analysys mason

Report for BT Wholesale

Narrowband market review – international review and analysis of Ofcom’s fixed LRIC model

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Contents

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1 Executive summary

As part of BT Wholesale's response to Ofcom's narrowband market review, Analysys Mason was engaged to provide an independent review of international long-run incremental cost (LRIC) models of fixed-line networks and analysis of Ofcom's fixed LRIC model. We also compared Ofcom's approach to LRIC modelling in mobile and fixed environments.

Our international benchmarking process is not exhaustive, but rather highlights key areas for consideration. We identify the different approaches taken to modelling network costs, and where the approach taken in the UK varies from the different international cases.

Figure 1.1 summarises the findings of this study. Additional detail is provided in each of the separate chapters of this report.

Figure 1.1: Alignment of approach taken in the UK fixed cost model compared to fixed LRIC models benchmarked, and the UK mobile cost model [Source: Analysys Mason, 2013]

Item	UK situation	Detail
Alignment of the fixed model with evolution of fixed core technologies		
Migration profile between legacy and NGN networks	× compared to BT	• The UK model assumes all traffic is carried over an NGN by 2011/12 • In reality, a very small proportion of BT's voice traffic is routed via IP from the access network boundary • The models benchmarked all assume that the migration of voice traffic to NGN will be completed between 2014 and 2019; in Ireland, the migration is not assumed to begin until 2013
Alignment of the model with current/planned delivery of voice origination and termination		
Retail VoBB **Access method**	× compared to BT × compared to BT	• The UK model assumes that all traffic is carried over an all-IP network by 2011/12. Currently BT has neither a retail VoBB strategy in place to migrate traffic to IP from the customer premise, nor a FTTH-dominated access strategy, which would result in VoBB traffic from customer premises. A mass migration of traffic to all-IP is therefore unlikely in the short to medium term, unless BT places TDM-IP voice access gateways in cabinets or exchanges • The other markets benchmarked appear likely to adopt either a retail VoBB or a FTTH-dominated access strategy, which will enable the migration of voice traffic towards all-IP
Alignment of the fixed model with current/planned network architecture		
Core	✓ compared to benchmarked models × compared to BT	• The UK model assumes that an IP core is used for both voice and data traffic; this is similar across all of the benchmarked models • However, in the UK, BT does not plan to route voice traffic over its IP core, but rather plans to continue to use its SDH core for this purpose. As noted above, BT has not implemented a strategy for mass migration of voice traffic to all-IP • In most of the benchmarked markets, operators have already started to transfer voice traffic onto the IP core
Transmission	× on the use of 100Gbit/s units ✓ for router cost and meshing	• The UK model assumes extensive use of 100Gbit/s cards from 2007/08 • None of the benchmark models assume that 100Gbit/s units are used • 100Gbit/s cards only became readily available in 2011/12 and only now is 100Gbit/s being planned in the BT network. • The costs of the core routers assumed appear reasonable, and the meshing of the network assumed in the model is also largely reflective of reality

Item	UK situation	Detail
Alignment of the model with current/planned delivery of voice: fixed vs. mobile model		
General approach to modelling fixed core and mobile network costs	× when compared to the degree of model-to-reality alignment in the mobile sector	• The UK fixed model is based on a hypothetical operator rolling out an NGN network in four years from 2007/08 to 2011/12; the operator is not assumed to operate a legacy network, and no migration period is assumed in which costs for both legacy and NGN networks are included (we note traffic migration, but not the inclusion of legacy network costs during the migration period) • By comparison, the UK mobile cost model is much more closely aligned to the network evolution of the mobile operators in the UK, in particular, an evolution from 2G to 3G is assumed, during which time, the costs of both networks are included • The UK mobile market model is also closely aligned with the actual UK operator network dimensioning, network sharing and market shares
Comparison of approach taken towards depreciation and cost recovery		
Depreciation methodology	✓ similar approach taken in some of the benchmarked models × compared to tilted annuity models	• The UK model uses an economic depreciation approach, which is in line with the approach used in the Netherlands, and also in the UK mobile cost model • We note that the majority of our benchmarks (Sweden, France, Italy, Malta, Ireland) have adopted a tilted-annuity depreciation approach for their fixed cost models
Comparison of cost recovery	× compared to benchmarked models	• The UK model has a significantly slower cost recovery profile than our benchmarks, reaching only 60% cost recovery in 2020 (full costs are recovered by March 2046), compared to 94% for the UK mobile at the same date, over 98% in France and over 78% in the Netherlands
Opex, working capital and installation costs		
Opex price trends	× compared to benchmarked models	• The UK model assumes a significant annual reduction in opex prices, which means that prices (in real terms) reach 34% of their 2007 price by 2026 • By comparison, in France and the Netherlands, opex prices are kept stable in real terms across the whole period modelled (stable real-terms opex reflects general inflationary increases to rents, wages, etc.) • The UK mobile model also assumes roughly constant prices – in real terms – from 2007, across all network elements
Treatment of working capital	✓ compared to benchmarked models	• The UK model does not include provision for working capital • Within our benchmarks, only the Dutch and Maltese models include an allowance for working capital • The UK approach is therefore consistent with the majority of benchmarks

Item	UK situation	Detail
Treatment of installation capex	**✓ compared to benchmarked models**	• The UK model assumes installation capex by network element based on the number of man days to install • The overall installation capex as a percentage of total capex during the network roll-out period is in the middle of our benchmarks where installation costs are explicitly modelled (the Netherlands and Sweden)
Implemented termination rate, adjustments and glide path		
Adjustment to pure LRIC	**× compared to France, and LRAIC+ countries**	• Ofcom proposes to implement the pure LRIC rate to fixed termination in the UK, with no adjustments assumed • By comparison, some benchmark markets do include some adjustments to the pure LRIC cost calculated, e.g. France (where an adjustment of 22% can be seen) and (potentially) in Sweden where additional costs are identified. In the Netherlands and Sweden some form of LRAIC+ methodology was applied
Glide paths applied to the implementation of the new termination rates	**× compared to longer glide paths in other countries**	• The UK model assumes a 6-week glide-path for migration from current termination rates to pure LRIC termination rates • Other benchmark markets have applied glide paths of between six months and one year • However, we note that all but one (Sweden) end before the UK date of October 2013, as the processes were started earlier (Sweden's glide-path ends in 2014)

Some of the analysis in this report concerns timescales for the evolution of technology and traffic. In Figure 1.2 we have summarised the alignment of each of the benchmarked models with the current and planned strategy of the former incumbent telecoms operators across four different time periods.

This analysis highlights that the UK mobile model is in line with the mobile operators' strategies both historically and currently. The UK fixed model, by contrast, does not reflect BT's strategy either today or in the short- to medium-term future (2013–20). In France the model reflects the former incumbent operator's strategies both today and in the short- to medium-term future (2013–20); in Sweden, Ireland and Malta, the single-year models reasonably reflect the former incumbent operators' strategies in the short and/or medium term.

Figure 1.2: Summary of alignment of benchmarked models with the current and planned strategy of operators across four different time periods [Source: Analysys Mason, 2013]

Model	1990-2005	2005–2012	2012–2020	from 2020
UK mobile model				
2011 Mobile	**The model is in line with past and current behaviour and publicly stated future behaviour of major operators** It designs a hypothetical operator with a long-term 25% market share. In the model, operators use 1800MHz band for 2G and 2100MHz band for 3G	**The model is in line with market** The model assumes a gradual migration of voice traffic from 2G to 3G and network sharing	**The model is partly in line with market plans** The model does not foresee switch-off of GSM networks by the end of the forecast period However, 4G network costs are not included	No plans are known beyond 2020
UK fixed model				
IP core	Not applicable, the model starts in 2005/2006	**The model is not in line with market** The model was built based on the 21CN plan, which included 100G Ethernet links. BT completed 21CN core but it is used to carry data and not voice traffic (outside Cardiff)	**The model is not in line with market expectations** The model assumes that all voice is on 21CN. We understand that BT does not have any medium-term plans to migrate voice to all-IP	No plans are known beyond 2020
SDH	Not applicable, the model starts in 2005/2006	The model ignores SDH	The model ignores SDH	
France fixed model				
IP core	IP core was not available	**The model is in line with market** France Telecom has completed the migration to an IMS-based, all-IP core	**The model is in line with market** France Telecom has completed the migration to an IMS-based, all-IP core	
SDH	The model ignores SDH	The model ignores SDH	The model ignores SDH	
The Netherlands fixed model				
IP core	The model starts in 2004	**The model is not in line with market** KPN announced all-IP plans and completed NGN core, but it is used to carry data but not voice KPN has yet to switch off its legacy network	**The model is eventually in line with plans** The model assumes all-IP core, but it was only in February 2013 that KPN commissioned Alcatel-Lucent to migrate its network to IMS-based, all-IP platform	No plans are known beyond 2020
SDH		The model ignores SDH	The model ignores SDH	

Model	1990-2005	2005–2012	2012–2020	from 2020
Sweden fixed model				
IP core	Not applicable, it is a single-year model	Not applicable, it is a single-year model	**The model is in line with market** TeliaSonera migrated to IMS in 2007.	
SDH	Not applicable, it is a single-year model	**The model is in line with the market** A glide path from the previous legacy model has been applied	Not applicable, it is a single-year model	
Ireland fixed model				
IP core	Not applicable, it is a single-year model	Not applicable, it is a single-year model	**Short-term all-IP is not expected** A short migration to IP technologies is modelled	
SDH	Not applicable, it is a single-year model	Not applicable, it is a single-year model	**The single-year model is in line with short-term market plans** A short migration off TDM is modelled	
Italy fixed model				
IP core	Not applicable, it is a single-year model	Not applicable, it is a single-year model	**We do not know the future plans of the operator** A short migration to IP technologies is modelled	
SDH	Not applicable, it is a single-year model	**The model is in line with the current market** A short migration off TDM is modelled	The model ignores SDH	
Malta fixed model				
IP core	Not applicable, it is a single-year model	Not applicable, it is a single-year model	**The model is in line with medium-term market plans** All-IP technologies are expected to accompany FTTH and be deployed relatively rapidly in a small country like Malta	
SDH	Not applicable, it is a single-year model	Not applicable, it is a single-year model	The model ignores SDH	

2 Introduction

As part of BT Wholesale's response to Ofcom's narrowband market review, Analysys Mason was engaged to provide an independent review of international long-run incremental cost (LRIC) models of fixed-line networks and analysis of Ofcom's fixed LRIC model. We also compared Ofcom's approach to LRIC modelling in mobile and fixed environments.

This report consists of in-depth analysis into selected areas, namely:

- Migration profile between legacy and next-generation networks (NGNs).
- Alignment of the model with current/planned delivery of voice origination and termination:
  - Retail offer
  - Access method.
- Alignment of the model with the current/planned network architecture:
  - Core network
  - Transmission network.
- Alignment of the model with current/planned delivery of voice origination and termination, comparing the UK mobile model with the UK fixed model
  - Modelled operator
  - Technology and spectrum
  - Technology migration
  - Network dimensioning
  - Network sharing.
- Comparison of the approach taken towards depreciation and cost recovery
  - Depreciation methodology
  - Comparison of cost recovery.
- Review of the approach to opex, working capital and installation costs
  - Opex price trends
  - Treatment of working capital
  - Treatment of installation capex.
- Review of glide-paths and other adjustments applied to the implementation of the new termination rates.

Each item listed above is considered within a separate section of this document. We have first summarised the status, dates and documents referred to in our benchmarks (Section 3).

3 Summary of benchmarks

In order to put the proposed fixed termination rates for the UK into context, we have reviewed the approach taken in a selection of Western European markets. We have undertaken a detailed assessment of three markets, and a higher-level review of three more, as described below:

- For **France, the Netherlands** and **Sweden**, we have access to model documentation, regulatory announcements and the cost models themselves. As such, have undertaken detailed reviews and comparisons with the UK.
- In the case of **Italy, Ireland** and **Malta**, we have reviewed model documentation and regulatory announcements. However, the cost models themselves are not available, and as such, a higher-level review was performed.

We have also compared the approach taken in the UK fixed LRIC model with that taken in the UK mobile LRIC model.

The markets for which detailed reviews were undertaken were agreed in advance with BT Wholesale. They were chosen according to the availability of the full cost model and supporting documentation, implementation of fixed termination rates, use of a cross-section of approaches and final rates. As such, the benchmarks represent a sample of different approaches rather than a comprehensive review or a 'typical' approach.

We have summarised the key dates and features of the benchmarks used in Figure 3.1, with further details of the sources and publication dates of the reviewed documentation below.

Figure 3.1: Summary of benchmarked market fixed LRIC models [Source: Analysys Mason, 2013]

Country	Date of European Commission (EC) notification / implementation	Start date of model	FTR approach (LRIC, LRIC+, LRAIC, etc.)	Single year / multi-year (years)	Legacy / NGN	Built by	Material in the public domain
UK	Notification not yet provided (draft model for consultation released on 05/02/2013)	2005/06	Pure LRIC	Multi-year (40 years)	NGN	Ofcom/ CSMG	Draft public model, model documentation and consultation documents
France	11/07/2011	2004	Bottom-up LRIC (BU-LRIC)	Multi-year (12 years)	NGN	ARCEP/ Analysys Mason	Public version of the model, model documentation, consultation and decision documents
The Netherlands	13/02/2012 (however, model information based on original model of April 2010)	2004	BU-LRIC	Multi-year (49 years)	NGN	OPTA/ Analysys Mason	Public version of the model, consultation and decision documents
Sweden	26/11/2012 (however, model update made in December 2012 – the EC has not yet been notified of the new rates)	Single year model, current model for 2013	Hybrid LRIC	Single year	NGN	PTS/ BWCS	Public version of the model, consultation and decision documents
Italy	07/02/2013	Not known, model not released	BU-LRIC/TSLRIC	Not known, model not released	NGN	AGCOM/ NERA	Access model and consultation documents
Ireland	12/11/2012	Not known, model not released	BU-LRIC	Not known, model not released	Transition from legacy to NGN	ComReg/ TERA	Consultation and decision documents
Malta	14/12/2012	Not known, model not released	BU-LRIC	Not known, model not released	NGN	MCA/ Analysys Mason	Consultation and decision documents

Our analysis was based on the following documentation from the public domain:

UK fixed

- Draft CSMG network charge control model, February 2013
  - http://www.ofcom.org.uk/static/models/NCC-models.zip
- Draft CSMG model documentation, Fixed narrowband market review: NGN cost modelling, February 2013
  - http://stakeholders.ofcom.org.uk/binaries/consultations/nmr-2013/annexes/Annex_13_CSMG_report.pdf
- Review of the fixed narrowband services markets: consultation on the proposed markets, market power determinations and remedies, February 2013
  - http://stakeholders.ofcom.org.uk/binaries/consultations/nmr-2013/summary/NMR_Consultation.pdf
- Commission decision concerning case UK/2011/1182: Modification of remedies concerning fixed narrowband wholesale services in the UK.

UK mobile

- Ofcom, Analysys Mason, Final UK mobile LRIC model, March 2011
  - http://www.ofcom.org.uk/static/wmctr/

France

- ARCEP, Analysys Mason, Final model, Modèle technico-économique des coûts de la terminaison d'appel fixe en France, April 2011
  - http://www.arcep.fr/index.php?id=8080
- ARCEP, Analysys Mason, Model documentation, April 2011
  - http://www.arcep.fr/index.php?id=8080
- Commission decision concerning Case FR/2011/1236: call termination on individual public telephone networks provided at a fixed location in France.

The Netherlands

- 2010 model, consultation and decision documents, Ontwerp marktanalysebesluit vaste en mobiele gespreksafgifte, April 2010
  - http://www.opta.nl/nl/actueel/alle-publicaties/publicatie/?id=3180
- Commission decision concerning case NL/2012/1284: Call termination on individual public telephone networks provided at a fixed location in the Netherlands

- Commission decision concerning case NL/2010/1079: Call termination on individual public telephone networks provided at a fixed location.

Sweden

- Hybrid model version 9.1, December 2012
  - http://www.pts.se/upload/Ovrigt/Tele/Prisreglering/2013/12-6520-hybridmodel-9_1.zip
- Model documentation, Dokumentation av hybridmodell v.9.1, December 2012
  - http://www.pts.se/upload/Ovrigt/Tele/Prisreglering/2013/12-6520-dokumentation-hybridmodell-9_1.pdf
- Consultation document, PTS konsultationssvar på samråd av hybridmodell, December 2012
  - http://www.pts.se/upload/Ovrigt/Tele/Prisreglering/2013/12-6520-pts-konsultionssvar-hybridmodell-9_1.pdf
- Consultation document, PTS Berakning av samtrafikpriser medsarkostnad – en kosekvensanalys, March 2012
  - http://www.pts.se/sv/Dokument/Remisser/2012/Forsta-samrad-pa-samtrafikmarknaderna/
- Commission decision concerning Case SE/2012/1379: Price related remedies in Sweden
- Commission decision concerning Case SE/2011/1205: Further details of price control remedies – review of the LRIC model
- Commission decision concerning case SE/2009/1017 – Call termination on individual public telephone networks provided at a fixed location,

Italy

- Consultazione pubblica concernente la definizione di un modello di costo per la determinazione dei prezzi dei servizi di accesso all'ingrosso alla rete fissa di Telecom Italia S.p.A. ed al calcolo del valore del WACC ai sensi dell'art. 73 della delibera n. 731/09/CONS, May 2010
  - http://www.agcom.it/default.aspx?message=viewdocument&DocID=4178
- Commission decision concerning Case IT/2013/1415: Price related remedies on the markets for call origination, call termination and call transit on individual public telephone networks provided at a fixed location in Italy.

Ireland

- Voice termination rates in Ireland: proposed price control for fixed and mobile termination rates, June 2012
  - http://www.comreg.ie/_fileupload/publications/ComReg1267.pdf

- Mobile and fixed voice call termination rates in Ireland: response to consultation, decisions and decision instruments, November 2012
  - http://www.comreg.ie/_fileupload/publications/ComReg12125.pdf
- Commission decision concerning Case IE/2012/1372 – Call termination on individual public telephone networks provided at a fixed location in Ireland – remedies
- Commission decision concerning Case IE/2011/1220: Modification of remedies in the wholesale call origination and call termination markets.

Malta

- The MCA's new bottom-up cost model for fixed networks and proposed interconnection prices: public consultation and proposed decision, October 2012
  - http://www.mca.org.mt/consultations/mcas-new-bottom-cost-model-fixed-networks-and-proposed-interconnection-prices
- The MCA's new bottom-up cost model for fixed networks and proposed interconnection prices: response to consultation and decision, December 2012
  - http://www.mca.org.mt/service-providers/decisions/mcas-new-bottom-cost-model-fixed-networks-and-fixed-interconnection
- Commission decision concerning Cases MT/2012/1401-1402: Cost model and review of rates in the markets for call origination on the public telephone network provided at a fixed location and for call termination on individual public telephone networks provided at a fixed location, December 2012.

4 Migration profile between legacy and NGN networks

According to the EC's 2009 Termination Rates Recommendation, the cost model used in the calculation of termination rates should be based on the "*efficient technological choices available in the time frame considered by the model, to the extent that they can be identified*". This Recommendation encourages modelling a network with an NGN core; however, there is no guideline for the time scale within which this transition might occur in the individual market. This has been interpreted by the regulators in two main ways:

- modelling an NGN, using an IP core
- setting out a migration path for the move from TDM to NGN technology.

The Ofcom model considers a 40-year modelling period from financial year 2005/06 to 2045/46. The core NGN roll-out commences in 2007/08 and lasts for four years, during which time "*a number of exchanges are added to the NGN each year until all exchanges have been covered*". The modelled NGN roll-out is completed in 2011/12 and as a result, the forward-looking costs produced as outputs from this model are for an all-IP NGN. Ofcom considers that this "*provides an appropriate basis for setting efficient prices for wholesale call origination and wholesale call termination*".

