BCMR) Ofcom states (para 3.45) that it expects that many businesses will increasingly favour (low cost) Ethernet services over Traditional Interface services. BIPT notes that TI lines are being phased out in favour of ethernet
5 WIK Enterprise communications discussion paper January 2014, data from BT Global Services indicates that >90% of access circuits in the EU used for MPLS were provided by means of Ethernet leased line technologies
6 Letter C(2013) 4816 dated 19/7/2013 states that traditional interface leased lines will be phased out at retail level by 2015 and at wholesale level by 2018
7 See for example Teligen benchmarks for European Commission
http://ec.europa.eu/digital-agenda/sites/digital-agenda/files/voice_tariff_1998_2010.pdf
8 EC Recommendation C(2014) 7174 final, 9.10.2014

1.2   Scope of the benchmark

The benchmark covers Reference Offer (RO) prices and service level agreements (SLAs) for terminating segments of Ethernet leased lines extending from the customer site to the operator handover point.

A reference offer consists of standard conditions made available to authorised telecommunications operators. In market segments where significant market power (SMP) has been found in the former market for terminating segments of leased lines[9], most regulators require the publication of a reference offer for relevant products including Ethernet leased lines. Where available, we have also included within the benchmark reference offer prices and SLAs for Ethernet leased lines which are not subject to SMP regulation[10]. The primary focus of the study is fibre-based Ethernet leased lines, although information is also shown for copper EFM where relevant.

The benchmark was intended to cover 15 countries – namely Austria, Belgium, Czech, Denmark, France, Germany, Hungary, Ireland, Italy, Luxembourg, Netherlands, Poland, Spain, Sweden and the UK. However, published incumbent reference offers for Ethernet leased lines could not be found for Luxembourg, Poland or Hungary, while information for the Czech Republic and Denmark was incomplete.

Since Reference Offers are often produced in conjunction with regulatory obligations, one explanation for the lack of readily available information in some countries might be a finding of 'no SMP' or a decision by the NRA not to apply certain remedies. As described in Table 2, no price regulation[11] applies for leased line terminating segments above 2Mbit/s in Hungary, the Czech Republic and Denmark, while market analyses for terminating segments of leased lines have not been conducted for a number of years in Poland and Luxembourg[12].

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[9] Former market 6 of the EC Recommendation C(2007) 5406 17/12/2007
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:344:0065:0069:en:PDF
[10] For example, leased lines in Germany are regulated only up to 155Mbit/s. However, there is a commercial Reference Offer available from Deutsche Telekom for 10Gbit/s Ethernet leased lines
[11] In the Czech Republic and Hungary, no SMP was found in this segment
[12] The last recorded market analysis notification for terminating segments of leased lines in Luxembourg dates from 2006

2 Ethernet leased line product description

2.1 Core product characteristics

The aim of the benchmark is to describe the provisioning and service conditions for Ethernet products which have been designed to meet the requirements of high-end business customers as a replacement for traditional interface leased lines.

Common features exhibited by all products assessed in the benchmark are:

- Ethernet interface (layer 2)

- Symmetric bandwidths (ie the same download and upload capacities)

- High speeds with availability of access bandwidths up to 1Gbit/s or above[13]

- Uncontended (or the capability to design in a manner which is uncontended) ie bandwidth is dedicated and not shared amongst customers

In most cases a high level of service guarantee as would be expected for business purposes, such as 24/7 repair are also available, either for the standard product or through an enhanced SLA. Many Reference Offers also offer the option of redundant fibre, to provide further guarantees of reliability.

Wholesale Ethernet access products available to the mass-market such as Virtual Unbundled Local Access (VULA), local or regional Ethernet bitstream are not included within the benchmark. Depending on the specificities of national product descriptions, mass-market products may differ from Ethernet leased lines in respect of the availability of very high bandwidths (eg above 100Mbit/s), symmetry, available SLAs and (with the exception of certain VULA products) contention.

This does not preclude the possibility that VULA or bitstream services, if offered with business-grade characteristics, might be found in the context of a market review to be substitutable for Ethernet leased lines at certain (eg lower) bandwidths or for certain sites or customers or to provide a pricing constraint on some or all aspects of the market. In accordance with the European Commission's Recommendation on Relevant Markets, NRAs should assess such considerations in the context of market analyses of 'high quality' access (market 4).

2.2 Technical and service characteristics

The product descriptions for Ethernet leased lines in the benchmarked countries differ in certain aspects such as the maximum size of an Ethernet frame (typically between 1,500 and 1,600 Bytes[14]) or by the way VLANs[15] are handled (VLAN tagging[16]).

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13 In italy the Reference Offer covers speeds up to 100Mbit/s
14 In certain countries such as Ireland, Jumbo frames of up to 9,000 bytes are available

Technological differences can affect the performance of leased lines in relation to certain tasks. Detailed technical analysis was not a core focus of this benchmarking exercise, but may be important in defining and establishing common minimum parameters for the EU-wide provision of Ethernet leased lines as for example proposed by the European Commission in the draft Regulation on a 'Connected Continent'[17].

The incumbent offers vary in the implementation options used for Ethernet leased lines. In most cases the connection is made via Ethernet Customer Premise Equipment directly operating over access Fibre or WDM (Wave division Multiplex) links – 'native Ethernet'. The other implementation option, seen in Italy, Germany, and in less dense areas in some other countries, uses the Ethernet transport capability of already existing SDH equipment, which may be optimized by NG-SDH (Next Generation – Synchronous Digital Hierarchy). Such a solution however may increase costs compared with a native Ethernet implementation.

2.3   Architecture

Ethernet leased lines are available in two distinct architectures in the countries studied. These are shown in Figure 1.

Figure 1:   Ethernet leased line architectures
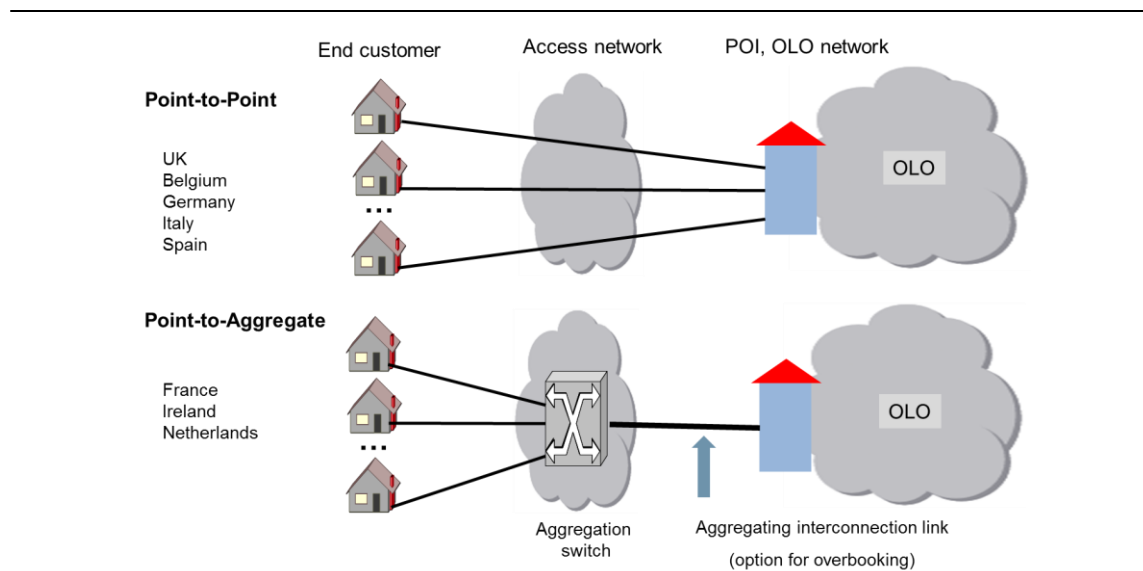
Source: WIK

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15   Virtual Local Area Network
16   With VLAN tagging packets are marked so that a single interconnect (trunk) can be used to support data for multiple VLANs
17   Draft Regulation laying down measures concerning the European single market for electronic communications and to achieve a Connected Continent
https://ec.europa.eu/digital-agenda/en/news/regulation-european-parliament-and-council-laying-down-measures-concerning-european-single Annex I

In a point to point (P2P) configuration, a single dedicated fibre is available from each end-customer to the OLO handover site.

In a point to aggregate configuration (also referred to as point-to-multipoint), traffic from individual fibres is aggregated to a backhaul/interconnection link. This allows the option (although not the requirement) for overbooking on the interconnection link.

The P2P configuration guaranties that the full capacity of the access link is available for the customer without any intermediate quality decrease affecting delay, jitter and packet loss. In contrast, in the Point-to-Aggregate configuration, the intermediate switch may add additional quality degrading characteristics with regard to delay, jitter and packet loss and is a potential additional source of failure. However, the costs for this solution may be lower compared with a P2P approach if there is a sufficiently high demand for connections which can be aggregated via the interconnection link.

2.4   Handover points

Different options may be available for handover to the receiving operator, depending on the country considered. Most ROs offer an option for 'local' access, whereby the receiving operator connects to the circuit at or close to the customer-serving exchange.

Regional access options are also available in many cases where, for an additional charge, handover can be offered at a higher point in the network, aggregating several exchange areas or at a defined distance from the serving exchange. This option enables operators with a less extensive backbone network to achieve coverage of the served territory. In some cases there may also be a national handover point allowing coverage via just one or two points of interconnection.

Figure 2:   Handover points for Ethernet

Source: WIK
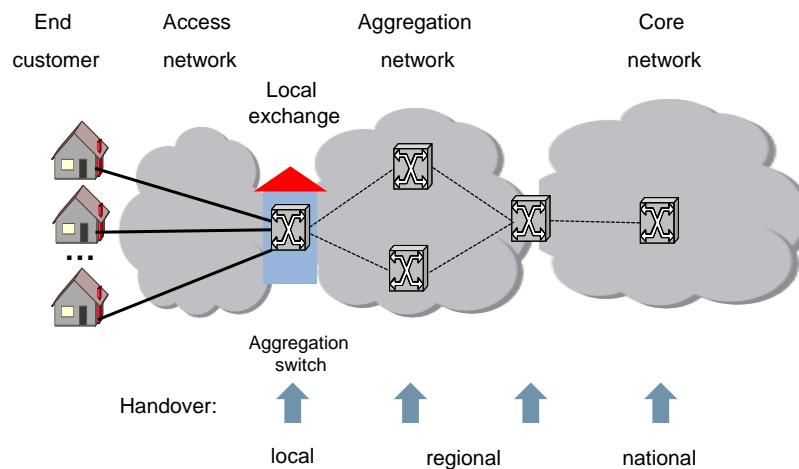
3   Availability

It should in principle be possible for an operator to offer Ethernet leased lines at all relevant bandwidths in any area where fibre has been or can be readily deployed to business premises in the access network and where the serving exchange has been Ethernet-enabled. In some countries such as the UK, Germany, Netherlands, Spain and Italy Ethernet leased lines are in principle available under the Reference Offer across the national territory (although may in certain areas be subject to excess construction charges). In others, such as France, the availability of the product is limited to exchanges which have been Ethernet enabled.

4   Standard offers and 'excess construction'

When comparing standard provisioning service level targets and prices, it is important to set these in the context of how a 'standard' product is defined. In some countries such as France and Germany, 'standard' connections are considered to be premises which are already served with fibre ('on-net' sites), while in others such as the UK and Ireland, standard connections may include some element of 'excess construction'. Some examples are shown in Table 1.

Table 1:   Definitions for standard and non-standard connections

	Standard	**Non-standard**
France	On-net (fibred)	Non-fibred (served area) requires €3830 connection rather than €730
Germany	On-net (fibred)	Excess construction charges determined by DT, subject to agreement of receiving operator
Ireland	Standard price where end-user premise served by usable eircom-owned duct and is within 500m of available eircom access fibre which can connect to the serving node	Actual costs
Netherlands	On-net NLS1 and NLS2 (free fibre available and maximum three splices required)	On-net NLS3 and Near-net defined as 250m digging distance from nearest connection point, providing no structural works required and KPN has rights to install Off-net defined as all sites which are not near-net or on-net
UK	On-net and near-net up to cost of £2,800 included in standard price	Excess construction above £2,800 costs based on actual costs

Source: Incumbent reference offers as of October 2014

5 Provisioning and associated penalties

5.1   Provisioning timescales

Most Reference Offers include target minimum timescales for provisioning. A summary of the range of timeframes is shown in Figure 3. Standard on-net provisioning targets range from 30 working days in the UK and Austria to 50 or more in the Netherlands and Spain. Some ROs also include maximum timeframes for provisioning requiring additional works. For example, in Germany a target of 6 months is set for lines requiring significant construction. Further details on provisioning are shown in Annex I. Some ROs also allow for expedited provision at additional charge – for example 17 days in Austria or 20 in France.

Figure 3:   Ethernet leased line RO provisioning timescales
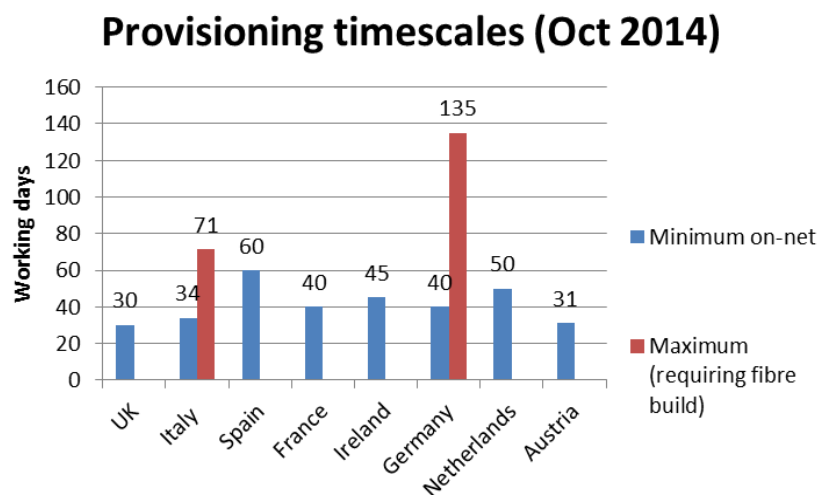
Source: Incumbent reference offers as of October 2014**18**

Minimum provisioning timeframes are typically assessed from the point at which a firm order has been placed. Depending on the country and circumstance, this may be preceded by preparatory activities such as undertaking a site survey and may be conditional on given circumstances. As discussed in section 4, the types of connection which qualify for standard provisioning timescales and whether this timeframe is also intended to include some construction activities to bring the line into service may also vary.

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18 On-net implies available fibre. 1 calendar days=0.71 working days

In addition to minimum provisioning targets, most Reference Offers allow for provisioning to be scheduled on a specific date, which may be important in enabling the co-ordination of provisioning to multiple business sites.

5.2   Provisioning penalties

Penalties are normally applicable for failure to meet specified provisioning targets in the Reference Offer SLA. Penalties increase with the duration of the delay and are typically based on a percentage of the monthly rental charge or connection charge. Figure 4 provides a summary of the penalties that would be due for a delay of 5 or 10 working days after the standard or agreed provisioning date, as a proportion of the monthly rental charge[19].