In terms of international comparators, summaries of the choice of modelled network technology from the regulatory announcements and models are provided below.

France

The ARCEP model considers a generic operator with IP-based NGN technology throughout the entire modelling period 2004–16. However, the transition from traditional voice calls to voice over IP (VoIP) carried on the NGN is assumed to occur in a phased manner over the period of the model. As a result, there is a load-up of traffic that the NGN can carry over the duration of the model. The migration of voice traffic is assumed to follow the path illustrated in Figure 4.1 below. The choice of 90% of voice traffic carried over IP in the French market in 2016 is based on France Télécom's decision to shut down its PSTN network in 2018. A similar trend is modelled for the data traffic; however the migration to IP for this is slower than for voice calls.

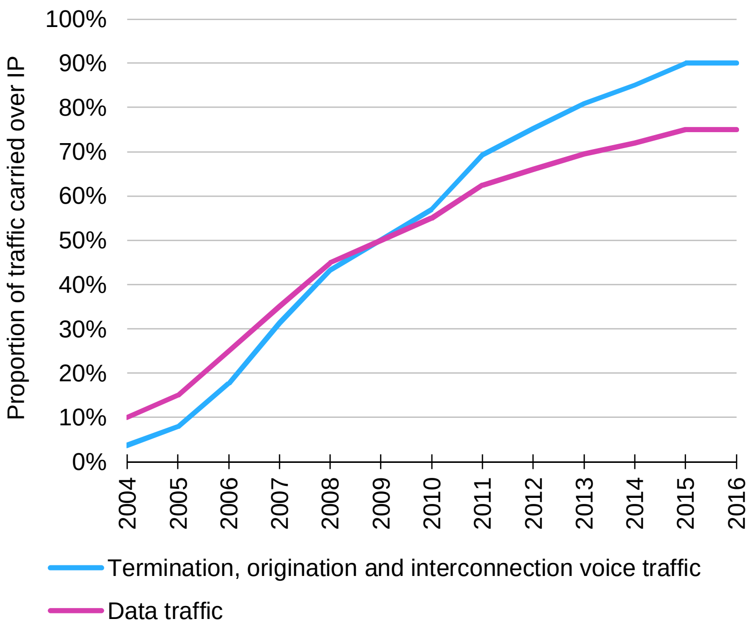


Figure 4.1: Proportion of market voice traffic carried over IP in the French model [Source: French fixed LRIC model, 2011]

The Netherlands

OPTA's model is based on the assumption of a transition to NGN infrastructure, with rapid roll-out to nationwide coverage over a two-year period. We note that the Dutch traffic profiles are consistent in principle between the fixed and the mobile models because they were built in parallel

National NGN services (VoIP) are modelled as being launched on 1 January 2006, with the assumption of a transition from traditional services carried over the operator's legacy network to those carried over the new network. The operator's legacy network is due to be shut down in 2019. The curves used in the model for the loading of the NGN with voice and data traffic are shown in Figure 4.2 below – these differ by traffic type.

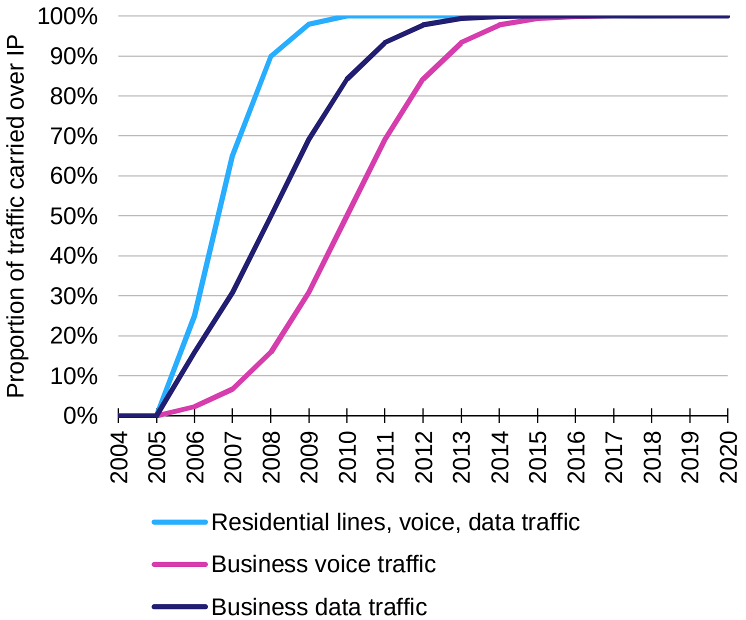


Figure 4.2: Proportion of residential and business traffic on the NGN in the Dutch model [Source: Dutch fixed LRIC model, 2010]

Sweden

The PTS model uses a "*stepped transition scheme*" over the period 2008–14 to move between two LRIC hybrid models based on different technologies: one on circuit-switching technology and the other on NGN technology. The weighting on the circuit-switching-based model falls by one seventh (of the initial value) each year from six sevenths in 2008 to zero in 2014, at which point the regulated rates will fully reflect a next-generation fixed network. However, within the 2014 model, the network design and costing calculation assumes that all of the relevant traffic is carried immediately on the NGN.

Italy

The model considers an all-IP NGN, based on AGCOM's assumption that such a technology will soon be adopted by all market operators. The proposed regulated fixed termination rates are calculated as a weighted average of the results of this model and a 2012 termination rate, set via a previous model on the basis of a TDM network and using a LRIC+ methodology. The details of the weighting between the results of the two models and the resulting proposed termination rates are set out in Figure 4.3 below.

Proposed date of implementation	Proposed rate (EURc/min)	Proposed IP traffic percentages to be used in the FTR weighting
2012	0.272	0%
2013	0.206	33%
2014	0.127	66%
2015	0.043	100%

Figure 4.3: IP traffic percentages proposed for the calculation of weighted average fixed termination rates in Italy [Source: EC decision IT/2013/1415, 2013]

Ireland

ComReg's model for fixed termination rates is based on a combination of PSTN and NGN technologies, with NGN deployment beginning in 2014 and the proportion of these technologies in use varying over time. This choice of launch date for NGN deployment is based on statements from the operators that their own procurement of an NGN solution is not going to be completed during 2013. As such, until the end of 2013, the model considers a TDM network as it currently exists. Given the acknowledgement by operators that procurement is under way there is a relatively short migration profile from TDM to NGN technology, finishing with a full next-generation voice network in 2015. The details of the migration between the efficient network technologies are shown in Figure 4.4 below.

Proposed date of implementation	Proposed rate (EURc/min)	Efficient network technology
1 July 2013	0.098	TDM
1 July 2014	0.085	TDM/NGN
1 July 2015	0.072	NGN

Figure 4.4: Migration profile between efficient network technologies in Ireland [Source: EC decision IE/2012/1371, 2012]

Malta

The MCA's model calculating Maltese fixed termination and origination rates has the capability to run under two distinct technology scenarios:

- an 'as-is' scenario based on the latest financial year for which full year data is available (2011)
- a scenario based on next-generation access (NGA) using fibre to the cabinet (FTTC) with an all-IP NGN reflecting the modern efficient technological choice that meets the requirements of the EC Recommendation.

However, only the result with the 'FTTC NGA and all-IP NGN' scenario is public and these are the values used for the regulated termination and origination rates. The MCA has stated that technology choices prescribed by the EC Recommendation are "*compliant with the FTTC NGA and all-IP NGN scenario in BUCM 2*".

Conclusion

The majority of models benchmarked assume some kind of gradual migration of traffic between TDM and IP. However, the UK model assumes the earliest TDM switch over, with all traffic assumed to be carried over IP by March 2012. Following this, Sweden assumes all IP voice by 2014, whilst the Netherlands assumes that some traffic will be on TDM until 2019, and the remainder of our benchmarks sit in the middle.

We consider the alignment of these assumptions with the strategies of the operators concerned in the following section.

5 Alignment of the model with current/planned delivery of voice origination and termination

All of the fixed cost models benchmarked assume a migration of fixed voice traffic to the all-IP NGN. However, the real (as compared to modelled) migration of fixed voice delivery to IP in each of the countries benchmarked varies significantly, both in terms of the progress of this migration, and the approach taken.

It is customary that the cost model for voice origination and termination is a model of *core* network costs, excluding access elements beyond the line card. However, the core network model implicitly relies on a choice of (IP) voice access methods.

In order to transfer all voice traffic to an all-IP network (and switch off the legacy SDH core), operators will have to adopt one of three main approaches:

- **Retail offer of voice over broadband** (VoBB) with IP telephones or routers that support a VoIP function (possible over ADSL or VDSL) located at the customer premises.
- **FTTH with native VoBB**, which includes new FTTH customer premises equipment.
- **TDM to IP gateways in the access node (at the line card)**, allowing transport of traffic via IP from the line card, whilst maintaining PSTN voice between the line card and the premises (i.e. no change to customer premises equipment). This approach is possible in parallel with ADSL or VDSL, using MSANs.

Each of these three approaches requires an IP core and transmission network. Models may, to a greater or lesser extent, reflect the actual IP core and transmission deployed by the former incumbent operator.

Approach

For the purpose of comparing the benchmark cost models with the current and planned operator strategies, the delivery of voice origination and termination service can be seen in terms of two principal characteristics:

- retail offer
- access method.

We consider each of these areas in turn below, along with comparisons and conclusions.

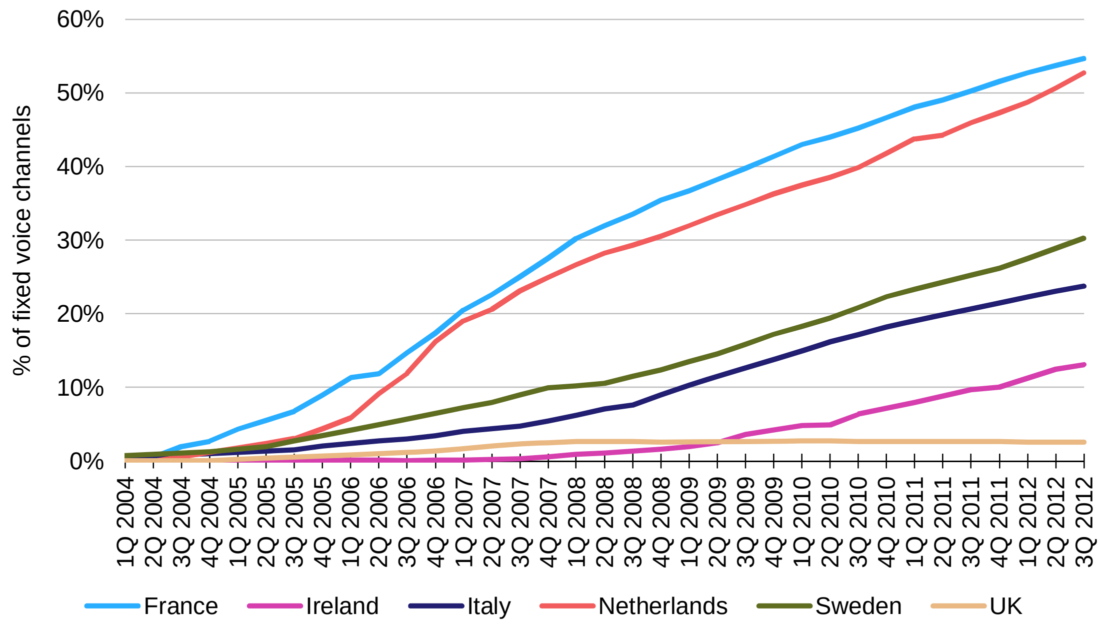
5.2 Retail offer

5.2.1 Historical and current

In the UK, retail offers for fixed voice services are overwhelmingly focused on TDM, based on PSTN and ISDN services. There has been only very limited migration to VoBB within BT's fixed network.

This is in contrast to some of our benchmark markets, in which take-up of VoBB has been significant, as shown in Figure 5.1 below. Here we observe 'leaders' such as France and the Netherlands, 'followers' such as Sweden, Italy and (just started via cable operator UPC) Ireland, and 'refrainers' such as the UK.

Figure 5.1: VoBB channels as a proportion of total fixed voice channels [Source: Analysys Mason Research, Q3 2012]



The migration of voice channels to VoBB is driven by retail offers and upgrades to customer premises equipment, providing customers with incentives to move away from PSTN.

In France, in particular, retail offers for VoBB (as part of a triple- or quad-play package) provide a reduced cost option for customers compared to the PSTN alternative. France Telecom, Iliad ('Free'), Numericable and Neuf Cegetel/SFR all have double- and triple-play packages, over both ADSL2+ and FTTH. As a result, VoBB take-up in France has been very high, at 55% in Q3 2012.

Take-up of VoBB in the Netherlands is driven by the cable companies (such as Ziggo and UPC), which offer VoBB as part of a triple-play subscription, at competitive prices. These offers have been matched by KPN for its FTTH customers. Given the high coverage and penetration of cable services, VoBB represents over 50% of fixed voice channels in the Netherlands.

In Sweden, all fixed line operators offer VoBB, which is delivered over ADSL, VDSL, FTTH and cable, with both double- and triple-play packages. VoBB accounted for 30% of fixed voice channels in Q3 2012.

In Italy, all fixed operators offer VoBB on both ADSL and FTTH with double-play packages (and triple-play packages for Telecom Italia and Fastweb). The VoBB share of fixed voice channels has now reached 24%.

In Ireland, UPC has (cable) double- and triple-play offers that include VoBB; eircom is also starting to offer VoBB with its FTTH packages. As VoBB is not available with ADSL2+ connections, it is largely limited to premises with cable access, and therefore remains relatively low, at around 13% of fixed voice channels (but growing).

In the UK, existing VoBB offers are insufficiently attractive to cause any significant migration away from PSTN. The UK market is not currently structured in such a way as to make VoBB an attractive mass-market proposition for fixed voice service providers. BT does offer a range of double- and triple-play VoBB services over both ADSL and FTTH however payment of line rental is still required. Orange is the only provider to offer VoBB services without additional payment of line rental in the UK.

5.2.2 Planned

We understand there are no current plans by BT to transfer fixed voice customers en masse onto VoBB offers in the UK, either on the copper or the FTTC access network. Indeed, a wholesale voice-over-VDSL offer is not currently available, and only a single copper exchange has been closed down and replaced by a fibre-only exchange in a trial area.[1]

France Telecom has already begun to close down some of its PSTN switches ("consolidating the PSTN network"[2]), though the cost model documentation notes that it does not expect to decommission its PSTN network before 2018.

Neither KPN nor Telecom Italia have committed to a PSTN switch-off date. In the Dutch model, it is assumed that PSTN switch-off will occur in 2019.

In Sweden, PSTN lines have dropped by almost 50% over the last five years, from 2.9 million in 2006 to 1.5 million in 2011 with a relatively linear trend[3]. Should this trend continue it can be expected that PSTN will be phased out entirely by 2020. However, TeliaSonera has not made any announcements to this effect.

1 BT announced on 29 March that a UK village would be its first pilot location for fibre-only network infrastructure, and therefore the first fibre-only exchange (FOX) in the UK

2 ARCEP, Public Consultation, February 2011

3 TeliaSonera Investor day presentation, 2011

In Ireland, ComReg commented in its Next Generation Access (NGA) Remedies in Wholesale Regulated Markets consultation in February 2012, that *"at this time we cannot see any removal of the PSTN before the next 5 to 10 years in the key urban areas and a lot longer in areas where NGA is not deployed by eircom."*[4]

5.2.3 Conclusion

From this analysis, it is clear that migration to VoBB has not yet happened to any meaningful extent in the UK, and there appear to be no plans to push for such a transition. It does not appear that any of the benchmarked incumbents are adopting a rapid 'forced' migration strategy. It is also apparent that, once a VoBB strategy has been adopted, the managed migration process is likely to take more than ten years to complete (e.g. based on the historical take-up in France).

Therefore the assumed IP-based voice in the UK will need to be provisioned via access gateways in the short and medium term.

5.3 Access method

5.3.1 NGN plans

Fixed-line operators across Europe are upgrading their access networks to NGA. A wide variety of approaches have been taken, however, they can largely be split between those countries with a focus on FTTH, and those using VDSL.

Note: In the analysis below we focus on copper- and fibre-based incumbent operators, we acknowledge that cable operators also provide NGN services; however, we have excluded these for the purpose of comparison in the context of fixed core network cost modelling.

The different expectations are illustrated in Figure 5.2 and Figure 5.3, which show current Analysys Mason Research forecasts for NGA roll-out, described in more detail below.

4 Next Generation Access (NGA) Remedies in Wholesale Regulated Markets: Wholesale Physical Network Infrastructure Access (WPNIA) and Wholesale Broadband Access (WBA) Remedies in an NGA Environment, 03/02/2012

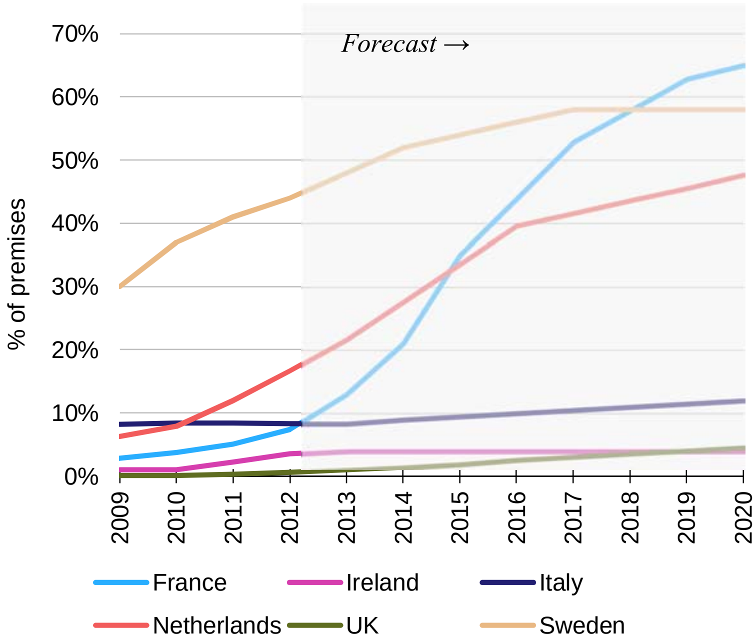


Figure 5.2: FTTH roll-out coverage forecasts by country [Source: Analysys Mason Research, Q1 2013]

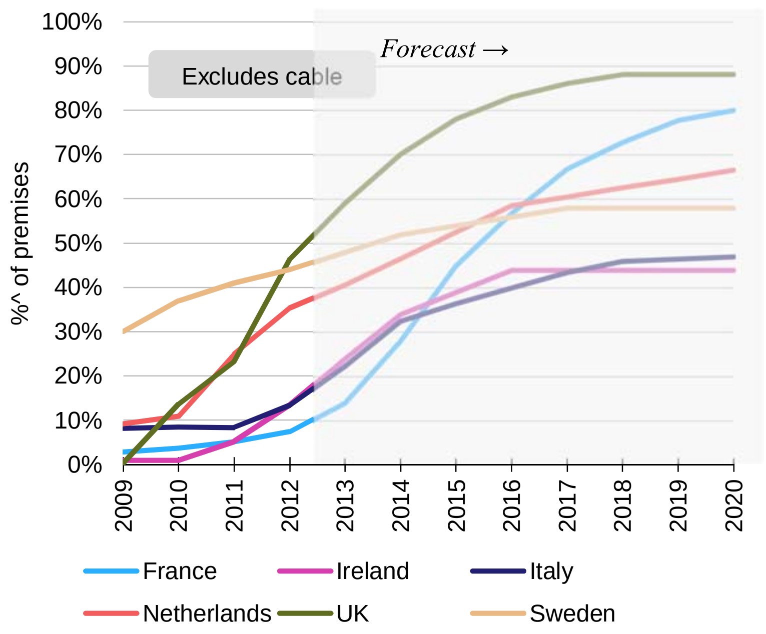


Figure 5.3: Total FTTx (FTTP, VDSL, FTTB/LAN) roll-out coverage forecasts by country [Source: Analysys Mason Research, Q1 2013]

UK

In the UK, BT intends to provide rapid and widespread NGA coverage of premises, with a roll-out that focuses provincially on VDSL, complemented by a limited roll-out of FTTH (expected to be around 5% of premises covered by 2018[5]). BT plans to reach 66% coverage of premises in the UK

5 Analysys Mason Research estimates

by early 2014[6] commercially. In addition to this, a series of local and regional government schemes are expected to extend this to around 90% NGN coverage by 2018[7].