Figure 4:   Penalties for delayed provisioning
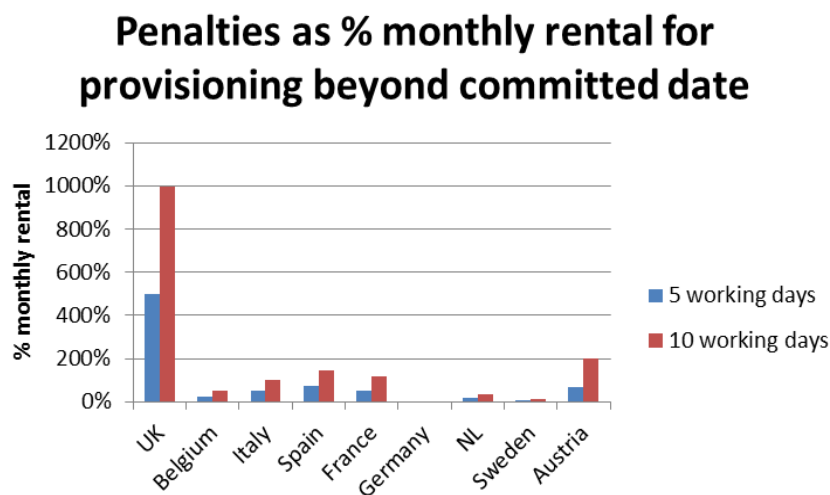
Source: reference offers Oct 2014 [20]

A wide variation can be seen. In the UK, penalties of 100% monthly rental are applicable for each working day of delay up to a maximum of 60x the monthly rental. In contrast, in Germany, no penalties are applicable in the standard SLA until 15 working days following the provisioning date and a maximum of 60% of the connection fee is due for delays of 45 days or more beyond the agreed provisioning date. In Spain, an

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19 Where penalties are calculated on another basis eg as a proportion of the connection charge eg Spain, or as a flat fee eg Austria – the equivalent proportion as a % monthly rental has been calculated on the basis of charges for a 5km 100M circuit

20 Spain: Penalties are based on a proportion of the connection charge and are applicable if 85% scheduled provisioning target not met. Estimate as a proportion of monthly rental is based on the ratio of connection:rental fees for 100M 5km circuit. France: 12 calendar days assumed equivalent to 10 working days. Austria penalties are based on a flat charge per WD increasing each week. Penalties as % monthly rental estimated on the basis of costs for a 100Mbit/s benchmark circuit.

extension to the delivery date can be made for the remainder of connections providing 85% of connections have been delivered by the due date. In some countries such as the Netherlands, higher penalties are applicable with an 'advanced' SLA, although these are capped at 100% of the monthly charge for delays of 15 days or more. Further details on penalties for delayed provisioning are shown in Annex I.

In several countries, including the UK, Ireland and France, penalties are automatically deducted from the following invoice, placing the responsibility for initiating payment on the SMP operator. In others, such as Germany, Italy, Sweden and the Netherlands, deductions are not automatic and operators affected by provisioning delays must actively request compensation.

6 Repair and associated penalties

6.1 Fault repair times

SLAs typically set maximum timeframes within which faults on the line must be repaired. These are in some cases differentiated according to whether the fault results in an interruption or degradation of service. Figure 5 shows fault repair times for standard and (where available) enhanced service level packages for service interruption.

Figure 5: Fault repair times, service interruption
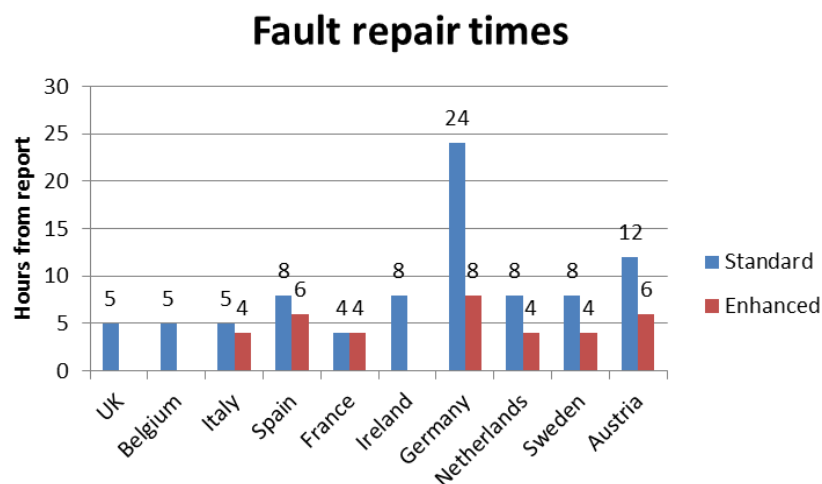
Source: incumbent reference offers October 2014[21]

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21 Spain: capitals of provinces, elsewhere additional 2h. France – standard offer within working hours, enhanced 24/7. NL: 90% within this period, 100% within the relevant period + 2h

The shortest repair times for service interruption of 4-5 hours can be found in France, the UK, Belgium and Italy. However, in France (as well as Sweden, Austria and Ireland), the standard offer provides for repair within working hours only. The longest contractual repair times are seen in Germany, where 24 hours is offered within the standard RO. In Spain, repair times of 10 hours are offered outside capitals of provinces, while in the Netherlands, 8 hour repair targets must be met for 90% of lines, with the remaining 10% addressed within 12 hours.

Several countries including Sweden, the Netherlands, France and Italy offer enhanced service levels committing to repair within 4 hours including 'out-of-office' hours for an additional premium. In Germany, enhanced service levels promise repair within 8 hours, while 6 hour express repair is available in Spain and Austria.

6.2   Availability guarantees

In addition to targets for the resolution of faults, most Reference Offers provide for 'availability' targets for total uptime over the course of a year, reflecting the practice for retail services to contain similar guarantees. Availability targets for standard offers range from 99% in Germany (downtime of 87.6 hours annually) to 99.9% in Ireland, Belgium and the Netherlands (downtime of 8.76 hours annually) for access provided via fibre. Higher availability guarantees are also often provided for redundant access solutions[22] or enhanced SLAs. For example, TeliaSonera offers a standard availability target of 99.2% or 99.8% for a 'platinum' connection, while Telecom Italia offers 99.5% standard for terminating circuits rising to 99.8% for a premium SLA. The Netherlands offers 99.98% availability guarantees for redundant fibre.

Figure 6:   Ethernet leased line service availability guarantees
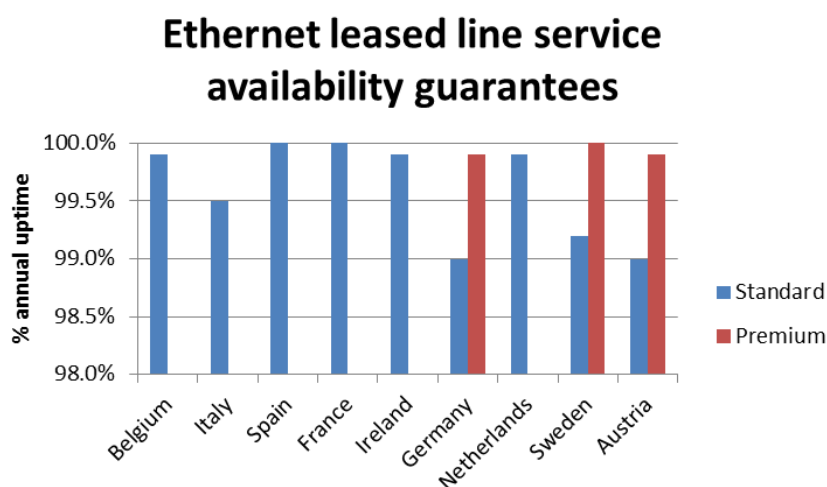
Source: Incumbent reference offers Oct 2014

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22 Separate access lines entering the building to provide additional security of provision

6.3   Penalties

Reference Offers typically include penalties (as a proportion of the monthly line rental) for failure to repair lines within the target timeframes. The level of penalties varies widely. In France 50% of the monthly rental is due for repairs up to one hour late with increases for additional hours, although this applies only to working hours for the standard product[23]. In the UK, penalties of 15% of the monthly rental charge are due for each hour taken for repair in excess of 5 hours. Conversely, in Germany no penalties are due until 12 hours following the 24 hour repair target, while in Ireland penalties of 2% of rental are charged per working hour of delay. Most of the benchmarked countries apply repairs on a 24/7 basis. However, France, Austria, Ireland and Sweden apply working hours repairs for the standard SLA.

Figure 7 shows penalties applicable as a proportion of monthly rental for repairs to a broken line made respectively 8[24] and 12 hours after the initial fault report.

Figure 7:   Penalties for repair at 8 and 12 hours following fault report
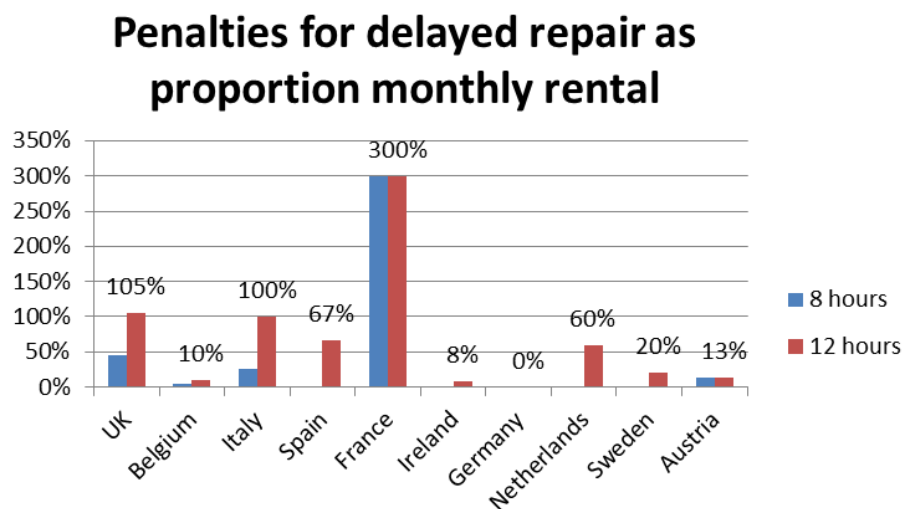
Source: WIK based on incumbent Ethernet LL Reference Offers October 2014[25]

Many ROs include a maximum cap on penalties. In the UK, the maximum applicable penalty is 30 times the monthly rental. In France penalties for late repair are capped at 300% of monthly rental per fault and at 6 months rental for all faults on a given line. Considerably lower penalty caps apply in other countries with a maximum of 20% of the monthly charge per fault in Germany and Sweden, and 25% in Belgium.

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23 Repair times and associated penalties on a 24/7 basis are available at an extra charge

24 For countries with an 8 hour standard SLA, no penalties would be due at this stage

25 France, Austria, Ireland, Sweden – standard repair within working hours only. Austria – fixed fees apply. % of monthly rental estimated on basis of costs for a benchmark 100Mbit/s circuit

6.1.1   Other penalties

Where Reference Offers set standards for availability (annual uptime), additional penalties may be due if the total downtime from one or multiple faults exceeds the annual availability target (see Figure 6), sometimes subject to caps. For example, in Sweden and Belgium the supplying operators commit to pay respectively 0.25% and 0.5% of the monthly rental for every 100th of a percentage point below the guaranteed availability up to a maximum of 40% of the monthly rental. In Belgium, the incumbent is required to pay 1.5% of the annual connectivity fee for uptime of less than 99.9% and 5% of the annual connectivity for uptime of less than 99.7%.

Further details on repair times, availability guarantees and associated penalties are shown in Annex II.

7   Pricing

7.1   Benchmarking methodology

As has historically been the case for traditional leased lines[26], undertaking price benchmarking of Ethernet leased lines is a complex process due to the differing approaches to pricing in different countries, and also in some cases differences in the technical characteristics of the product[27]. In order to achieve prices which are as far as possible comparable, it is necessary to select sample products for which national differences are minimised and to carefully describe all relevant assumptions.

For this exercise, we have undertaken price benchmarks of local access and regional Ethernet terminating circuits at 5km (with fixed charges amortised over 24 months) and 25km (with fixed charges amortised over 36 months). The main factors affecting pricing and the overall methodological approach used in the benchmarks are described below. Details of the assumptions used for each country included in the benchmark is shown in Annex III.

7.1.1   Local vs regional access

Most incumbent operators offer a 'local access' Ethernet circuit where the handover point for the receiving operator is colocated at the customer-serving exchange. As the simplest form of Ethernet access circuit, extensively used by operators which have achieved scale across the national territory, this kind of circuit is likely to offer the best

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26 See for example methodological discussions in section 8 of the Teligen Report on Telecoms Price Developments for the European Commission 1998-2010
http://ec.europa.eu/digital-agenda/sites/digital-agenda/files/voice_tariff_1998_2010.pdf
27 For example whether the architecture is point to point or point to aggregate

potential for achieving comparable price benchmarks. Local access is therefore considered to be the primary benchmarking output.

In some countries regional access options are available at an additional charge whereby the receiving operator can reach widespread coverage by connecting at a subset of served exchanges. The extent to which regional access costs are comparable across countries may be affected by the degree of 'regionalisation' (ie the extent to which different regions are aggregated within the 'regional' offer) in each case. Although regional offers are less likely to be directly comparable, some example prices are shown.

7.1.2 Non-recurring charges

Charges for Ethernet leased lines are typically composed of non-recurring connection charges and recurring monthly or annual charges for line rental. The benchmark includes the non-recurring charges amortised over 24 months in the case of a 5km circuit and 36 months in the case of a 25km circuit.

7.1.3 Distance-related charges

Historically, leased line charges often had a distance component due to the significance of loop lengths in affecting costs in the local access network[28]. This benchmark continues this tradition in assessing benchmark prices for lines of 5km and 25km. Countries which pursue distance-based pricing include Belgium, Italy, Ireland[29] and Spain. However, it is notable that many ROs for Ethernet Leased Lines do not distinguish prices by distance – especially in the access segment[30]. Instead, there may be a flat charge (subject to a maximum reach) or charges which vary by area (see below).

Where prices are distance-dependent or where charges are set in distance bands, the local access benchmarks reflect respectively the relevant charges for 5km and 25km in the access segment between the end-user and handover point at the serving exchange.

For regional access, a short access loop of 2km is assumed with the remaining distance accounted for in the interconnecting circuit.

7.1.4 Area type

Some reference offer price lists distinguish charges according to area type, often as an alternative to distance. Distinctions between dense and less dense, metropolitan vs rural districts may reflect the cost implications of different customer densities and/or

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28 A large proportion of these costs are associated with ducting
29 Access segment
30 The UK and Germany have distance-related pricing for non-local Ethernet leased lines, but not in the access segment

differing levels of competition in these areas. Countries which distinguish prices in this way include Germany, France, Ireland[31], Netherlands and Austria.

For countries with distinctions by area type, the benchmark charges are based on a weighted average of regions with 40% assumed to be in 'metropolitan' areas, 40% in other 'urban' areas and 20% in rural areas. Lowest (metropolitan) and highest (rural) values are also shown to indicate the extent of the price variation.

7.1.5   Treatment of point to aggregate connections

In most countries Reference Offers for point to point Ethernet leased lines are available. These have been used as a base for comparison. In those countries where only point-to-aggregate Ethernet leased line reference offers are available (such as France Ireland and the Netherlands) the benchmarks assume for the interconnect link a one for one bandwidth relation with the access circuit[32], based in France and the Netherlands on:

- 1G interconnect link for access lines of 10M and 100M with charges proportionately allocated (eg 10% of the 1G interconnect charge for each 100M access circuit)

- 10G interconnect links for access lines of 1G, with charges proportionately allocated

This methodology implies that there is no overbooking of the interconnect circuit to ensure an 'uncontended' connection which as far as possible approximates a point to point circuit.

The Class of Service (CoS)[33] is selected so as to allow maximum flexibility for the receiving operator over prioritisation, again to approximate the service experience over a point to point circuit.

7.2   Price benchmarks for 5km local access

Following the methodology described results in price benchmarks for 5km local access Ethernet leased lines as shown in Figure 8. A wide variation in charges can be seen especially at speeds of 100M and above, which are typically provided via a fibre connection[34]. Monthly costs for 100M range from €271[35] in the UK to €3,115 in Italy. All benchmarked Reference Offers differentiate charges according to speed. These

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31 Area differentiation in addition to distance-based differentiation
32 This is a conservative assumption which is likely to overestimate the utilisation of the interconnect circuit and therefore underestimate the total cost.
33 Class of Service allows management of multiple traffic profiles over a network by giving certain types of traffic priority over others.
34 10Mbit/s Ethernet may be provided via copper
35 Based pm exchange rate of GBP1=€1.27

variations are especially pronounced in the relative charges for 1G connections in Spain and Austria and for 100M connections in Italy. No Reference Offer price is available for 1G in Italy.