France

In France, the four key fixed-line infrastructure operators all have active fibre-deployment plans to provide NGA. France Telecom has a target of 60% of households by 2020, however we expect the combined total to be closer to 80% within this period. A significant proportion of these lines are expected to be FTTH (around 80% in 2020). This is a result of clarification of the regulatory framework for co-development and sharing of infrastructure and access, combined with government pressure and incentives, and operators' own initiatives.

The Netherlands

In the Netherlands, the incumbent's strategy involves a roll-out of VDSL2 from the central office[8] (VDSL2-CO), VDSL2-FTTC and FTTH via its Reggefiber joint venture with the private investment firm Reggeborgh. Reggefiber plans to roll-out FTTH to around 20% of premises by the end of 2013. Roll-out targets for VDSL have not been disclosed, however, we expect around 70% of KPN's NGA coverage to be FTTH.

Sweden

Sweden has a high concentration of superfast NGA infrastructure, particularly in larger urban zones. This includes a substantial amount of fibre, in two main variants:

- Fibre LAN networks in apartment blocks and housing estates in both the public and private sector, the construction and running of which is generally subcontracted to third-party platform providers and operators, and which are increasingly being opened up to competing service providers.
- Utility- and, mainly, municipality-owned FTTH networks, which are also generally open-access and accommodate multiple service providers.

In addition to this, the incumbent, TeliaSonera is rolling out VDSL-CO to around 800 000 households. Overall, NGA coverage is expected to reach 68% of premises by 2020, of which around 70% is expected to be FTTH or fibre LAN.

6 This is 18 months ahead of the original planned schedule of the original schedule of the end of 2015

7 Analysys Mason Research estimates

8 Local exchange

Italy

Telecom Italia's NGA development plan uses FTTC and VDSL architecture by laying fibre-optic cables to street and MDU building cabinets. Telecom Italia announced targets to cover the largest 125 cities and main industrial districts by 2015. In Milan, Telecom Italia aims to extend its FTTH coverage to 75% of households by 2014, with the rest being connected by FTTC.

Fastweb's fixed FTTH network reaches about 2 million households and SMEs. The operator is also deploying VDSL2 to cover an additional 3.5 million premises. The company aims at to reach 20% of Italian families and businesses with NGA by the end of 2014.

Ireland

In July 2011, the incumbent operator eircom announced an ambitious roll-out of FTTH and FTTC/VDSL, aiming to reach 900 000 of Irish households and 100 000 businesses by 2015. eircom will deploy FTTC and to a limited extent, GPON FTTH in commercially viable areas[9].

Malta

A European Commission decision published in November 2011 noted that 75% of cabinets in Malta had already been upgraded to FTTC, and the remainder are expected to be completed shortly[10]. Incumbent operator GO started advertising its FTTH network in Malta in October 2012, under the brand name 'Rapido'. GO plans an 'extensive' FTTH roll-out, although planned coverage figures are not available. The Maltese Government has also launched an initiative to promote an open-access FTTH network based on co-investment and government subsidies.

5.3.2 Impact on VoIP delivery

In those markets in which a predominantly FTTH strategy for NGA has been set out, VoIP services will automatically be enabled, and the customer premises equipment will already be in place to carry IP voice calls from the premises. By comparison, in those markets which have adopted a VDSL-based NGA strategy, voice traffic may continue to be carried over the PSTN network, as is the case for BT in the UK (e.g. where a VoBB strategy is not adopted at the retail level – see previous section).

As such, in order to migrate to voice traffic delivery over IP, the operators in these markets will need to either adopt a VoBB retail strategy (see previous section), or build PSTN-VoIP gateways at the boundary of the access network. In the UK, this would either be in the VDSL cabinets (decommissioning the primary feeder copper network), or in the exchange-based multi-service access nodes (MSAN). This would incur capex for purchasing and installing gateways. This cost is not included in BT's current NGA roll-out plans, nor in the UK fixed cost model.

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9 http://www.comreg.ie/_fileupload/publications/comreg1227.pdf

10 European Commission decision, C(2012) 8499 final, 15/11/2012

5.3.3 Conclusion

The NGA roll-out in the UK is will be dominated by VDSL in the medium term. As a result, this will not automatically enable the delivery of VoIP as in other markets where FTTH is being deployed on a large scale. In order to deliver VoIP without adopting a retail VoBB strategy, BT would need to install additional network equipment, with associated additional expenditures.

5.4 Summary of operator retail and access strategy for migration to a full IP network

As discussed, all of the fixed cost models that we compared shared the assumption of a migration of fixed voice networks to an all-IP NGN. The approach and progress towards this transition varies significantly by market. We have summarised in Figure 5.4 the strategy adopted for the delivery of fixed VoIP in each of the benchmarked markets.

	VoBB retail offer?	Widespread FTTH with native VoBB?	Target FTTH coverage in 2020	Main operator using PSTN-IP voice access gateway in the cabinet or exchange?
UK	✗	✗	5%	✗
FR	✓	✓	80%	✗
NL	✓	✓	70%	✗
SE	✓(growing)	✓	100%	✗
IT	✓(growing)	✗	25%	✗
IE	✗	✗	10%	✗
ML	✗	✓	assume 100%	✗

Figure 5.4: Summary of approach to the delivery of fixed VoIP in the short to medium term [Source: Analysys Mason, 2013]

As shown in Figure 5.4 we understand that BT has no plans to offer retail mass-market VoIP in the short to medium term. By comparison, in the other markets under consideration, VoBB retail offers are generally being used to migrate customers onto IP voice technology. In addition, several of the markets investigated have a major focus on FTTH for NGA which requires IP voice from the customer premises. None of the former incumbents in the selected markets have chosen to move to an all-IP network using a national deployment of PSTN gateways in the cabinet or the exchange.

5.5 Comparison of historical migration assumptions: modelled and real

In order to further understand the alignment of the models with current/planned delivery of voice origination and termination, we have analysed the alignment of the assumed migration of lines / traffic from TDM to IP in the fixed LRIC models, with the actual historical VoBB share of fixed lines. We note that the comparison is not direct for France and the Netherlands, given that the modelled share is for traffic migration. Although the actual share is for lines, it nevertheless provides an indicative comparison.

Based on this analysis, it is clear that for all of our models the historical IP migration assumed in the model is higher than in reality, however the degree of discrepancy varies significantly.

In the UK, by 2012 (the year that the model was built), the discrepancy is between 3% (actual) and 100% (modelled), as shown in Figure 5.5 below.

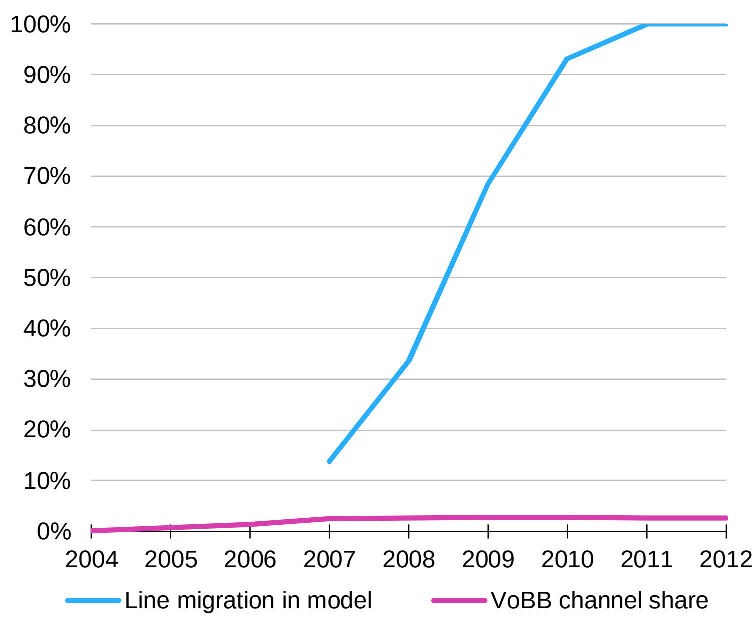


Figure 5.5: UK fixed LRIC model assumed historical share of lines compared to actual historical VoBB share of lines [Source: Analysys Mason, 2013, UK fixed LRIC model, 2013]

The discrepancy is significantly smaller in France, where in 2011 (the year the model was published), the modelled IP share of traffic is 70%, and the VoBB channel share was 52%, as shown in Figure 5.6.

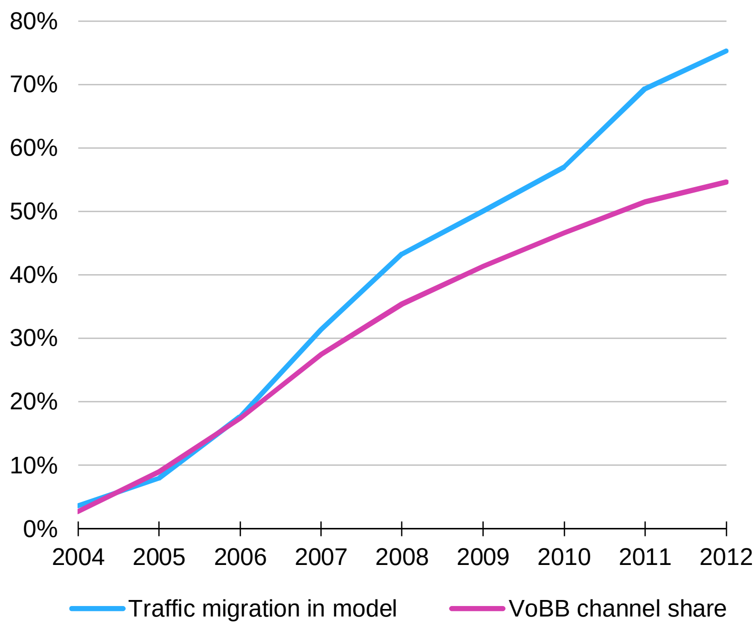


Figure 5.6: French fixed LRIC model assumed historical share of lines compared to actual historical VoBB share of lines [Source: Analysys Mason, 2013, French fixed LRIC model, 2011]

In the Netherlands, the migration in the model reaches 100% by 2010 (the year the model was built), whilst the actual VoBB share of channels was 42%, as shown in Figure 5.7.

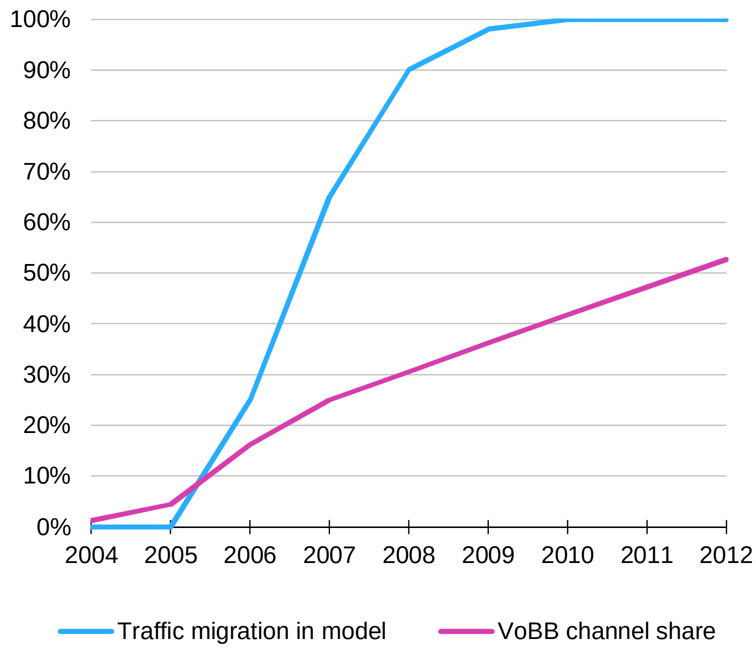


Figure 5.7: Dutch fixed LRIC model assumed historical share of lines compared to actual historical VoBB share of lines [Source: Analysys Mason, 2013, Dutch fixed LRIC model, 2010]

5.5.1 Conclusion

All of the models analysed assume a more rapid migration from TDM to IP voice than has occurred in reality. However, the discrepancy in the UK is significantly larger than that seen in either France or the Netherlands.

6 Alignment of the model with the current/planned network

Most European incumbent operators are in the process of a complex next-generation core network transformation, consisting of legacy equipment maintenance and/or retirement, and IP-generation deployments for voice and/or data traffic. Core network costing models can reflect these complex transformations to a greater or lesser extent, or not reflect any transformation (according to the simplifications adopted in the modelling process).

In this section we:

- summarise the high-level network architecture assumed in the core network cost models
- review the planned use of IP and SDH core networks by the benchmarked operators
- analyse the line card capacity and core router costs assumed within the transmission network for each benchmarked model

We consider each of these areas in turn below, along with comparisons and conclusions.

6.1 High-level network architecture used in the core network cost models

We have assessed the high-level architecture used for the available cost models. There is a contrast in the choice of *access* technology for voice traffic, as summarised below.

	Modelled technology
UK	Copper-based PSTN and ISDN at the MSAN
France	Copper-based voice over xDSL at the DSLAM
The Netherlands	Copper-based PSTN at the MSAN
Sweden	Fibre-based voice over broadband
Malta	Copper-based PSTN at the MSAN

Figure 6.1: Voice access technology used in the model [Source: Analysys Mason, 2013]

Within the Ofcom model, access to the integrated services digital network (ISDN) is specifically modelled for the provision of business fixed-line call services over digital technologies as well as via analogue lines. As with the public switched telephone network (PSTN) in the model, ISDN access is terminated at the basic access (BA) node in the MSAN. Despite the inclusion of ISDN traffic within the UK model, we note that there are no ISDN-specific costs assumed in the core network model.

The Dutch and Swedish models also consider business voice services over ISDN. However, in the Netherlands, the model includes a steady migration of the business voice service on to the NGN over the period of time in which "*service support, emulation and customer equipment (e.g. PABXs) can be prepared for the market place*". More details of this migration can be seen in

Section 4. In Sweden, the business voice volumes over ISDN are treated the same way as PSTN calls in the model.

The French model, however, does not explicitly model business voice services and there are no ISDN assets within the core network.

The modelled *core* network architecture is broadly similar in each model, consisting of interconnect, IP core and Ethernet aggregation nodes. However, the number of nodes of each type in the modelled networks is quite different, for two main reasons: firstly, the countries have very different sizes and populations, secondly the choice of (scorched-) node architecture varies, depending on the modelled efficient network and/or the choices of the incumbent.

Node counts are summarised below.

	Inner core	Outer core	Regional	Aggregation
UK	8	12		106
France	10		26	400
The Netherlands	4		12	145
Sweden	14		139	480
Malta	4			8

Figure 6.2: Node counts by benchmarked country [Source: Analysys Mason, 2013]

It is informative to show a comparison of the number of people served by each node, which highlights the different hierarchy of scale present in the modelled networks.

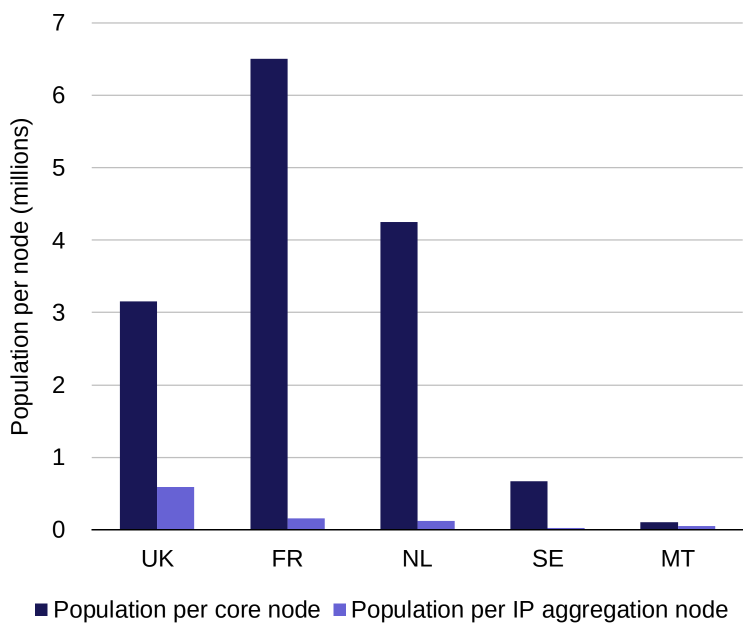


Figure 6.3: Scale hierarchy for the modelled networks [Source: Analysys Mason, 2013]

This information suggests that the modelled UK core network is quite centralised, yet numerous: there are relatively large numbers of people attached to each edge node, yet the core nodes serve a relatively small population of agglomerations.

A comparison of the modelling of IP transmission capacities is shown below.

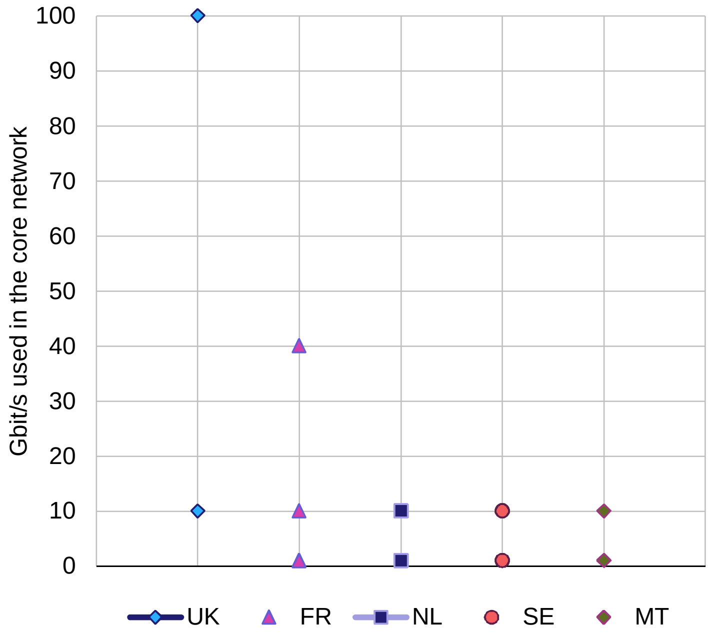


Figure 6.4: Core IP capacities in the models [Source: Analysys Mason, 2013]

This shows that the UK is the only model utilising 100Gbit/s core transmission links, with a minimum 10Gbit/s capacity unit. Combined with the comparison of population per node, this suggests that the UK model could be characterised as a complex, centralised, high-capacity network. Conversely, the French network model appears to have a more graduated hierarchy of nodes sizes with three steps of IP transmission capacity.

These differences will have implications for the costing of voice services; however, it is challenging to draw simple conclusions from these differences.