Figure 8:   Ethernet leased line 5km local access pricing benchmarks
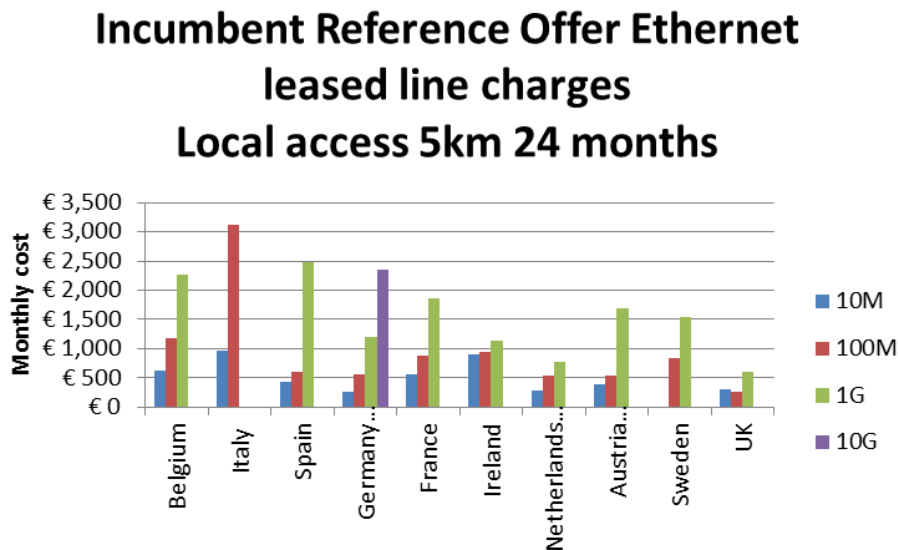
Source: WIK based on Reference Offers as of October 2014[36]

7.1.6   Sensitivity to distance

Local access connections in most countries do not vary with the length of the access segment. Exceptions are Belgium, Italy, Ireland[37] and Spain, as shown in Figure 9.

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36   Prices in Germany, Austria and Netherlands are based on a weighted average
37   In practice, access segments in Ireland rarely extend to 25km

Figure 9:   Variation in price by distance for local access connections
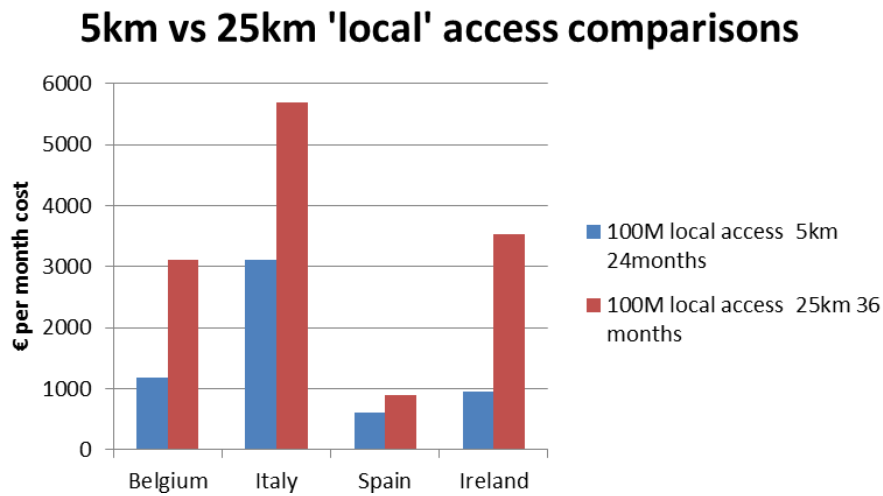
Source: WIK based on Reference Offers as of October 2014

In the UK, although local access lines are not charged on the basis of distance, standard (non-local) Ethernet leased lines are priced on a distance-dependent basis (see Figure 11).

7.1.7   Sensitivity to area type

Several countries, including France, Germany, Austria, Ireland and the Netherlands distinguish charges according to area type with a distinction between metro, urban/suburban and rural locations. The degree to which the area type affects the monthly price is shown in Figure 10.

Figure 10: 100M local access Ethernet leased lines – price differentiation by area

100M Local Access 5km Ethernet leased lines: Price differentiation by area
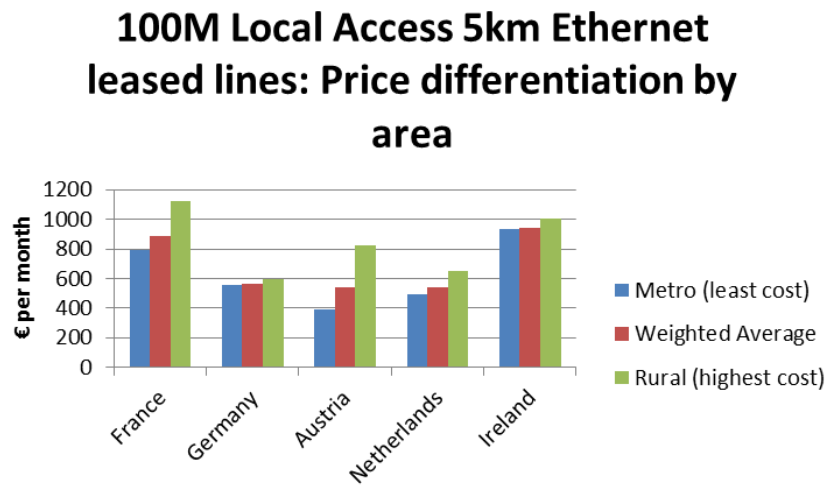
Source: WIK based on Reference Offers as of October 2014

7.1.8 Impact of local vs regional connectivity

In benchmarked countries where local and regional access options are made available, there is a differentiation between the local and regional access price as seen in Figure 11. This gap is most significant for longer lines in the UK, due to the strong distance-dependent aspect of the 'main link' for the benchmarked product[38]. A smaller differential would be seen for a shorter link. In contrast, there is no distance dependence for local or regional Ethernet leased lines in France and the Netherlands.

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38 Ethernet Access Direct

Figure 11:   Comparisons of local and regional Ethernet leased line pricing

Comparisons for local and regional 100M Ethernet leased lines 25km (36 months)
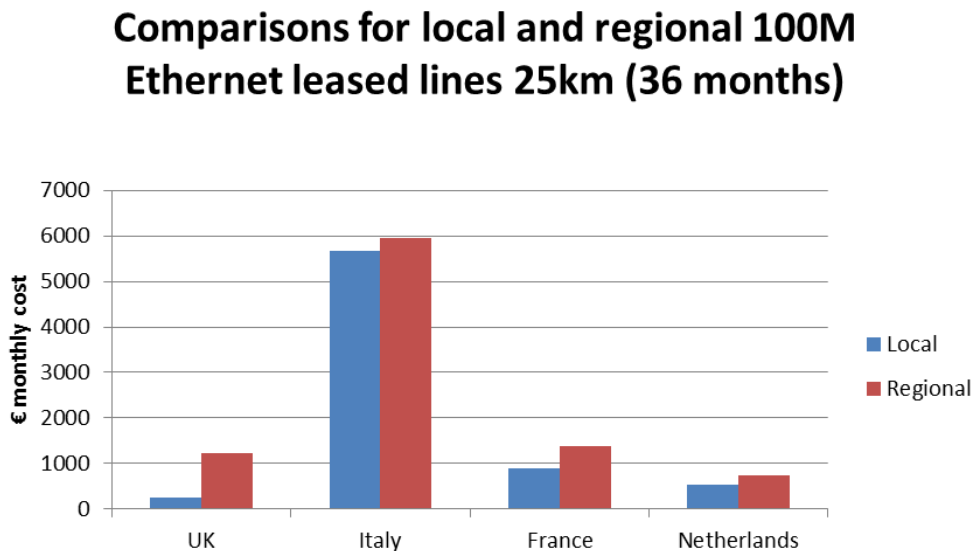
Source: WIK based on Reference Offers as of October 2014[39]

7.1.9   Excess construction pricing implications

As explained in section 4, the benchmarks are for standard reference offer products. As such, they may include or exclude certain 'near-net' construction charges, depending on the country. For example, in the UK, excess construction up to a cost of £2,800 (€3,556[40]) is included in the connection fee, whereas excess construction costs are excluded from the standard connection fees in France, Germany and some other countries, and incur an additional charge.