While we have ignored interconnection nodes in our discussion above, we note that the UK is the only modelled network to have interconnection at all core nodes as shown in Figure 6.5 below:

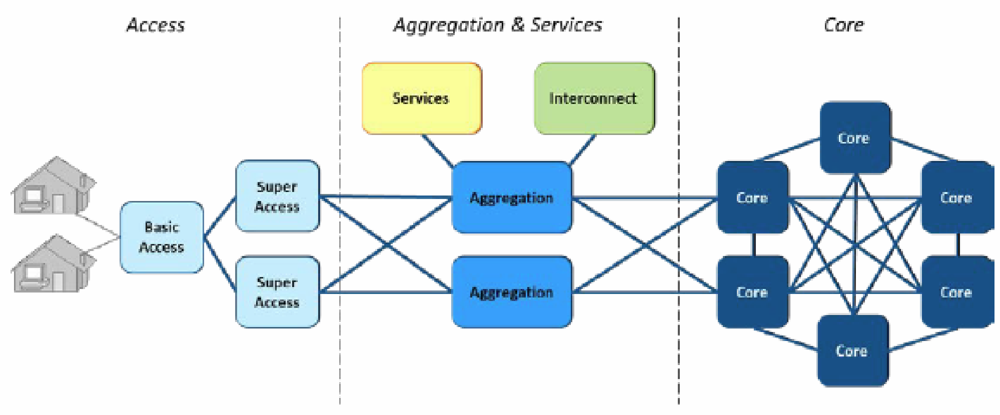
	Inner core	Outer core	Population per interconnect node
UK	8	12	3 150 000
France	5		13 000 000
The Netherlands	4		4 250 000
Sweden	12		787 500
Malta	2		209 500

Figure 6.5: Interconnection node counts by benchmarked country [Source: Analysys Mason, 2013]

UK

Diagrams for the modelled network are shown below.

Figure 6.6: NGN architecture [Source: CSMG, UK fixed LRIC model supporting documentation, 2013]



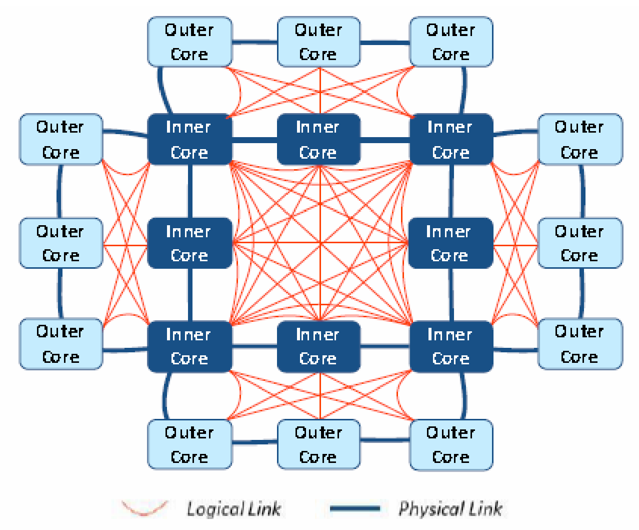


Figure 6.7: Core architecture [Source: CSMG, UK fixed LRIC model supporting documentation, 2013]

The model assumes copper-based access lines, with PSTN and ISDN emulation at the MSAN. The BA node is the most common type of access node. All BA nodes are dual-parented to super access (SA) nodes. There are approximately 4000 BA nodes. The remote access (RA) node is a special type of access node that serves small and/or remote communities. The RA node serves the same function as the BA node, but due to its geographical location it is not connected to the SA node on a ring topology. Instead, two diversely routed point-to-point connections are used. Based on the distribution of BT exchange sites, the model assumes there are 1600 RA nodes. The SA node sits between the BA and RA nodes on the one hand and, on the other, the aggregation node (AN) in the network hierarchy and aggregates traffic from the BA nodes. All SA nodes are dual-parented to ANs. There are approximately 1100 SA nodes in the modelled network.

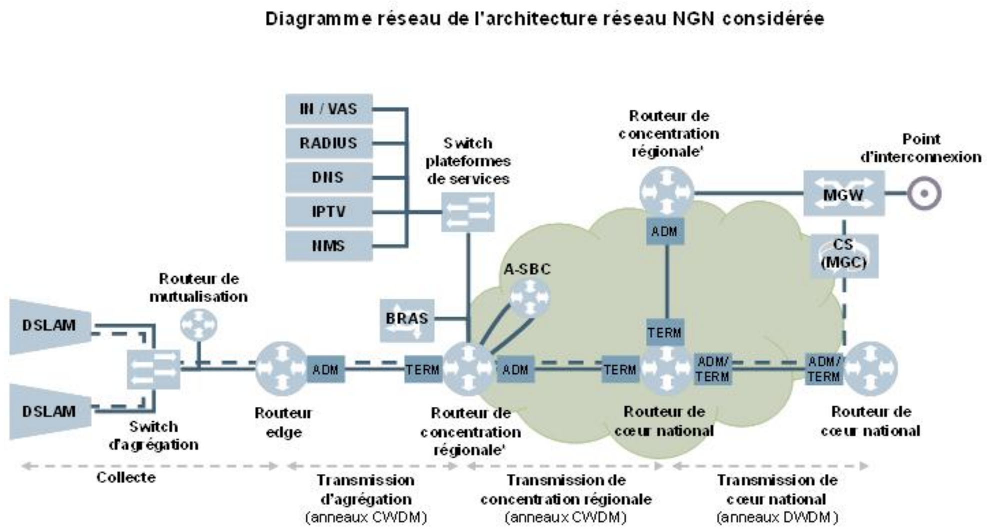
The AN is deployed between the SA nodes and core nodes (CNs). Each AN is co-located with an SA node. All ANs are dual-parented to core nodes. There are 106 ANs in the modelled network. The role of the CN is to transport traffic between ANs. There are 20 CNs in the modelled network, each co-located with an AN.

In the IP MPLS core, 10Gbit/s ports on 100Gbit/s transmission are modelled. In the Ethernet aggregation layer, 1GE and 10GE transmission is modelled.

France

Diagrams for the modelled network are shown below.

Figure 6.8: NGN architecture [Source: Analysys Mason, French fixed LRIC model, supporting documentation, 2011]



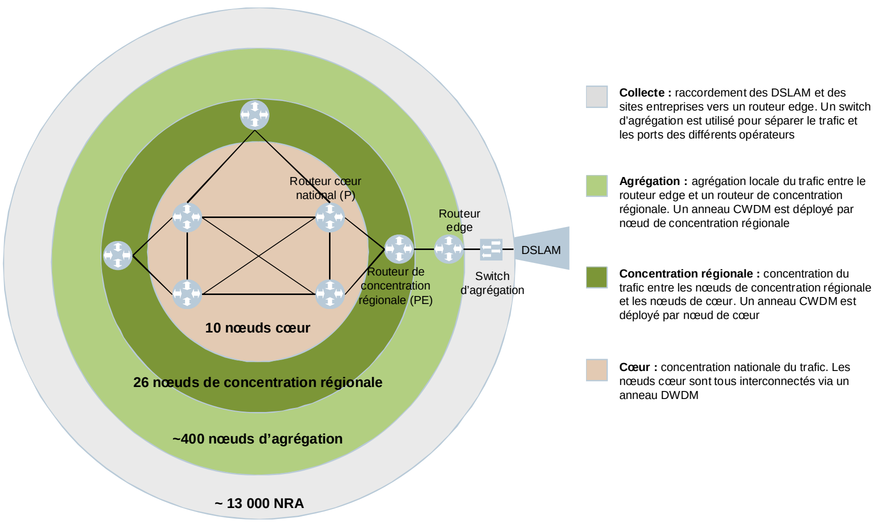


Figure 6.9: Core architecture [Source: Analysys Mason, French fixed LRIC model, supporting documentation, 2011]

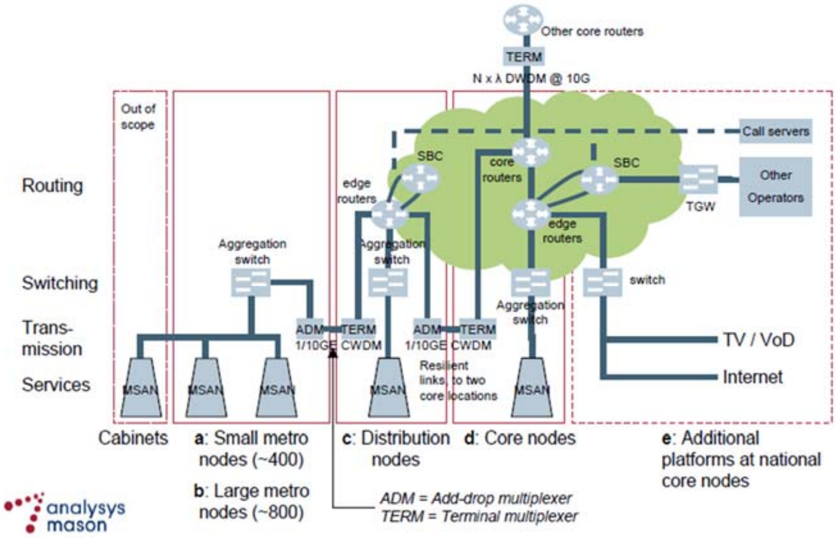
Copper-based access is assumed, however only xDSL is provided at the DSLAM (with voice carried over broadband). 13 000 access nodes are modelled, aggregated into 400 nodes. There are 26 regional and 10 core nodes, with only five of the core nodes being interconnect nodes.

In the IP core, 1Gbit/s, 10Gbit/s and 40Gbit/s transmission is modelled. In the Ethernet aggregation layer, 1GE transmission is modelled.

The Netherlands

Diagrams for the high-level network architecture of the Dutch fixed termination and origination rate model are shown below.

Figure 6.10: NGN architecture [Source: Analysys Mason, Dutch fixed LRIC model, supporting documentation, 2010]



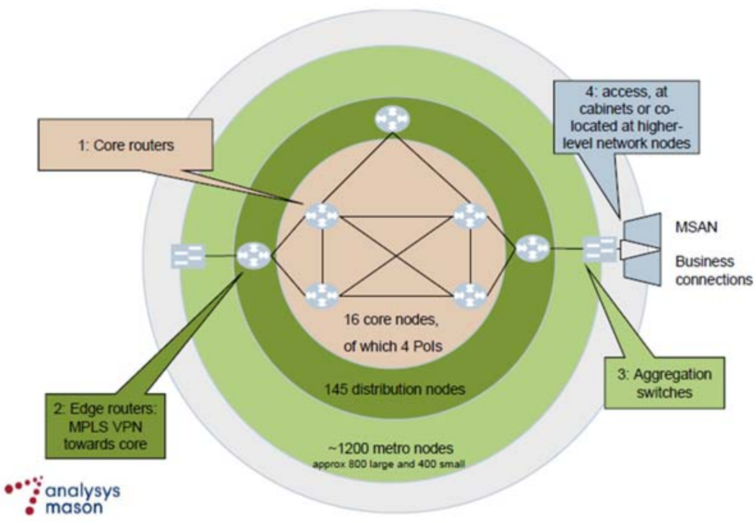


Figure 6.11: Core architecture [Source: Analysys Mason, Dutch fixed LRIC model, supporting documentation, 2010]

Copper-based access is assumed, with xDSL/VDSL and PSTN from the MSAN at the current 1345 MDF locations. Aggregation to 145 distribution nodes is modelled. There are 16 core nodes, of which four are interconnect nodes.

In the IP core, 1Gbit/s and 10Gbit/s transmission is modelled. In the Ethernet aggregation layer, 1GE and 10GE transmission is modelled (mainly 1GE is deployed).

Sweden

A diagram for the modelled network is shown below.

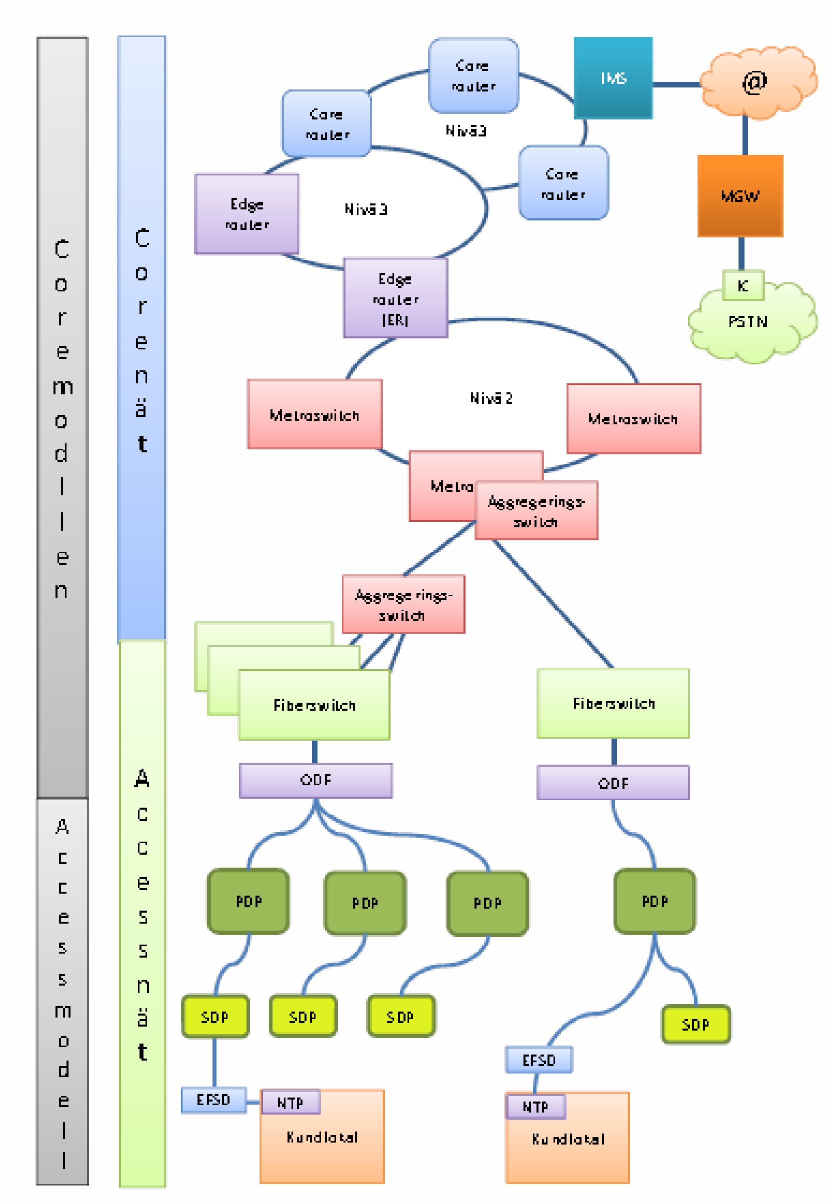


Figure 6.12: High-level network architecture in the Swedish fixed termination/origination rate model [Source: PTS fixed LRIC model, supporting documentation, 2012]

Fibre access is assumed, using 6650 fibre access locations. Aggregation is made to 480 metro switches and 139 edge nodes. There are 14 core nodes, of which 12 are interconnect nodes. 2.5Gbit/s and 10Gbit/s transmission is modelled.

Malta

A diagram of the modelled core and aggregation network is shown below.

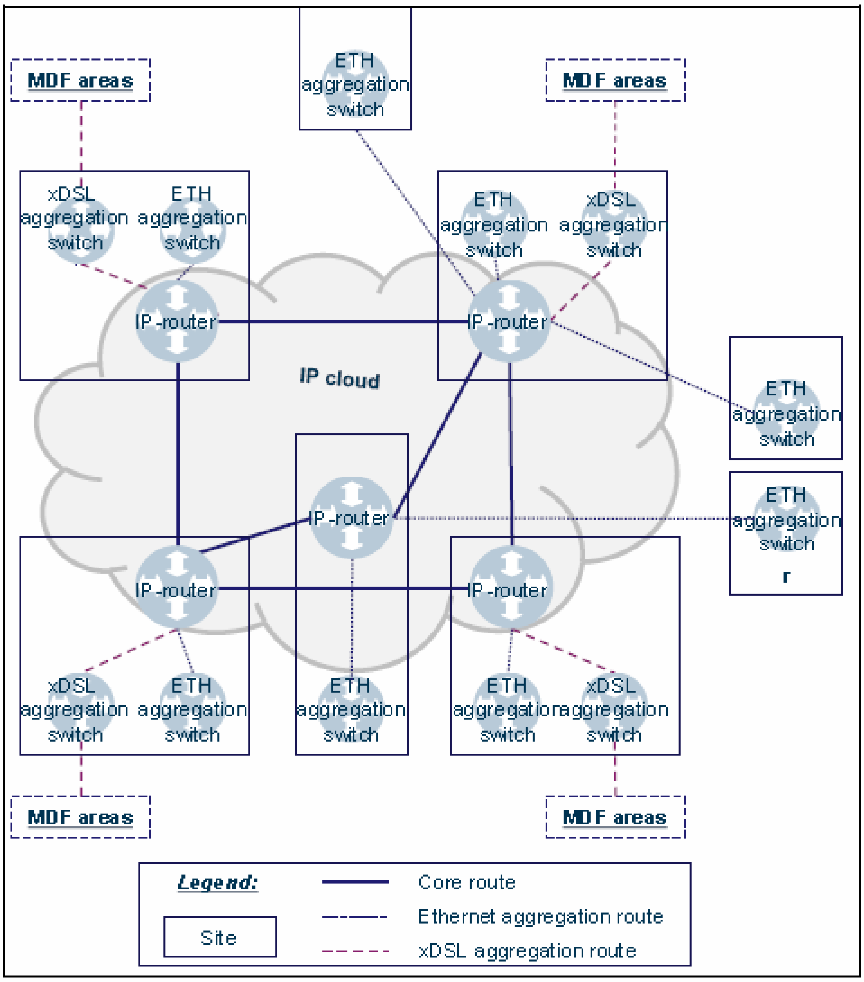


Figure 6.13: Overview of the core and aggregation network modelled in Malta [Source: Analysys Mason, Malta fixed LRIC model, supporting documentation, 2013]

Copper-based access is assumed, with xDSL and PSTN from the MSAN at the current MDF locations. Voice software for the MSANs is also included. There appear to be eight aggregation nodes and five core sites and two interconnection locations. Transmission is modelled using 1Gbit/s and 10Gbit/s for IP MPLS and 1GE and 10GE aggregation, although it is not explained in the public documents whether the larger transmission capacities are needed on the small island of Malta.

6.2 IP and SDH core networks plans for the actual operators

IP core

In order to deliver (end-to-end) fixed VoIP, an all-IP core network is required. The operators in the benchmark markets have already upgraded their networks to include an IP core.

In the UK, BT has rolled-out an IP '21CN' core network, however, this is currently only used to carry broadband and Ethernet data traffic (voice traffic is managed separately on the SDH core)[11].

France Telecom has completed the migration of its core network to an IMS-based, all-IP system, and ARCEP noted in the February 2011 consultation on fixed termination rates, that almost all operators in France had migrated to an IP core[12].

In the Netherlands, as a part of its all-IP transformation, KPN outlined plans to migrate its core to IP/Ethernet/MPLS with an Ethernet backbone connecting the 200 MDF locations that it would retain as 'metro core locations'. In February 2013, KPN signed a contract with Alcatel-Lucent to migrate KPN's core network from SDH to all-IP and to move voice services to an IMS platform[13].

TeliaSonera in Sweden was one of the first operators to migrate to an IMS-core, announcing that it would adopt Nokia Siemens Networks' IMS solution in May 2007.

In Malta, GO (formerly Maltacom) upgraded to an Ericsson IP-based soft switch solution in 2005, although the 'core' network in Malta can be expected to be quite different from that in a large country such as the UK.

In November 2005, the replacement of the legacy switching exchanges in Italy with a new platform based on class-4 soft-switches according to NGN architecture and IMS model was completed.

In Ireland, eircom operates an NGN core network. However this carries only data traffic with voice traffic remaining on its legacy network. In its recent response to ComReg, eircom does not agree with the position taken by ComReg that fixed termination prices should be set on the basis of an IP-enabled NGN. This is because eircom submits that the current TDM network using C7 signalling for interconnection services is likely to be providing fixed termination services in the coming years.[14]

All of the fixed network cost models use an all-IP core network to carry both voice and data traffic.

SDH core

In order to deliver *end-to-end* TDM-based PSTN services, an SDH core is required. Despite the recognition that a proportion of voice traffic will continue to be carried on the PSTN network in the short to medium term, an SDH core is included only in the Irish fixed network cost model. None of the other models investigated currently include an SDH core. In the case of the UK, the

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[11] Excluding Pathfinder trial area in Cardiff

[12] ARCEP consultation, 23/02/2011

[13] http://unified-communications.tmcnet.com/news/2013/02/27/6953498.htm

[14] http://www.comreg.ie/_fileupload/publications/ComReg12110.pdf

majority of voice traffic is expected to remain on the PSTN network towards 2020, as BT plans to maintain its SDH transport network.

Conclusion

The current and planned continued use of the PSTN and SDH network for the delivery of fixed voice by BT in the UK means that the model of the core network in Ofcom's fixed cost model is significantly different from the expected BT situation for the coming years.

Compared to the UK, this point (the omission of short- to medium-term SDH components) is less significant in some of the benchmark countries. This is because there are observed plans to actively migrate uses on VoIP, either using VoBB or FTTH.

6.3 Transmission network

Capacity deployed in the core network

The UK fixed cost model is the only model in which 100Gbit/s Ethernet (100GE) line cards are included. The only model to include line cards of over 10Gbit/s is the French model, which has 40Gibt/s line cards in the core network model.

Within the UK model, 44% of all line cards in the core are assumed to be 100GE from network launch, whilst in the aggregation network this increases to 80% of all line cards, also from network launch. This is illustrated in Figure 6.14 and Figure 6.15 below.

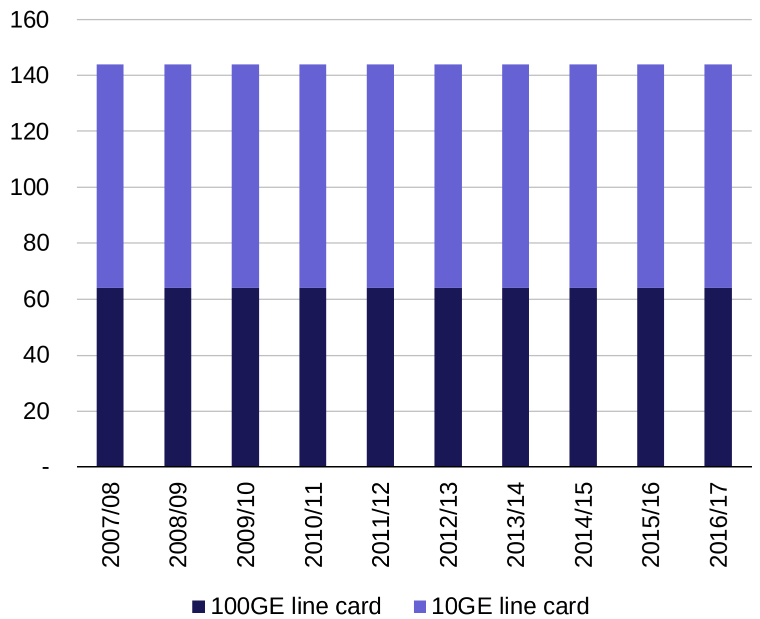


Figure 6.14: Total line cards by speed in the UK fixed cost model, core network [Source: UK fixed LRIC model, 2013]

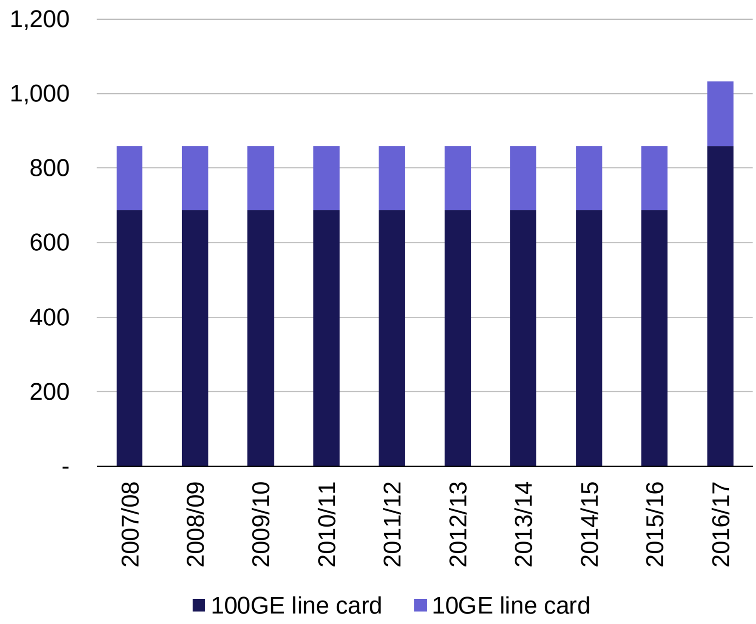


Figure 6.15: Total line cards by speed in the UK fixed cost model, aggregation network [Source: UK fixed LRIC model, 2013]

We understand that BT has only just begun to deploy 100GE line cards in its core network this year, and has historically used 10GE line cards. Furthermore, we note that 100GE line cards were not widely available until around 2011[15].

Core router cost comparison

We have analysed the core router costs assumed in each of the benchmark models compared to the UK. The core router chassis and line card costs assumed in the UK model are lower than in the model in the Netherlands, but higher than both Sweden and France. This is shown in Figure 6.16 below:

15 The IEEE standard 802.3ba-2010 was approved in June 2010

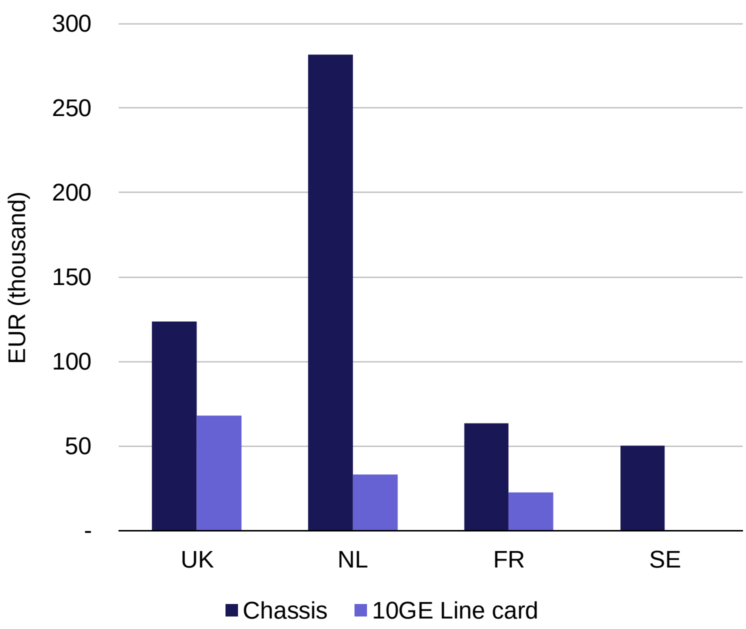


Figure 6.16: Comparison of core router chassis and line card costs in the benchmarked models (core network) [Source: UK fixed LRIC model, 2013]

Within the transport layer, the core DWDM chassis cost in the UK model is significantly below the values in the model of the Netherlands and France, but is higher than in the Swedish model. The line card cost in the UK model is the highest of those benchmarked, as shown in Figure 6.17 below:

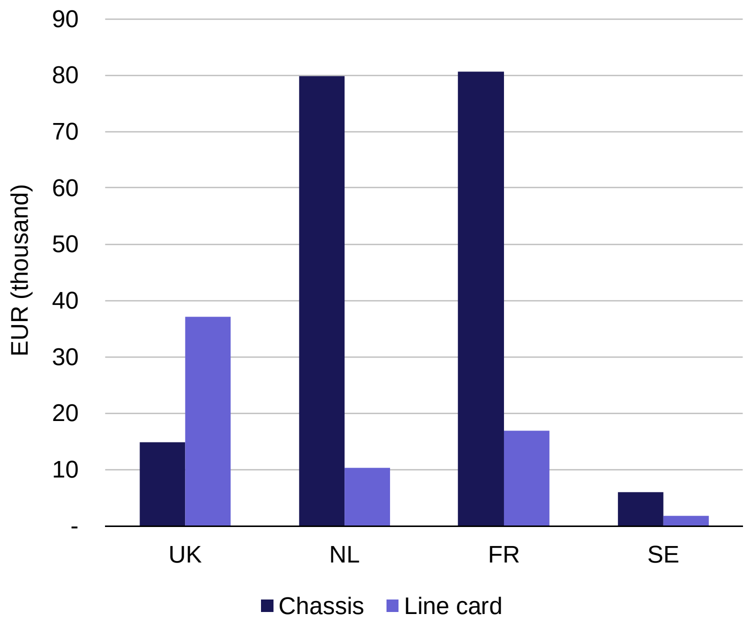


Figure 6.17: Comparison of core router chassis and line card costs in the benchmarked models (transport network) [Source: UK fixed LRIC model, 2013]

Note: In the UK model, it is a 100GE line card. In The Netherlands and Sweden, it is a 10GE line card. In France, it is a 40GE line card.

Conclusion

The UK model is the only one of our benchmarks to include 100GE line cards. The majority of benchmarks use 10GE line cards, whilst the French model also includes 40GE line cards. In the UK model, these line cards are applied from 2007/08, and represent around 44% of core network line cards, and 80% of aggregation network line cards. The core router costs are in the mid-high range of the benchmarks.

6.4 Comparison of planned network architecture with modelled network architecture

Given our analysis of the access method and core network, and considering the basic network architecture, it is clear that the modelled network in the UK differs significantly from the planned BT architecture in the short to medium term (2015–20), both in the exclusion of the SDH core and in the PSTN equipment in the exchange.

By comparison, over the same period, the operators in France, the Netherlands and Sweden plan to switch off their SDH cores and decommission PSTN equipment in the exchange, carrying all voice traffic over broadband and IP. Of further comparison, the model in Ireland reflects the use of both SDH and IP transmission by eircom in the short term.

In Sweden, the modelled architecture assumes a full FTTH delivery network, excluding all exchange costs in favour of municipal PoPs. While the Swedish operators are moving towards this model, we expect there will remain a significant proportion (40% of households) serviced by ASDL2+ and VDSL-CO, from the exchange.

In the remainder of this section we summarise key differences between the planned network architectures in the benchmarked countries, and highlight the elements of the core network cost models developed by the NRA.

Planned network architectures

Shown below is our simplified annotation of the planned 2015–20 network architectures in the UK, France, the Netherlands and Sweden.

In these diagrams we have removed elements we expect also to be removed from the real network during this period, and have 'greyed out' elements of the access network which we forecast will be minor parts of the network architecture.

Figure 6.18: UK planned network (2015–20) [Source: Analysys Mason, 2013]

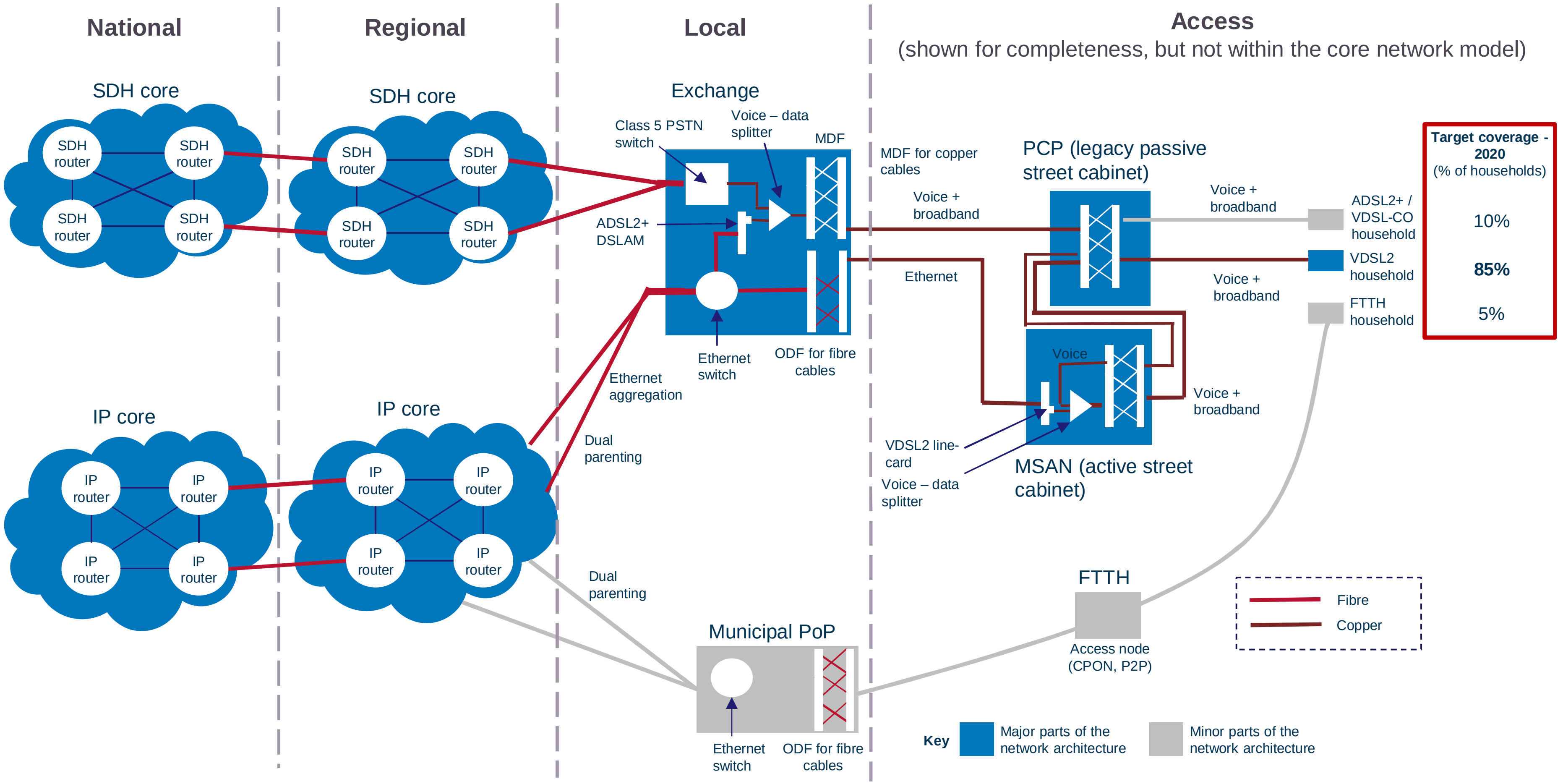


Figure 6.19: France planned network (2015–20) [Source: Analysys Mason, 2013]

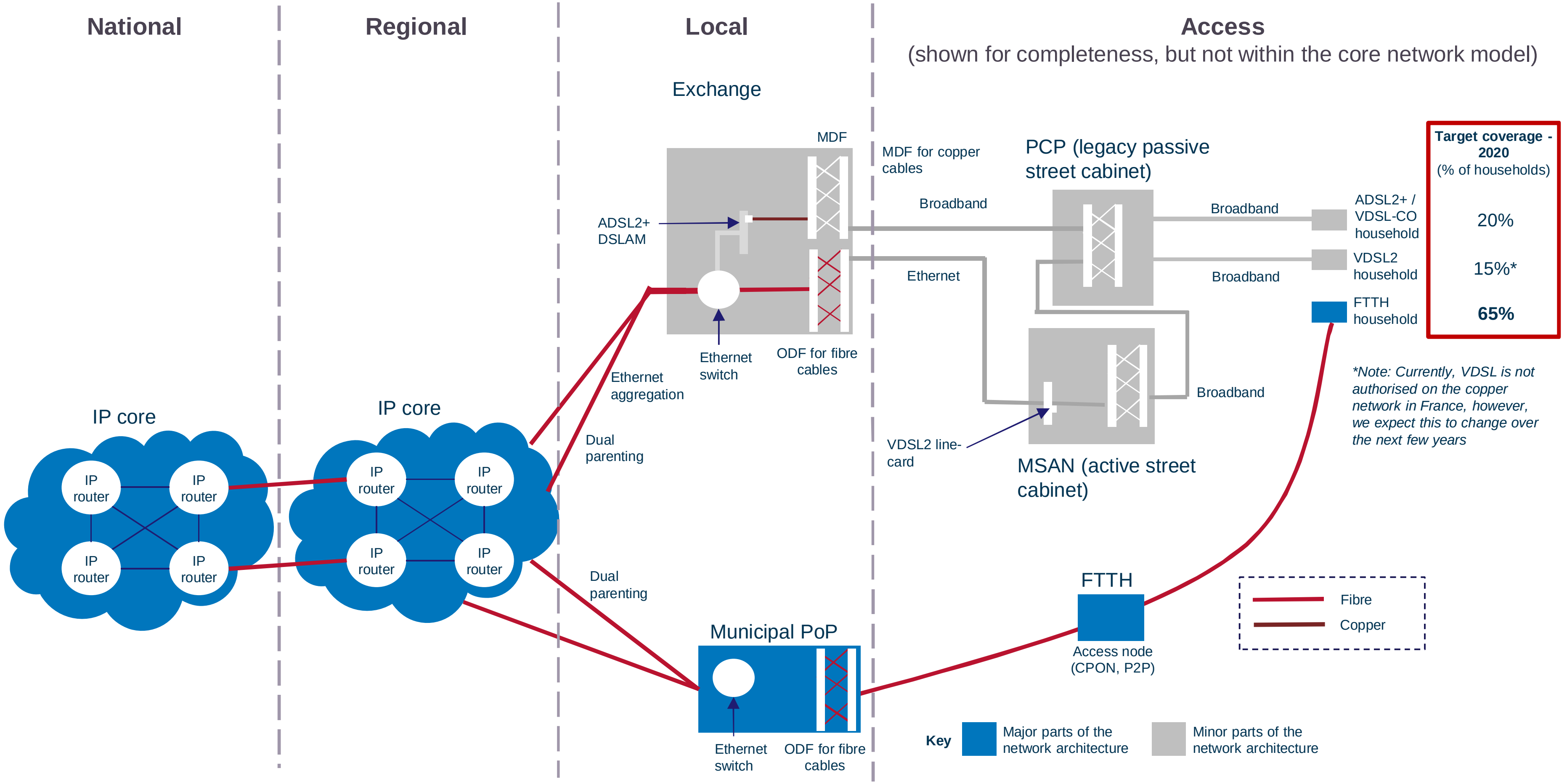


Figure 6.20: The Netherlands planned network (2015–20) [Source: Analysys Mason, 2013]