In France, lines in Ethernet served areas which nonetheless require fibre installation are subject to a connection fee of €3,830 instead of €730. The resulting cost difference, amortised over 24 months is shown in Figure 12.

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39 Charges in France and the Netherlands are not distance dependent and therefore 5km and 25km charges are the same. UK and Italy based on 'access segment' of 2km and 'main link'/interconnecting segment of 23km

40 Based on exchange rate GBP1=€1.27

Figure 12:   FT-Orange Reference Offer charges for standard and near-net connections (5km, local access)

FT-Orange RO charges for standard and near-net connections
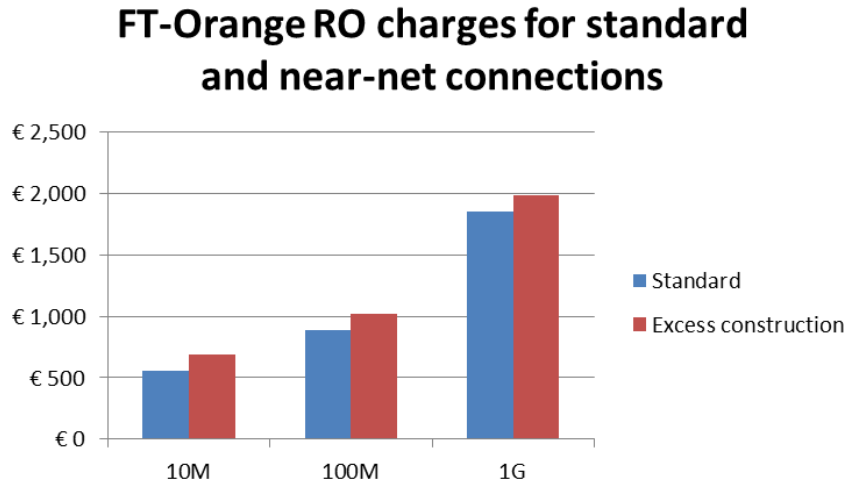
Source: WIK based on Reference Offers as of October 2014

Applying near-net charges to local access Ethernet leased lines in the Netherlands also results in a small increase as seen in Figure 13.

Figure 13:   On-net and near-net charges for 5km (24 months) local access in the Netherlands

On-net vs near-net charges NL 5km (24 months) local access
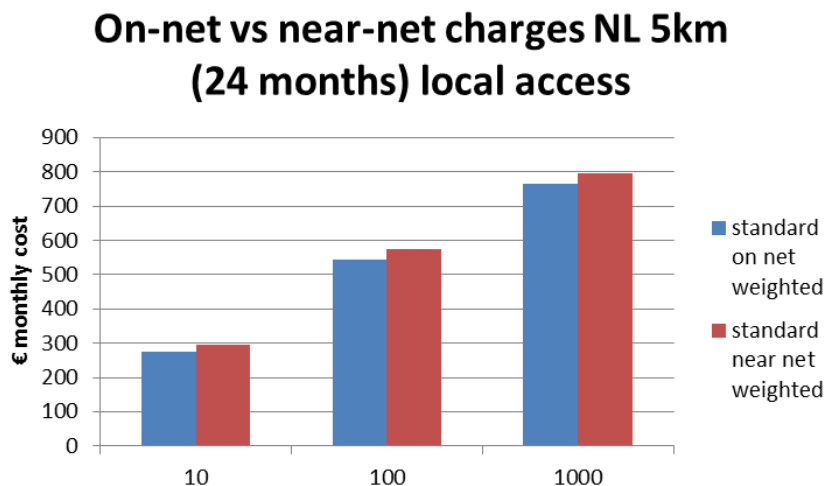
Source: WIK based on Reference Offers as of October 2014

7.1.10 Service level pricing implications

As discussed in section 6, standard Reference Offer Ethernet leased lines differ as to whether or not they include expedited service (eg at 5 hours or less) with 24/7 response. For example, in France a 24/7 response time can be achieved with an additional €126 per month for the interconnection link and €80 per month for the access connection[41].

8   Regulatory approaches

The availability of reference offers, as well as differences in SLAs and pricing, may be affected by the competitive dynamics within different countries as well as the extent and nature of SMP regulatory obligations. Table 2 summarises the approaches taken towards defining relevant markets applicable to Ethernet leased lines as well as applicable price regulation.

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[41] The benchmark price includes 24/7 response times for the interconnection circuit, but not for the access circuit

Table 2: Summary of market definitions and price regulation applying to Ethernet leased lines

	Price regulation	Geographic market	Speed boundaries?	Comments
Austria	Price cap on LL and Ethernet. Cost-orientation dark fibre June 2014	Nationwide <2Mbit/s Geog Segmented >2Mbit/s where at least 2 operators offer LL & ethernet + share TA <40% 359 communes deregulated on this basis out of 2350 communes	None	Dark fibre terminating segments considered within market for terminating segments of leased lines Business bitstream segmented from residential bitstream, but considered in separate market from leased lines
Belgium	Based on 2013 decision, cost-orientation for the transport segment of traditional and Ethernet leased lines. Local optical fibre section of traditional and Ethernet leased lines subject to a margin squeeze test to foster investment in this segment – except that retail services in local exchange areas where at least two optical fibre lines are deployed by operators other than Belgacom will not be taken into account for the margin squeeze test. BIPT maintains and updates a list for this purpose	Nationwide, but remedies take account of geographic variations in competition	None	BIPT notes that traditional interfaces are being phased out to be replaced with Carrier Ethernet at retail level by 2015 and at wholesale level by 2018
Czech Republic	2010 Decision Regulated up to (but not above) 2Mbit/s. Access, transparency, non-discrimination and acc. sep, but no charge control. Confirmed in 2014 proposal (withdrawn). 2014 analysis shows higher prices (by around 20%) than alternative operators For speeds 2-20 Mbit/s 2014 proposal (withdrawn) proposes non-discrimination and acc. Sep (no charge control). Market analysis shows average prices for incumbent below those for alternative operators	Nationwide	2010 Decision segments market below and above 2Mbit/s. Market aboye 2Mbit/s found to be competitive In 2014 proposal (withdrawn following Commission serious doubts), CTU proposed three segments – up to 2Mbit/s, 2-20Mbit/s and 20Mbit/s+, finding SMP up to 20Mbit/s, but not above Speeds from 2-20 Mbit/s are typically supplied via Ethernet (over copper)	Excludes lines supplying base stations
Denmark	2012 Decision Price control only on lines <2Mbit/s. Access, transparency and non-discrimination obligations apply across whole market. SLAs and KPIs included in reference offer TDC is required to provide for low capacity leased lines (<2Mbit/s)	Nationwide	None, but remedies differentiated by speed above and below 2Mbit/s	