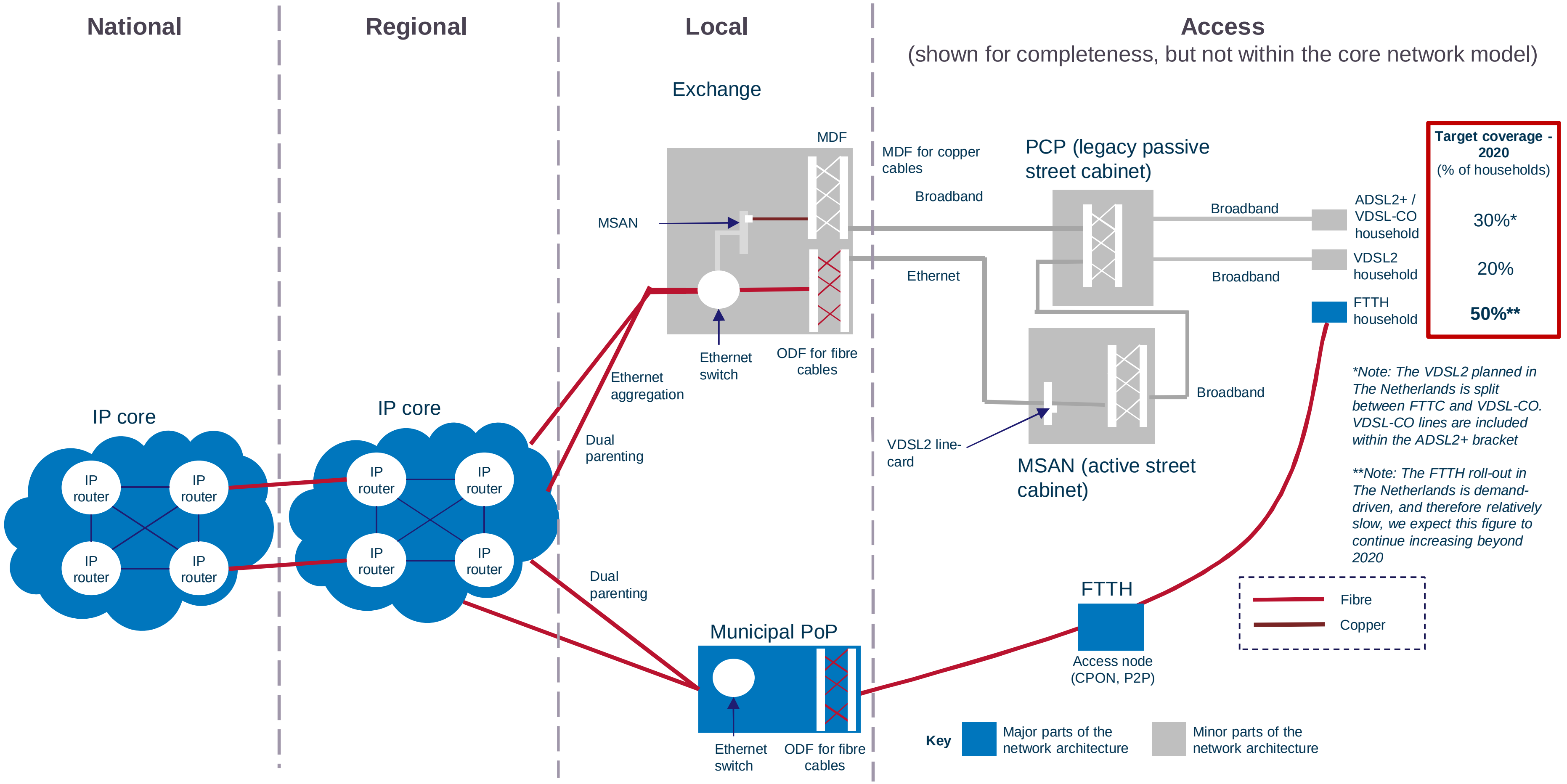
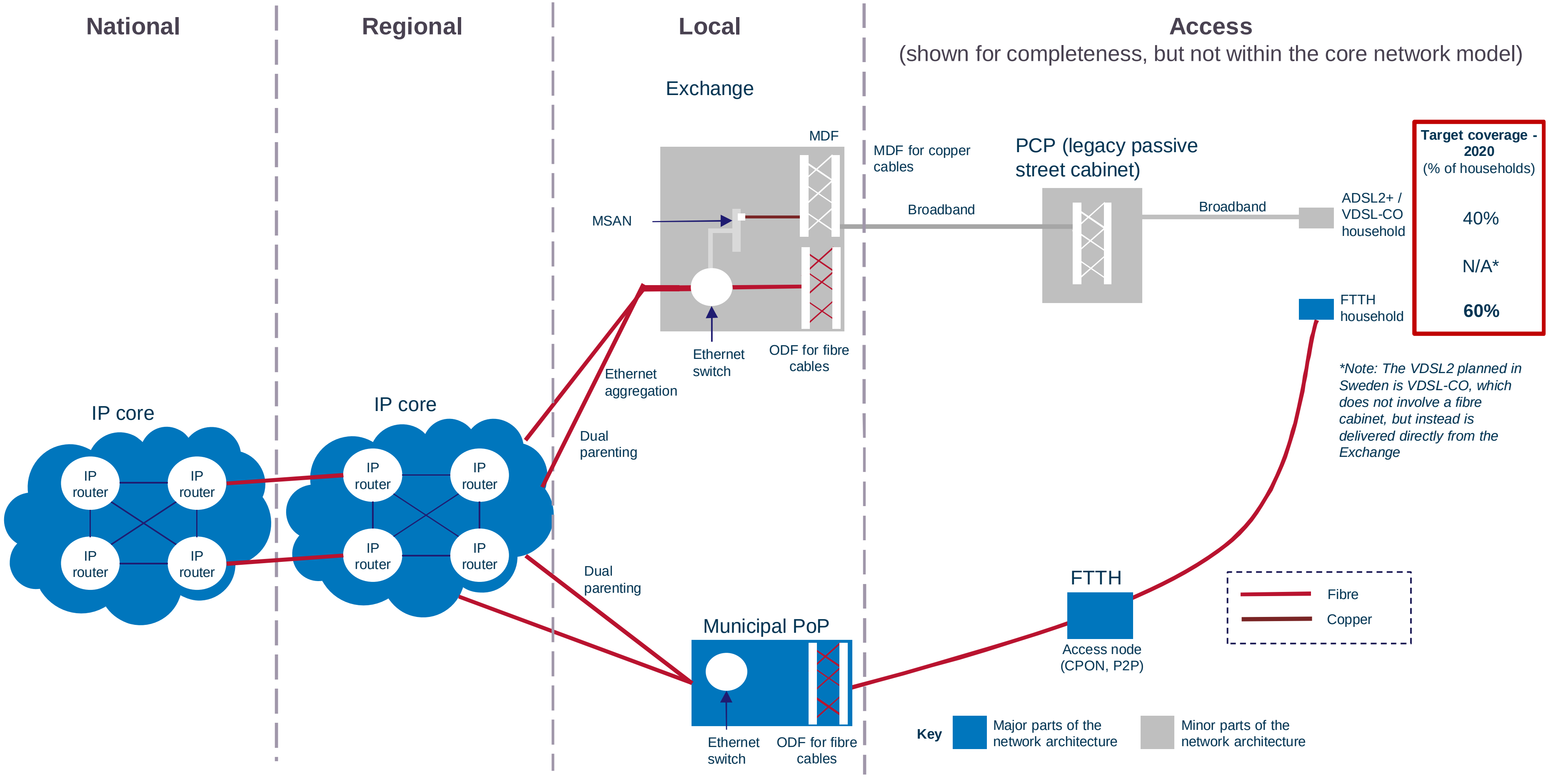


Figure 6.21: Sweden planned network (2015–20) [Source: Analysys Mason, 2013]



Modelled network architectures

Below we show the scope of the all-IP core networks included in the NGN cost models.

Figure 6.22: UK modelled network [Source: Analysys Mason, 2013]

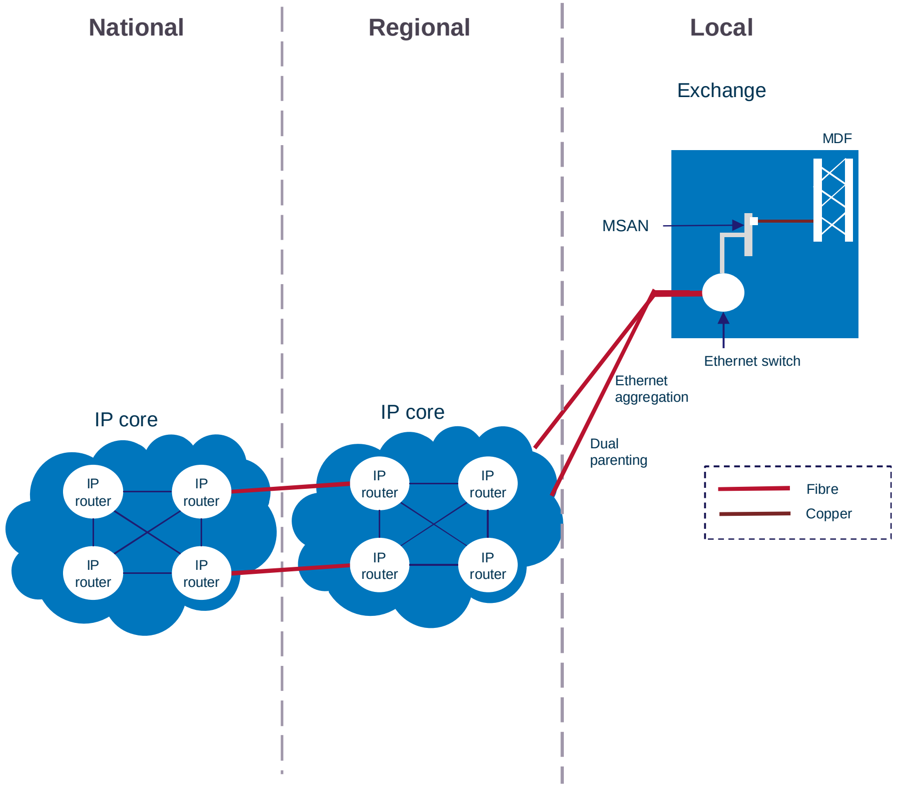


Figure 6.23: France modelled network [Source: Analysys Mason, 2013]

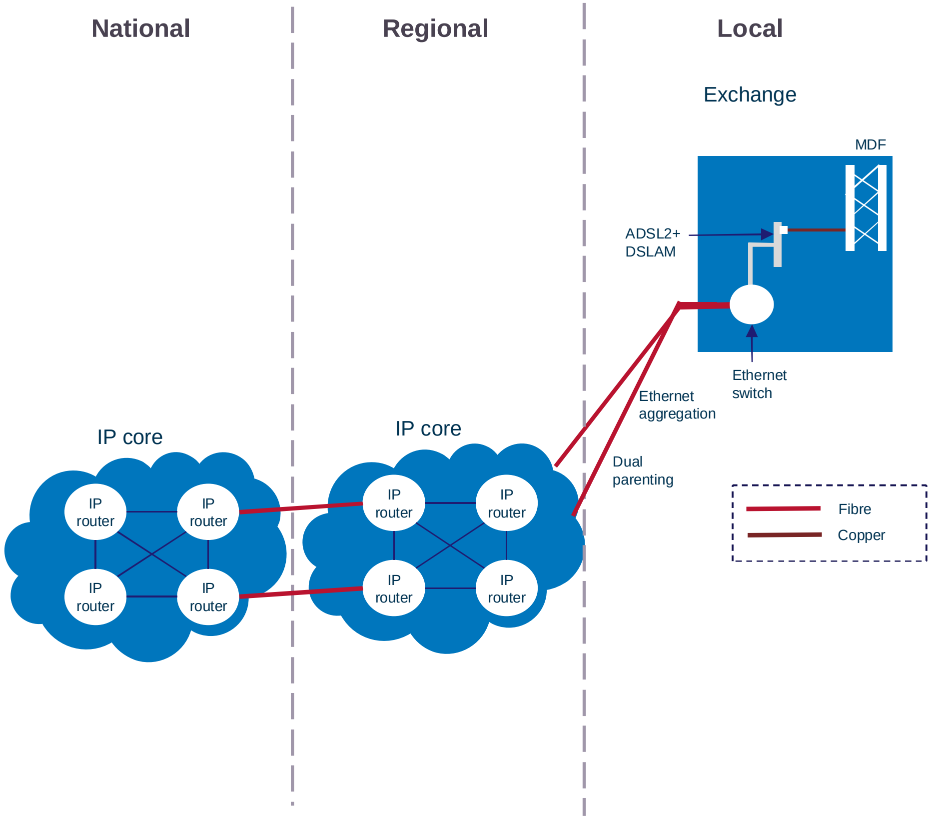


Figure 6.24: The Netherlands modelled network [Source: Analysys Mason, 2013]

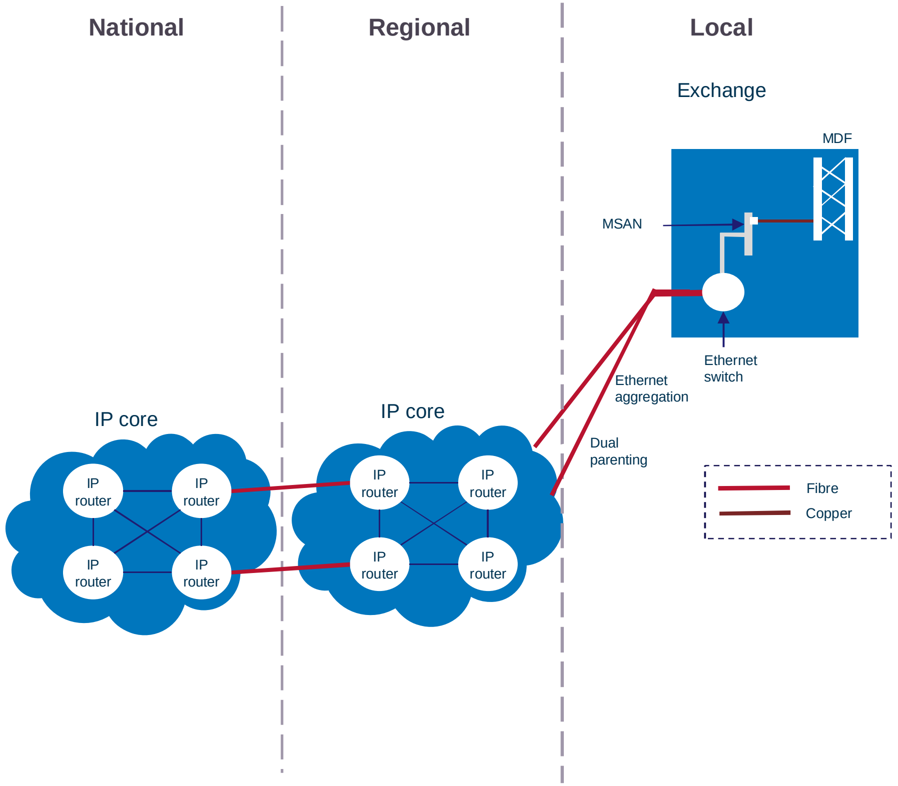
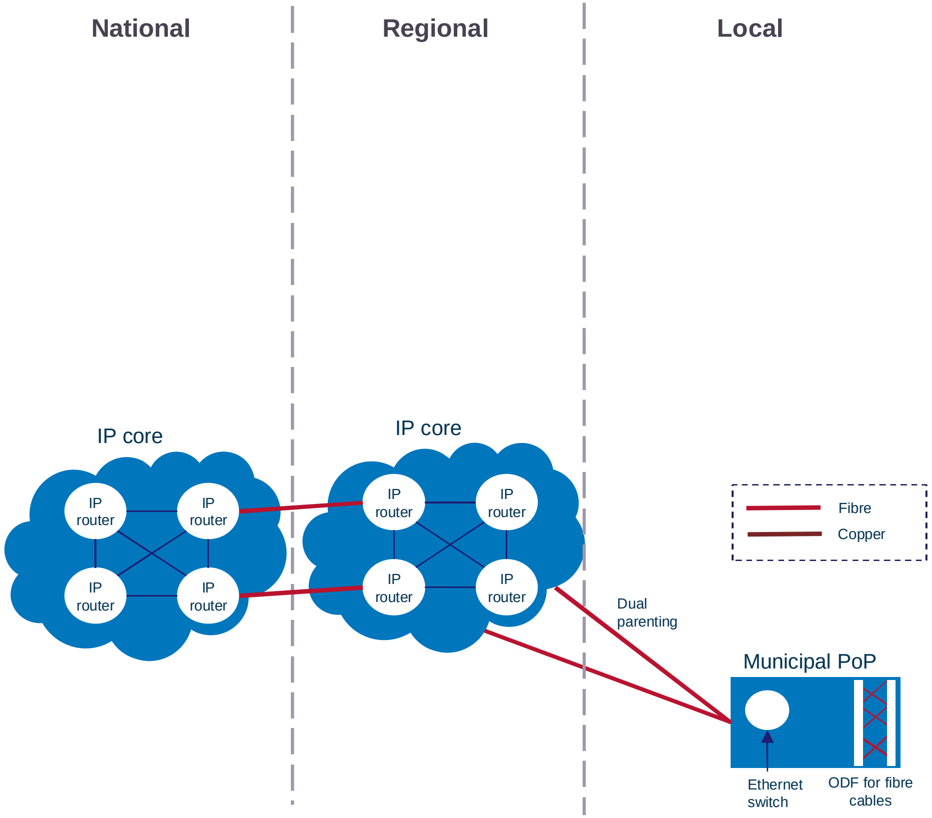


Figure 6.25: Sweden modelled network [Source: Analysys Mason, 2013]



Conclusion

All of the fixed cost models benchmarked assume an all-IP core network. This is aligned with the plans of operators in France, the Netherlands and Sweden, which all intend to move across to an all-IP model in the medium term. In comparison, due to the currently very limited migration to VoBB, and focus on FTTC rather than FTTH broadband access, BT anticipates continuing to require an SDH core and TDM access network in the medium term (to 2020). This diverges significantly from the modelled architecture.

7 Alignment of the model with current/planned delivery of voice: fixed and mobile models in the UK

This section examines whether Ofcom's UK mobile LRIC model is aligned with the real-life networks.

Modelled operator

The UK 2011 mobile LRIC model designs a hypothetical average efficient national mobile communications provider (MCP) with a long-term market share of 25%.

Until 2010, the UK mobile market was split between four mobile networks of almost equal size (O2, Orange, T-Mobile and Vodafone) and a fifth, smaller 3G-only player (3, owned by Hutchison Whampoa).

In 2010, the mobile market underwent consolidation and the UK networks of Orange and T-Mobile merged to create Everything Everywhere with a 36.8% market share in Q2 2012. The market share of 3, which was launched as a greenfield 3G operator in 2003, held at around 4-5% between 2005 and 2007, but increased to 8.4% at the end of the first half of 2012.

The 2011 model, completed in March 2011, broadly reflects the long-term market landscape by designing a hypothetical operator with a 25% market share.

Technology and spectrum

The hypothetical MCP operates a 2G network in the 1800MHz band, and 3G network (including HSPA) in the 2100MHz band.

In the UK market, O2 and Vodafone provide 2G (GSM) services in the 900MHz and 1800MHz band, whilst Everything Everywhere (EE) operates their GSM network in the 1800MHz band. All operators in the UK offer 3G services using 2100MHz spectrum.

From the perspective of technology choice and spectrum, the mobile LRIC model relatively accurately reflects the reality of the UK mobile market, as shown in Figure 7.1.

Operator	2G	3G
Hypothetical entrant in 2011 mobile LRIC model	1800MHz	2100MHz
O2	900MHz / 1800MHz	2100MHz
EE (Orange and T-Mobile)	1800MHz	2100MHz
Vodafone	900MHz / 1800MHz	2100MHz
3	not available[16]	2100MHz

Figure 7.1: Spectrum holding comparison between 2011 mobile LRIC model and real networks [Source: Analysys Mason, 2013]

16 However, 3 is currently purchasing 1800MHz spectrum from EE, which it is expected to use to offer LTE services

Technology migration

The 2011 mobile LRIC model reflects a gradual migration of voice from 2G to 3G networks. The model does not assume the decommissioning of GSM networks.