France	Two zones Competitive (decision on zone to be based on business density, sufficient number of business access lines, and presence of altnets with networks with a network reach comparable to Orange) – deregulation planned Non-competitive subject to 'non-eviction' and no excessive pricing Decision June 2014. Implementation pending	Nationwide market, segmented remedies	Differentiated treatment of copper and fibre	Business bitstream considered within terminating leased lines market
Germany	Cost orientation (to 155M) based on Eth over SDH July 2014	Nationwide	No SMP above 155Mbit/s	
Hungary	2011 Decision No price control. NMHH notes that the SMP operator had priced below the price required by a previously imposed retail minus obligation.	Nationwide	Segmented up to 2Mbit/s and above 2Mbit/s. Market >2Mbit/s does not pass 3 criteria test – notes decrease in average price for all higher bandwidth leased lines	
Ireland	Max price based on BU LRAIC for Ethernet leased lines (2012) – with geographic price deaveraging. Potential for downward pricing flexibility in geographic areas where there are at least two competing alternative infrastructure operators providing access with lower prices than Eircom.	Nationwide, but geographic deaveraging permitted and downward pricing flexibility possible in areas of enhanced competition	None	
Italy	RPI-~5% with separate basket for ethernet. Previously no CO – new decision for CO May 2014	Nationwide	None	Separate segment for mobile backhaul to base stations. No SMP found
Luxembourg	2006 Decision requires transparency (publication of a ref offer, cost-orientation and cost accounting)	Nationwide (2006)	None	No market analysis notification under 2007 or 2014 editions of relevant market recommendation.
NL	Cost orientation, but with ability to allocated fixed costs according to value-based pricing Margin squeeze test as safeguard 2012-2013	Nationwide	None	High quality whoiesale broadband access considered in same market as terminating segments of leased lines. Excludes backhaul including backhaul to base stations
Poland	2008 Decision. Cost-orientation, obligation to prepare and submit reference offers	Nationwide	None	

Spain	Retail minus 2013 decision	Nationwide	None	
Sweden	2013 Decision. Obligation to apply general terms and conditions for access, obligation to apply non-discriminatory pricing	Nationwide	None	
UK	CPI-X price control on baskets (targets cost orientation over time with flexibility and efficiency incentives)	Geographically segmented No SMP in WECLA region	Submarkets segmented by speed and technology. SMP in most submarkets with exception of WECLA district	

Source: WIK based on notifications to the European Commission under the article 7 procedure

Although in general, most NRAs have defined the market in a technologically neutral manner, including Ethernet, different approaches have been taken to other aspects of the market definition for the former market for terminating segments of leased lines.

The UK and Austria segment the relevant market by geography, and exclude from regulation regions which are considered to be competitively supplied. The remainder of countries consider the geographic scope of the market to be nationwide.

In Germany, the market is segmented by speed and no SMP is found at speeds of more than 155Mbit/s, while no SMP is found for speeds of more than 2Mbit/s in Hungary and Czech Republic. In the majority of other countries, the relevant market in which SMP is found (or submarkets in cases such as the UK) covers all applicable speeds.

Several countries which have defined the market on a nationwide basis, covering all speeds, have applied variations in remedies, either for specific zones or speeds. In France the NRA is in the process of identifying competitive zones in which price regulation could be withdrawn, while in Belgium the NRA plans to maintain a list of local exchange areas which are considered to be competitively supplied and could therefore be subject to deregulation. In Ireland, the incumbent has further pricing flexibility in areas with competitive pricing pressure. In Denmark, no price controls apply for speeds of above 2Mbit/s.

In markets or zones which are considered not effectively competitive, many countries including the UK, NL, Austria, Germany (and in a recent decision, Italy) apply the principle of cost-orientation or CPI/RPI-X controls on baskets which are intended to achieve cost-orientation over time. Conversely, Spain applies the retail minus principle, France requires 'no excessive' pricing (in non-competitive areas), and Sweden requires non-discriminatory pricing. In Belgium, the transport segment is subject to cost-orientation, while the access segment is subject to an obligation not to margin squeeze.

To date, most countries have defined a market for terminating segments of leased lines. However, in the Netherlands and France, the former market 6 has been expanded to include high quality wholesale broadband access, an approach which may become more prevalent following the release of the revised Recommendation on Relevant Market.

Annex I: Provisioning timescales and associated penalties

	Order confirmation	Standard provisioning	Penalties	Automated?
Austria	1 WD acknowledge receipt 15 WD response on service availability, infrastructure requirements and costs	31 WD Express provisioning 17 WD at double installation charge	€72.67 per working days for first week. Then double/triple/quadruple in the second/third/fourth week of delay	No
Belgium	No info	No info	25% monthly charge 1-5 WD after RFS date 50% monthly charge 6-10WD 100% monthly charge >10 WD	No info
Denmark		4-8 weeks		
France		56 calendar days for fibred premises Expedited installation available for a charge – minimum 20 days	10% of monthly rental per day capped at 6 months rental	Yes
Germany	2 WD acknowledged. Inspection of location 8 days after order	Delivery date confirmed 20 WD after order 8 weeks from order where available resources 4 months with a few additional works 6 months with significant additional work	Penalties apply in case of more than 15 WD delay 20% connection fee: 16-30 days 40% connection fee: 31-45 days 60% connection fee: >45 days delay	No
Ireland	2 WD acknowledged 17WD confirmed	45 working days	€250 per failure of order acknowledgement up to max €750 per service credit. For delayed delivery, a proportion of the connection fee reaching 100% connection fee 22 days after the 45 day provisioning deadline. Thereafter 100% of daily rental for each further day delayed	Yes

Italy		Terminating and interconnect circuit: 100 calendar days in 100% cases 48-90 calendar days (depending on works) in 95% cases	30% monthly charge: 1-2 CD 50% monthly charge: 3-7 calendar days 100% monthly charge: 8-15 CD 200% monthly charge 16-30 CD 200% monthly charge + 200% daily charge*day of delay >30 days	No – monitored every 18 months
NL	5 WD quotation 1 WD order confirmation 15 WD confirmation of date	50-65 WD fibre end-user access	20% monthly charge: 1-6 WD (50% advanced SLA) 35% monthly charge 7-14 WD (75% advanced SLA) 60% monthly charge >=15 WD (100% advanced SLA)	No
Spain	15 calendar days	Terminating circuits: 60 working days	5% of connection fee for each day beyond the scheduled delivery date, except that If 85% of scheduled provisioning is reached, an extension can be given for the remaining 15%	Yes (in case of unfulfilled standard provisioning)
Sweden		Set by Teliasonera. No information on targets	1% monthly recurring charge per day of delay up to 30 days following the installation date	No. In order to receive credits, customer should submit a written claim within thirty (30) days of the end of the calendar month in which the failure occurred.
UK	1 WD acknowledged 8 WD confirmed	30 working days (WD)	100% monthly rental charge per WD beyond delivery date. Max 60x monthly rental	Yes

Annex II: Repair times and associated penalties

	Service availability	Fault repair time	Penalties	Electronic interface/24/7
Austria	Standard business/business + 99% Professional 99.9%	Standard SLA 12 working hours (8-17) Business/professional SLA 10 working hours (8-17 + Sat) Professional/prof + 6 working hours Extra charge outside working hours	Standard fault Clearance: 1-12 hours: 72 € 13-24 hours: 144 € 25-36 hours: 216 € ≥ 37 hours: 470 € additional 235 € at the end of each week from the beginning of delay. Business and prof €216 1-8 hours, €432 9-16 hours, €648 17-24h, €1700 >25h Business and prof + €288 1-5h, €576 6-10h, €1700 >11h. Extra €850 end each week No automatic compensation Availability Credit for shortfall of average availability for Professional and Professional Plus: < 99,9 %: 10 % < 99,7 %: 20 % < 99,5 %: 30 % < 99,3 %: 40 % < 99,1 %: 50 % < 98,9 %: 60 % < 98,7 %: 70 % < 98,5 %: 80 % < 98,3 %: 90 % < 98,1 %: 100 %	Standard within working hours. 24/7 possible extra cost

Belgium	99.9% (recent adaptation)	Max response time 30 mins. Initial info 1 hour. Disruption resolved within 5 hours	> 5 hrs -> 5% of the monthly connectivity fee > 10 hrs -> 10% of the monthly connectivity fee > 24 hrs -> 25% of the monthly connectivity fee penalties on the availability level < 99,90% -> 1.5% of the annual connectivity fee < 99.70% -> 5% of the annual connectivity fee	Electronic interface 24/7
France	Annual downtime should not exceed 13 hours for optical connections (99.85%) and 20 hours for copper	4 hours (working hours standard, Priority service levels all hours)	For each of access and interconnect segment 50% monthly rental 4-5 hours 100% monthly rental 5-6 hours 150% monthly rental 6-7 hours 300% monthly rental 7 hours + Annual penalties capped at 6 months rental – with proportionate adjustments depending on order date For not respecting annual service availability obligations 25% of monthly rental between 13-15h, 50% 15-17h, 75%17-19h and 100 for 19h+	Service desk 8.00-18.00 standard 24/7 priority SLA