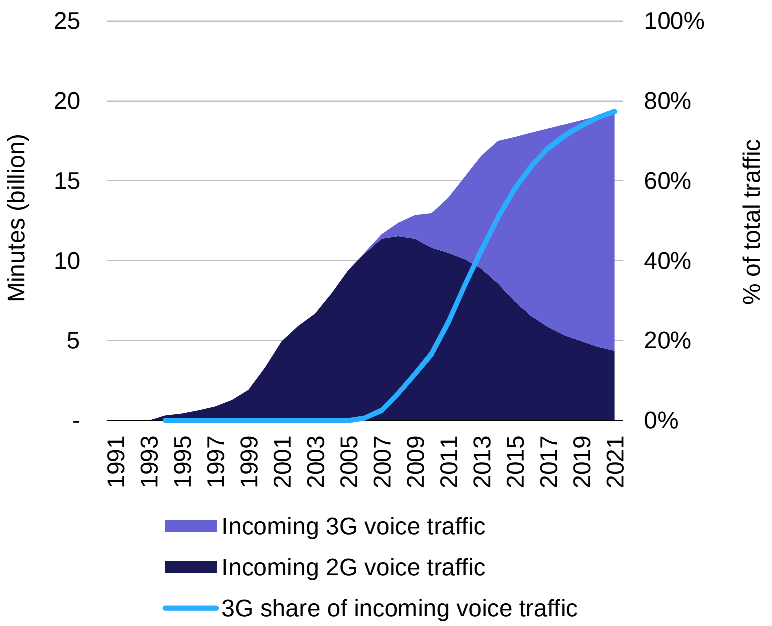


Figure 7.2: Traffic profile in the 2011 UK mobile LRIC model (year ending March) [Source: UK mobile LRIC model, 2011]

Network dimensioning

The 2011 mobile LRIC model applied a scorched-node approach to network dimensioning and had calibrated model outputs compared to the data provided by the operators. Figure 7.3 shows comparison of the asset counts produced by the model with the average of the asset counts provided by the existing mobile operators. The table in Figure 7.3 shows that the model is quite closely aligned with the actual operator deployments.

Asset type	MCP average	Model
2G macrocells	9,398	9,421
2G micro and picocells	1,989	2,171
3G macrocells	7,247	7,206
3G micro and picocells	409	415
Total macro sites	10,921	11,373
Total micro and pico sites	2,042	2,376
TRXs	65,626	67,481
BSCs	224	211
3G carriers	20,693	23,224
RNCs	49	59
2G MSC	30	29
2G/3G MSC Server	18	17
2G/3G MGW	30	31
SMSC	17	17
HLR	30	31
SGSN	14	16
GGSN	7	8

Figure 7.3: Comparison of asset count of key network equipment between model output and 2G/3G MCP data in 2009/1015[17] [Source: MCT Statement Annex 6-10, 2013]

Network sharing

The 2011 mobile LRIC model reflects network sharing. According to the model, mobile site sharing begins in Q1 2007/08, and all sharable macrocell sites (90%) are shared by the end of Q1 2014/15.

In reality, T-Mobile and 3 signed a 3G network sharing deal in December 2007; Orange and Vodafone announced plans to share mast sites in February 2008. The model can be seen to reflect accurately these developments in the market.

Conclusion

The UK 2011 mobile LRIC model relatively accurately reflects the reality of the UK mobile market at the time the model was developed.

17 The calibration of data assets (RNCs, SGSN, GGSN) is not as accurate due to the inclusion of H3G data

8 Opex trends, working capital and installation costs

8.1 Opex price trends

As shown in Figure 8.1 both the Dutch and French models assume constant opex prices in real terms (i.e. nominal growth is in line with inflation) across all network elements. The UK mobile model also assumes roughly constant real-terms prices from 2007, across all network elements.

By comparison, the UK *fixed* model assumes a weighted average opex price reduction, which means that real-terms opex levels (per unit of equipment) fall to 34% of their 2007 level by 2026.

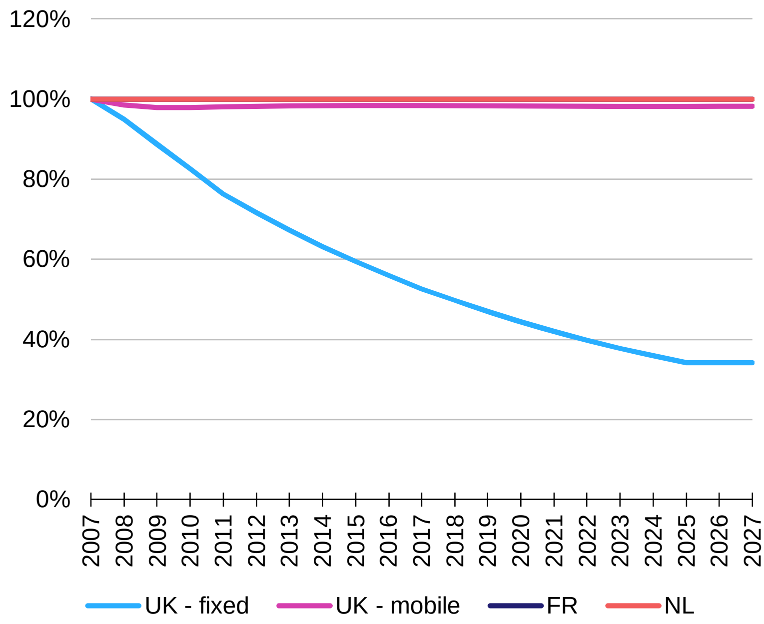


Figure 8.1: Weighted average opex price trend (in real terms) by model, indexed to 2007 prices (UK models, year ending March; other models, year ending December) [Source: Selected LRIC models, 2013]

Note: Commentary on operating cost trends is not included within the model documentation in Malta, Ireland and Italy. The Swedish model is a single-year model, and as such, opex trends are not included.

The opex price trend used in the UK model varies by network element type, with the same rate applied every year to 2026. Figure 8.2 below shows the price trends applied:

Cost category	Annual price trend (in real terms)
Property	-1.0%
Labour	0.9%
Racks and cooling	-4.9%
Software and platforms	-4.9%
Ducts and fibre	-5.9%
Active equipment	-7.8%
Passive equipment	-3.9%

Figure 8.2: Summary of opex trends in the UK fixed LRIC model [Source: UK fixed LRIC model, 2013]

The model documentation states that these are based on a combination of IDC forecast price trends and operator inputs. These trends cause the total network opex as calculated in the UK fixed LRIC model to fall significantly over time in real terms, reaching 52% of the 2013 level by 2026.

By comparison the benchmark models calculate opex as being either constant (the Netherlands), or increasing (France and the UK mobile model).

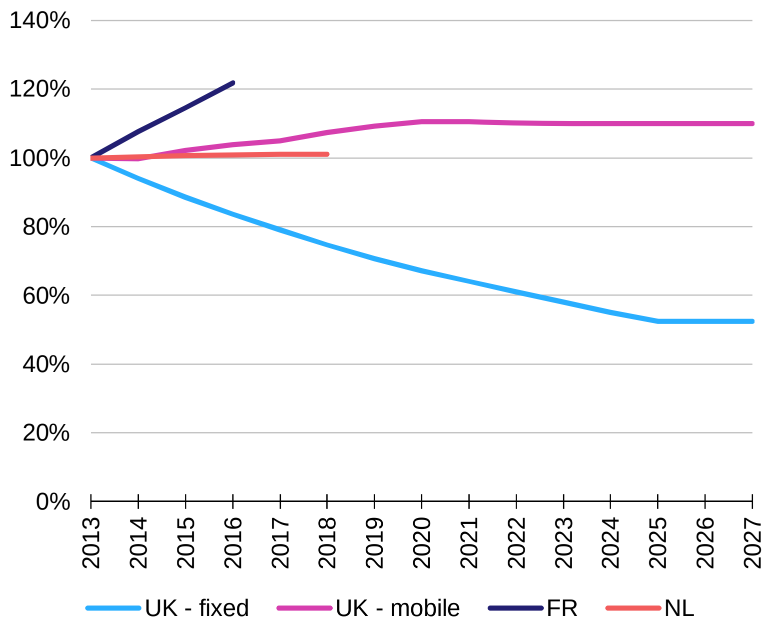


Figure 8.3: Total real-terms opex by country indexed to 2013 prices (UK models, year ending March; other models, year ending December) [Source: Selected LRIC models, 2013]

Depreciation of opex

We note that in the UK fixed and mobile cost models, and in the Dutch model (where economic depreciation is applied), opex is annualised (recovered) over the full duration of the model. By comparison, in France and Sweden, where tilted annuity depreciation has been applied, the annual recovery of in-year opex is assumed.

Conclusion

The UK fixed LRIC model is the only one of our benchmarks to assume a decline in individual opex items in real terms, reaching 34% of the 2007 level by 2026. As a result, it is also the only model to assume a decline in overall opex. Furthermore, where an economic depreciation is applied (the Netherlands and the UK), opex is recovered over time.

8.2 Treatment of working capital

The UK fixed LRIC model does not explicitly model working capital; nor is it mentioned in the model documentation or Ofcom consultation. This is similar to the UK mobile model and the French fixed cost model. In Sweden, working capital is discussed, but is set to zero for the purposes of the model.

One of the models reviewed in which working capital is included is the Dutch model. The model documentation states that:

> *"Working capital has not been modelled explicitly, but an allowance is included, defined as a fraction of yearly opex…and by default estimated to be equivalent to 30 days of opex expenditure."*[18]

A very similar approach has been taken in Malta:

> *"Working capital has not been modelled explicitly, but an allowance is included, defined as a fraction of yearly opex. This is estimated to be equivalent to 30 days of opex expenditure multiplied by the WACC"*[19]

Conclusion

Only two of our seven benchmarks include provision for working capital (The Netherlands and Malta).

8.3 Treatment of installation capex

A further area of expenditure considered in the UK cost model is installation (termed 'implementation') costs. These are modelled by network element, based on an estimated number of 'man-days' and a cost per man-day.

A cost of GBP275 per man day is assumed; no additional costs have been assumed for staff overheads, management or non-working time. This compares to the current Openreach charge of GBP120 for a standard chargeable visit (up to one hour), and GBP60 thereafter (on a normal working day), which would imply GBP510 for a 7.5 hour working day (note: this will include all overheads, management and non-working time)[20].

The man-days required to install each network element varies considerably. Voice platforms have a 0% implementation mark-up, whilst racks and cooling are mostly at 28%; cabling is assumed to have an 18% mark-up for the majority of items. The implementation costs for active equipment vary the most, between 0% and 275%.

Costs are projected on the basis of the capex trend for labour, which is assumed to increase in real terms by 0.9% per annum.

In the context of our benchmark markets, the UK's installation costs are similar to the assumptions for the Netherlands and Sweden. However, the network build period modelled in the UK is considerably longer than either the Netherlands (2 years) or Sweden (1 year – single year model).

[18] The Netherlands 2010 fixed LRIC model documentation, Annex C.8:Model Documentation – 20 April 2010

[19] The MCA's New Bottom-up Cost Model for Fixed Networks and Proposed Interconnection Prices, October 2012

[20] http://www.openreach.co.uk/orpg/pricing/serviceproducts.do

A comparison of the assumptions is provided in Figure 8.4 below:

	Build period	Installation cost as % of total capex	Man-years for build
UK	2007/08 – 2011/12	2.1%	1684 (over 5 years, average 337 FTE per annum)
NL	2004–05	1.0%	406 (over 2 years, average 203 FTE per annum)
SE	2013	1.5%	828 (over one year)*

Figure 8.4: Comparison of installation capex by country [Source: Selected fixed LRIC models, 2013]

Note: For man-years calculations, the UK cost per man-day has been used (converted into euro and Swedish krona. Note: given that this is an illustrative calculation, we have not made adjustments for different costs of labour in these markets

*In Sweden, the costs of the installation of submarine cable, fibre, microwave transmission and poles, have been excluded to calculate total installation costs, in order to make the calculation more comparable with the other models

In France, separate installation costs are not modelled. Instead, the cost of installation is included within the total capex assumed.

In the Netherlands, a 3% installation and connection mark-up is applied to all capex items except site acquisition, fibre and trenching (as a percentage of total capex, total installation costs equate to 1%). This is combined with the capex cost and projected forward based on the per-element capex trend. This price trend varies by network element type, with the same percentage applied every year until the end of the model (2053). The price trends per network element type are illustrated in Figure 8.5 below.

Network element type	Capex price trend
Line cards	0.0%
Port cards	-8.0%
Chassis	-5.0%
Active transmission equipment	-5.0%
Passive transmission equipment	0.0%
Service platforms	-5.0%
Network management and billing platforms	-5.0%
Sites	2.0%
Trench civil works	2.0%
Flat real	0.0%

Figure 8.5: Summary of the capex price trend in the Netherlands [Source: Dutch fixed LRIC model, 2013]

In Sweden, the installation mark-up varies by component, between 0% and 60% (higher figures for transmission). The Swedish model also includes detailed costs for buildings and trenches, including building costs per square metre, security and site preparation, in addition to capex for air conditioning and power supply units, and optical distribution frames.

The Italian model includes installation costs, however, details are not provided in the model documentation. Neither the Irish nor the Maltese model documents refer to installation costs.

Conclusion

Installation costs are explicitly modelled in the UK, Dutch and Swedish models and are broadly aligned at 1-2% of capex.

9 Comparison of approach taken towards depreciation and cost recovery

9.1 Depreciation methodology

The choice of depreciation method used in the calculation of regulated termination rates is important, as it has a major influence on the termination rate results produced by the model. This influence is due to the fact that the depreciation methodology establishes the rate of cost recovery, with different methods weighting the cost recovery towards different periods. A significant input to all depreciation methodologies is the weighted average cost of capital (WACC), as this will affect all asset costs, including those for the assets within the pure LRIC increment.

The Ofcom model makes use of a form of economic depreciation in its calculation of fixed termination rates, on the basis that this gives a result that mimics that of a competitive market. This method, referred to as Original ED,[21] "*matches the cost of equipment to its actual and forecast usage over the long term*". As a result, the depreciation rate is highest in those years in which equipment utilisation is maximised and higher in years where equipment costs are high. Ofcom notes three distinct steps in its Original ED calculation:

- **Stage 1**: Calculation of a constant unit cost, under the assumption that the final-year asset utilisation and cost are applicable over the entire network lifetime.
- **Stage 2**: Addition of a component to the constant unit cost calculated in Stage 1, recovering the additional costs resulting from network under-utilisation in earlier modelled years. This component is also calculated under the assumption that the final-year asset utilisation and cost are applicable over the entire network lifetime.
- **Stage 3**: Addition of a component to the value calculated in Stage 2, recovering the un-recovered costs resulting from input costs, including the WACC, varying from the final-year level. As a result of this third stage, more costs are recovered in the years in which the asset prices and WACC are above those in the final modelled year. The modelled WACC declines over the modelling period, resulting in cost recovery being front-loaded to those early years in which the WACC is high (WACC is shown in Figure 9.1).

While there are several different depreciation methods that have been considered by the regulators in the calculation of termination rates, the majority of those investigated have elected to use either an economic depreciation or a tilted annuity method as summarised in Figure 9.1 below.

21 This methodology is used in previous bottom-up MCT cost models and was developed by Oftel; see http://www.ofcom.org.uk/static/archive/oftel/publications/mobile/depr0901.htm

	Depreciation methodology	Modelled WACC[22]
UK	Original ED	2005/06–2008/09: 8.7% 2009/10–2011/12: 8.3% 20012/13 onwards 6.5% (real)
France	Tilted annuity	Varying in the early years of the model and reducing to 10.4% from 2010
The Netherlands	Economic depreciation	7.38% (real)
Sweden	Tilted annuity	8.80%
Italy	Tilted annuity	9.36%
Ireland	Tilted annuity	There has been no notification of the WACC used in the model; however, in 2008 the WACC for the relevant market was regulated at 10.21%[23]
Malta	Combination of tilted annuity, modified tilted annuity and standard annuity	9.65%

Figure 9.1: Summary of depreciation methodologies used in the relevant European models [Source: Selected LRIC models, 2013]

The choice of depreciation methodology in the calculation of each country's regulated charges is discussed in more detail below:

France

ARCEP has chosen to include four potential depreciation methodologies within its model, specifically:

- straight-line depreciation with constant depreciation over the life of the asset
- depreciation such that operational capability is maintained; such a method is heavily dependent on the acquisition date of the asset
- depreciation such that financial capacity is maintained; this is an adaptation of the operation capability maintaining method above such that the discounted annuities are equal to the initial investment
- tilted annuity method.

Of these, it is the tilted annuity method that is used by ARCEP in the calculation of the regulated fixed termination rates. This tilted annuity uses a modelled WACC in its calculations; as in the UK this is variable across the modelling period as shown in Figure 9.2. However, the modelled WACC becomes static at 10.4% (nominal) in 2010, which is before the start of rate regulation based on this model.

22 This is nominal unless otherwise indicated

23 See http://www.comreg.ie/publications/comreg_sets_new_eircom_cost_of_capital_at_10_21_.507.103090.p.html

Year	Nominal WACC	Real WACC
2002	12.93%	10.96%
2003	13.00%	10.96%
2004	10.40%	8.61%
2005	10.40%	8.46%
2006	9.80%	7.98%
2007	9.80%	8.21%
2008	10.70%	7.70%
2009	10.70%	10.63%
2010–2016	10.40%	8.89%

Figure 9.2: Real and nominal WACC for the relevant years in the French model [Source: French fixed LRIC model, 2011]

The Netherlands

OPTA considers economic depreciation to be the appropriate depreciation methodology as it considers all potentially relevant depreciation factors:

- MEA cost today
- forecast MEA cost
- output of network over time
- financial asset lifetime
- economic asset lifetime.

Due to the long lifetime of some of the assets in the network (up to 40 years), the model has a period of 50 years. This acts as a proxy for the lifetime of the hypothetical operator, thereby reflecting a situation of "*full cost recovery over the entire lifetime of the business*".

The OPTA model uses a different form of economic depreciation to Ofcom's method, being similar to the "Simplified ED" version provided in some Ofcom models.

Sweden

The Swedish model uses a tilted annuity methodology in the depreciation of the modelled asset costs. This calculation is based on the lifetime, price trends and residual values associated with the asset. The WACC used within the depreciation calculations is 8.80%.

Italy

The Italian model is capable of using three methods of economic depreciation:

- straight line
- standard annuity
- tilted annuity.

The regulated rates are calculated using the tilted annuity method with a WACC of 9.36%; this is justified by AGCOM as it believes the ability to tilt the recovery profile of the asset costs best promotes competitive behaviour in the market for access to the fixed network.

Ireland

ComReg uses a tilted annuity depreciation methodology in line with that used in other regulatory decisions in the fixed market. While there has been no notification of the WACC used in the LRIC model, in 2008 the WACC for the relevant market was regulated at 10.21%.

Malta

The MCA's model is capable of making use of four different depreciation methods:

- Standard annuity method; this calculates a fixed annual value for the recovery of asset costs.
- Tilted annuity method; this allows for a weighting of the depreciation to the earlier or later years of the asset lifetime.
- Modified tilted annuity method; this behaves in a similar manner to the traditional tilted annuity method, with the additional ability to factor changes in demand into the tilt.
- Straight line method; this assumes that the assets are on average 50% depreciated at the start of the model and depreciated in a straight line thereafter.

The modified titled annuity method acts as the default methodology in the model. However, there are assets which use different depreciation methods. Figure 9.3 below summarises the depreciation methods and the corresponding assets within the MCA model.

Depreciation method	Modelled assets with this depreciation method
Standard annuity method	Buildings
Tilted annuity method	Elements with a 0% utilisation trend
Modified tilted annuity method	All other assets
Straight line method	None

Figure 9.3: Depreciation methods used for different modelled assets in Malta [Source: Malta fixed LRIC model supporting documentation, 2013]

Additional consideration is given to the lifetime of the depreciation method, as this has a significant impact on the rate of cost recovery. Within the MCA model, all of the depreciation methodologies depreciate over the economic lifetime of the asset. The WACC used in the model is 9.65% across the modelling period for all of the depreciation methods.