Germany	99%
	High performance solution 99.9% is available for CFV Premium eg 10G, but not in RO
		24 hours (standard) and option for 8 hours express. CFV Premium 8 hours	Standard repair
			>12 h: 10% of the monthly price
			>30 h: 15% of the monthly price
			>48 h: 20% of the monthly price
			
			Express Repair within 8 hours (relevant for CFV Premium and CFV SDH or CFV Ethernet if the express option is ordered directly at the begin of the order process):
			  >2h: 10% of the monthly price
			  >4h: 20% of the monthly price
			  >8h: 40% of the monthly price
			
			No automatic compensation
				Telephone, not online. 24/7

Ireland	99.9%	3 working hours max response time 8 working hours max time to repair	2% of monthly circuit rental per working hour in breach to a max of 50% of monthly circuit rental per fault. Max 2 months circuit rental credit in any one 12 month period per circuit Automatic compensation	Not 24/7
Italy	99.5% terminating circuits 99.55% interconnection 99.8% premium service	Non-functioning circuits: 5 hours (4 hours premium) Deterioration:10 days in 90% of cases	Terminating circuits 25% monthly subscription: <=4 hours 100% monthly subscription: 4-8 hours 200% monthly subscription: 8-10 hours 200% monthly sub + 200% daily sub charge*delayed hour > 10 hours Failure to meet availability: 0.5% monthly sub for every 100th of percentage point for which availability standard not met	Electronic interface
Netherlands	Average yearly availability: 99,9 % over Fibre access standard (single fibre) 99,98% Fibre access protected (redundant) 99,9% Copper access	Restoration time: - standard: 90% within 8 hours of trouble ticket. 100% within 12 hours (except for fibre/copper disruption at end user side) - advanced: 90% within 4 hours, 100% within 8 hours	standard fibre & copper: - for standard SLA , restoration time longer than 8 hours: 60% discount on recurring monthly charge of end user access + virtual circuit. 20% on access port POI - for advanced SLA: between 2 and 4 hours: 40% discount, longer than 4 hours: 60% and maximum 50% discount on access port POI. - for advanced SLA: between 2-5 minutes, 10%, between 5 minutes and 1 hour, 20%, between 2-4 hours, 50% and above 4 hours 60% and max 50% on access port POI Compensation not automatic. Expires if not requested in 6 months	24/7, but telephone only – not online

Spain	Availability Client Service: 99,93% Availabilty connection service: dual path: 99,905% single path: 99,83% Availability of interconnection circuits Single path: 99,92% Dual path: 99,9595%	Capitals of provinces 8h (6h priority) Outside capitals 10h (8h priority)	Broken line (capital of province): 16,70% * monthly charge per hour delayed Broken line (others): 12,50% * monthly charge per hour delayed Service degradation(capital of province):12,50% * monthly charge per hour delayed Service degradation(others): 10% * monthly charge per hour delayed	Service desk 24/7
Sweden	Standard 99.2%/ Gold 99.6% / Platinum 99.8%	4h (Platinum) and 8h (Standard and Gold) after a trouble ticket for the fault has been openen	For each fault, 20% of monthly fee up to 60% max in each period For service availability, for every 100th percentage below guarantee, TeliaSonera pays 0.25% of the measurement period recurrent fee to a max of 40%	Standard hours 7.30-18.00 24/7 Gold and platinum service
UK	No general commitment	Acknowledge within 1 hour. Fault repair within 5 hours	15% of monthly charge for each full hour in excess of 5 hours. Max 200 hours Automatic compensation	Electronic interface 24/7 response

Annex III: Price benchmark methodology

	Product	Point to point or point to aggregate	Comments	Methodology
Belgacom (Belgium)	BROSToLL Ethernet BGC-sited	Point to point	Distance-based pricing in bands of 0-5, 5-20, 20-50 and >50km	Product assumed to be local access, relevant distances taken. Prices for link between Belgacom site and external site
BT Openreach (UK)	Ethernet Access Direct (EAD)	Point to point	Local access and 'standard' variants. Pricing for access circuit (customer to serving exchange) for local access and standard EAD is not distance dependent but has max radial distance of 25km (extended reach product available to 45km for additional charge). In addition to access circuit, standard EAD typically incorporates a 'main link' from the serving exchange charged on a per metre basis	Local access product used for local access benchmark Standard access treated as 'regional' access for benchmark purposes. The 25km regional benchmark assumes an access link of 2km and 'main link' of 23km
Deutsche Telekom (Germany)	CFV Ethernet	Point to point	Prices distinguished between same or different local areas. For same local area, different prices for 'backbone', 'regio' and 'country' For different local areas, charges vary according to which types of region (see above) are being connected with additional distance-related charges	Same area is treated as 'local access'. Different local l areas treated as 'regional access'. For the regional benchmark we assume 2km in the access/terminating circuit with the remainder of the relevant distance being accounted for in the connecting circuit between areas. For the access segment, a weighted average of the locations backbone/region/country in the ratio 40:40:20. For the regional benchmark the weightings are based on 20% backbone regio/ 5% backbone country/ 40% backbone backbone/ 35% all other
Eircom (Ireland)	Wholesale Symmetrical Ethernet Access (WSEA)	Point to aggregate	Area and distance-based charging in the access segment. Area distinctions in the interconnect (logical) link	Standard (non-promotional) offer taken Customer-sited handover (CSH). Same node considered to be local access. Same region and different regions considered to be regional and national access respectively In the access circuit urban, provincial and rural in 40:40:20 proportion. In the interconnection circuit high and medium density in 80:20 proportion. Option 6 class of service for the logical link (regional access)

KPN (NL)	Wholesale Ethernet Access Service (WEAS)	Point to aggregate	Price differentiation based on 'on-net' vs 'near-net', area (metropolitan, urban, rural) and Class of Service (CoS)	Local access is assumed to be access at one of the 124 metro core locations. Regional access is one of the 13 geographical backbone locations aggregating a number of metro core nodes On-net NLS1+NLS2 (fibre directly available or only through max 3 splices) Class of Service (CoS) premium – guaranteed no overbooking Area assumption (40/40/20%) metro, urban, rural
Orange (France)	Core Ethernet LAN (CELAN)	Point to aggregate	Pricing differentiated by zone based on customer density (O1, O2, O3) Different classes of service (CoS) and service levels available Handover possible at serving exchange, distant PoP. National extension also available	Standard product with co-location at serving exchange used for local access benchmark National extension price taken for regional access benchmark Pricing based on weighted average of 40% O1, 40% O2 and 20% O3 CoS 'data guarantee' Includes 24/7 SLA on interconnection circuit, but standard on access component (working hours repair only)
Telecom Austria	Terminierende Segmente von A1 Ether Link Services mit garantierter Bandbreite	Point to point	Pricing differentiated according to regional capitals, city/city areas and regional	Assumed distribution is 40% regional capitals, 40% city/city and 20% regional. Local access is assumed to be handover within the same region (regional). Uber-regional (national) connections are used for the regional access benchmark
Telecom Italia (Italy)	Ethernet over SDH	Point to point	Terminating circuit charged on the basis of distance – up to 5km, 6-20km, 21-60km and >60km Local and regional interconnection offered. Pricing on the basis of distance bands with additional per km charge	Local access benchmark uses respectively 5km and 25km terminating segment + local interconnection (up to 5km band, but with assumed interconnect at the serving exchange).. Regional access benchmark uses 2km in the terminating segment and respectively 3km and 23km for regional interconnection.
Telefonica (Spain)	Ethernet (10M) Fast Ethernet (100M) Gigabit Ethernet (1G)	Point to point	Distance-dependent charges in bands of 0-2, 2-12 and 12-35km. >35km available for 1G product	Product considered as 'local access'. Relevant distances used.
Teliasonera (Sweden)	EPL 1 EVC incl + 2 Accesses	Point to point	Flat charges (not distance or area-dependent). Available from >800 PoPs covering the whole country	Product assumed to be local access