Conclusion

Titled annuity is the most common approach towards depreciation in our benchmarked models. However, economic depreciation is used in both the UK and the Netherlands.

9.2 Comparison of cost recovery

Each cost model sets out the profile of recovery of network capex and opex. The shape of this profile will have implications for the pure LRIC of termination and for the cost of origination, which will take a share of the recovery of a wide variety of core network cost elements.

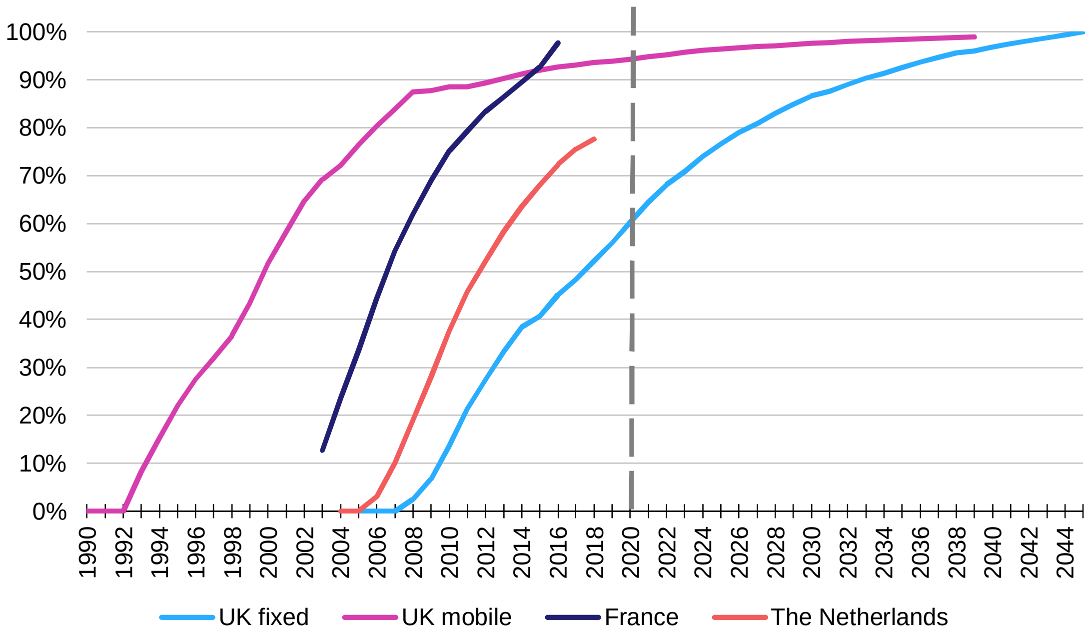
The table below summarises the implied timing of cost recovery in each cost model. It is evident that the two models that use multi-year economic depreciation will include assumptions that some cost recovery will have taken place in earlier years (when the NGN started to produce output). This historical recovery of costs could be significant in the case of steep downwards price trends and/or high past output.

Country	Depreciation method	Implications for cost recovery
UK	Multi-year economic	Some costs will be recovered in the past years when the NGN started to produce output, in proportion to the early-year output profile and early-year unit costs. Cost recovery from all assets and replacements will be smoothed across all years
The Netherlands	Multi-year economic	
France	Tilted annuity	In each modelled year, the annualised cost will be recovered according to the tilt factors. Cost recovery from each asset will be confined to its annuity lifetime All opex is recovered ‘in-year’ when using annuity depreciation
Sweden	Tilted annuity	
Italy	Tilted annuity	
Ireland	Tilted annuity	
Malta	Combination of tilted annuity, modified tilted annuity and standard annuity	

Figure 9.4: Implications for cost recovery [Source: Analysys Mason, 2013]

We have compared the cost recovery profile in the benchmark models. As shown on Figure 9.5, the UK fixed LRIC model has the slowest cost recovery among the benchmark models.

Figure 9.5: Comparison of cost recovery profiles in the benchmarked models (UK models, year ending March; other models, year ending December) [Source: Selected LRIC models, 2013]



The Figure 9.6 shows network expenditure and economic cost in the UK fixed LRIC model. By 2020, 60% of economic costs are forecast to be recovered. This means that 40% of costs need to be recovered in the "long" term (beyond 2020).

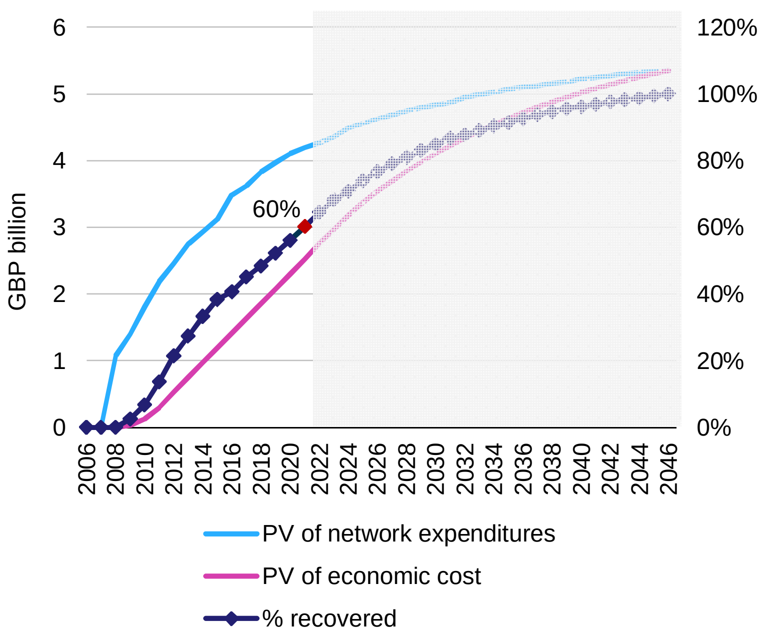


Figure 9.6: Cost recovery profile in the UK fixed LRIC model (year ending March) [Source: UK fixed LRIC model, 2013]

The UK 2011 mobile LRIC model forecasts that by 2020, 94% of economic costs will have been recovered.

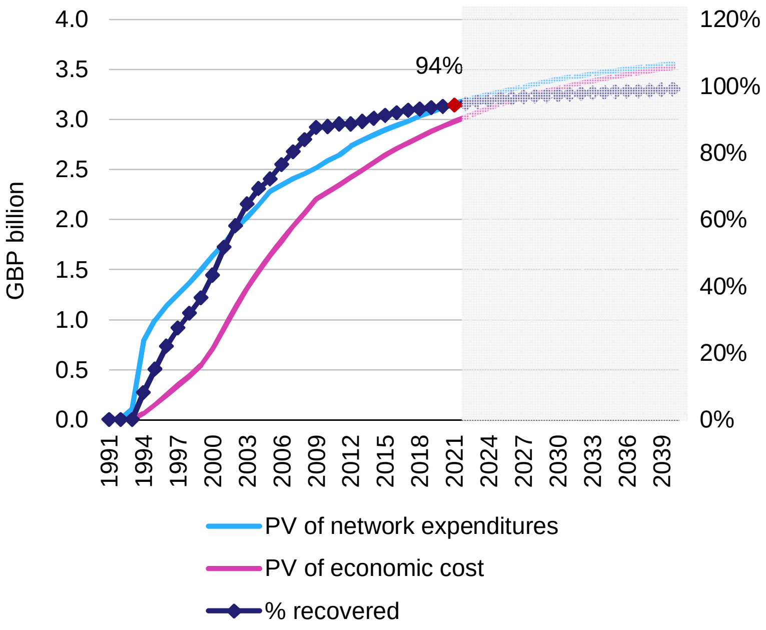


Figure 9.7: Cost recovery profile in the UK 2011 Mobile LRIC model (year ending March) [Source: UK mobile LRIC model, 2011]

The French fixed LRIC model includes forecasts up to 2016, by which time 98% of total economic costs are expected to be recovered.

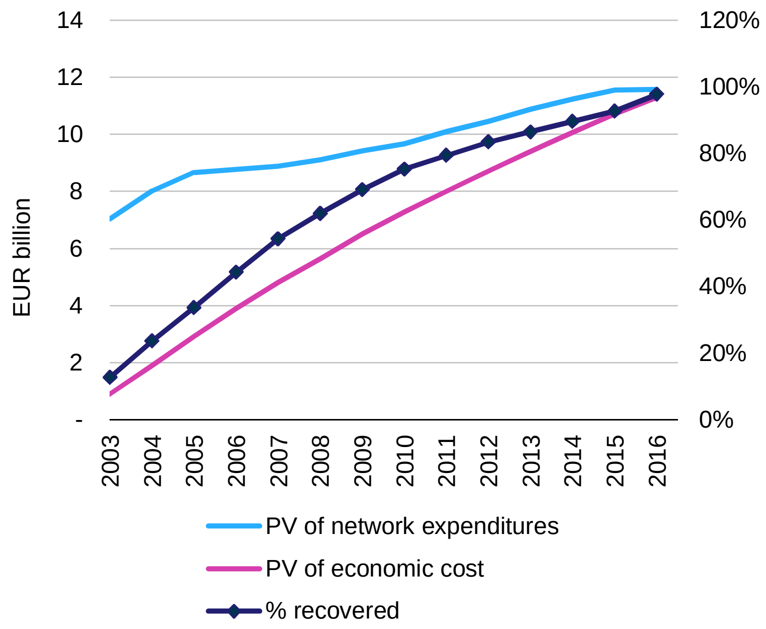


Figure 9.8: 2011 France fixed LRIC model (year ending December) [Source: French fixed LRIC model, 2011]

The Netherlands LRIC model forecasts that by 2018, 78% of economic costs will be recovered.

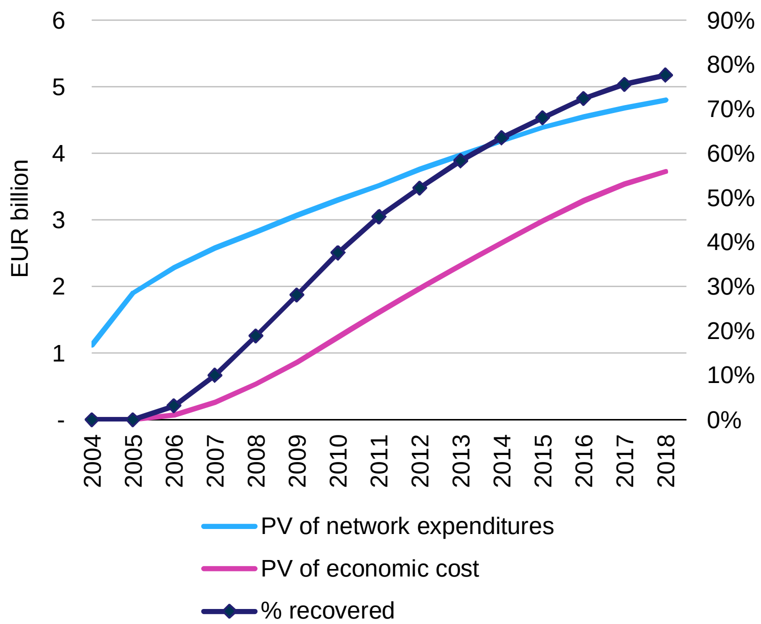


Figure 9.9: The 2010 Netherlands LRIC model (year ending December) [Source: Dutch fixed LRIC model, 2010]

Conclusion

The UK *mobile* LRIC model and French fixed LRIC model assume a relatively fast rate of cost recovery. The UK *fixed* cost model has the slowest cost recovery of the benchmarked cost models: by 2020 only 60% of cumulative discounted expenditure in the UK model is expected to be recovered. A slow cost recovery profile implies that if there is a possibility that the operator is not able to charge the calculated (cost-based) prices in the long term, there is a larger risk the full expenditures will not be recovered.

9.2.2 Annual expenditure and cost recovery

A similar effect can be seen on an annual (undiscounted) basis: the long-term rate of cost recovery in the UK fixed model is significantly higher than the long-term rate of expenditure. In other words, the cost recovery is delayed until later periods of the model.

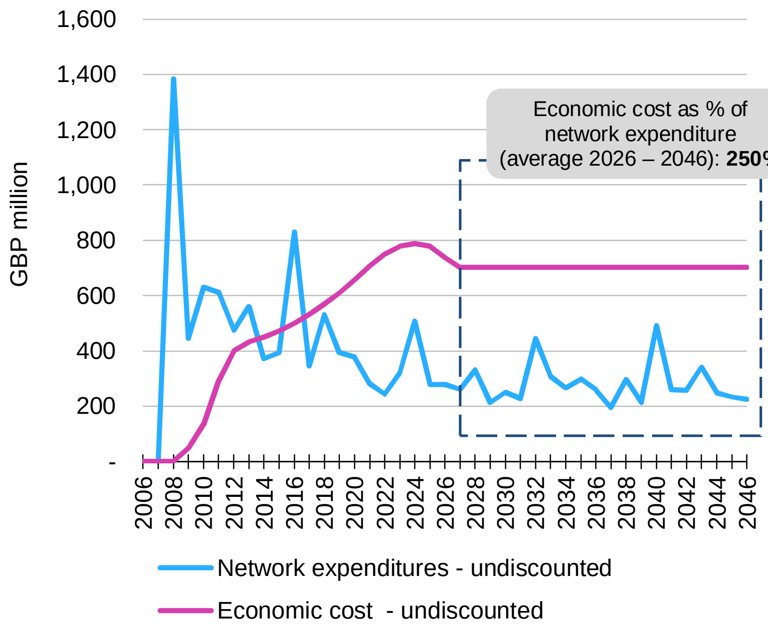


Figure 9.10: Network expenditure and economic cost in the 2010 UK fixed LRIC model (year ending March) [Source: UK fixed LRIC model, 2013]

Conversely, cost recovery in the mobile model is much closer to the rate of expenditure, as shown in Figure 9.11. This would appear to reflect quite a different dynamic effect when compared to the UK fixed LRIC model situation, particularly, as there is increasing competition and substitution between fixed and mobile services.

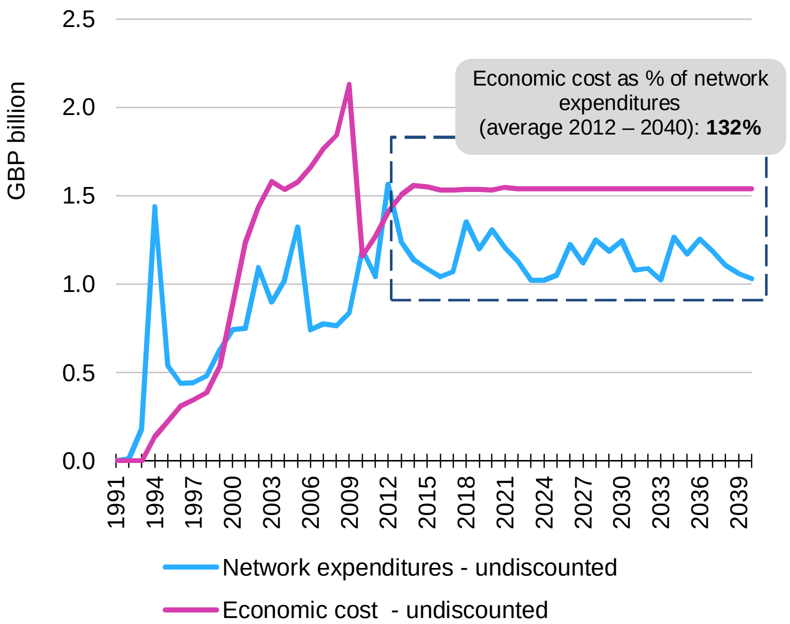


Figure 9.11: Network expenditures and economic cost in the 2011 UK mobile LRIC model (year ending March) [Source: UK mobile LRIC model, 2011]

Cost recovery in the benchmark models for fixed networks is also much closer to the rate of expenditure. Figure 9.12 shows that, in the French fixed LRIC model, the cost recovery is also much closer to the rate of expenditure compared to the UK fixed model.

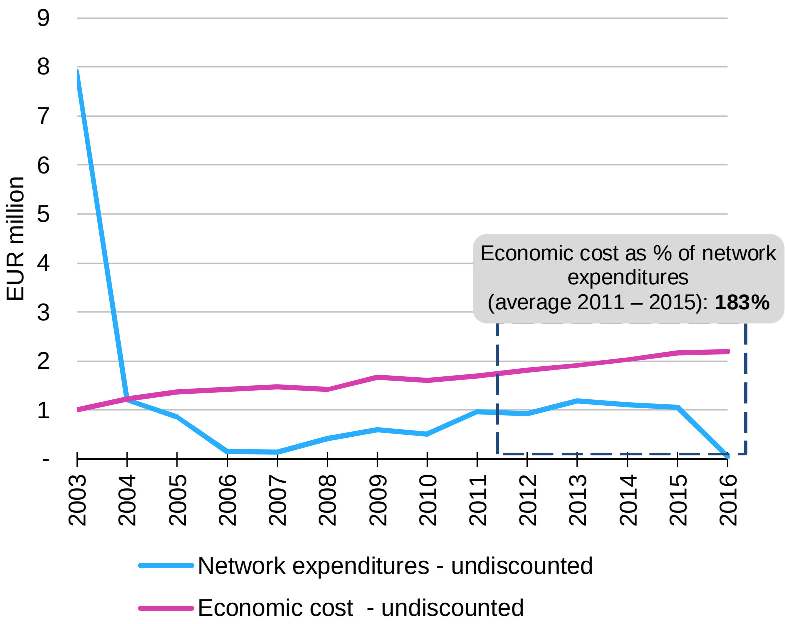


Figure 9.12: Network expenditures and economic cost in the French 2011 fixed LRIC model (year ending December) [Source: French fixed LRIC model, 2011]

This is also the case in the Netherlands (see Figure 9.13).

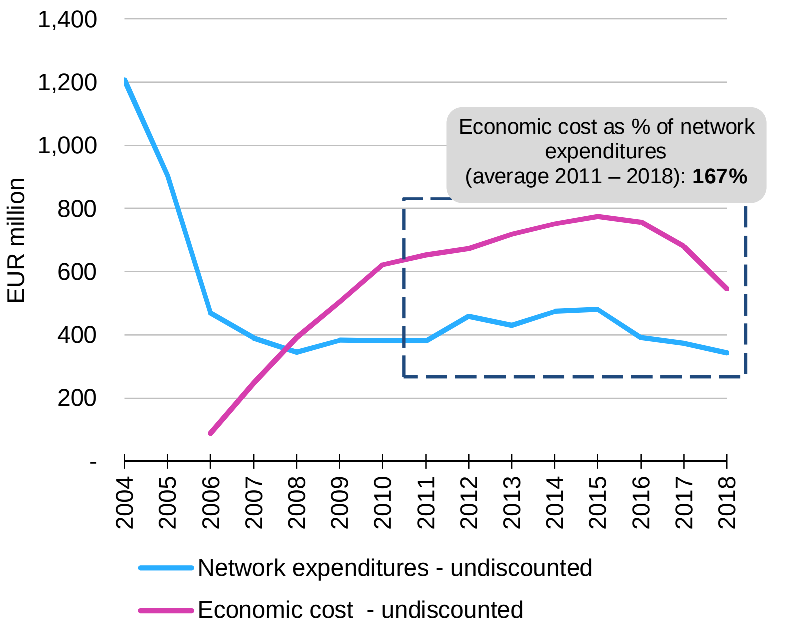


Figure 9.13: Network expenditures and economic cost in the 2010 Dutch fixed LRIC model (year ending December) [Source: Dutch fixed LRIC model, 2010]

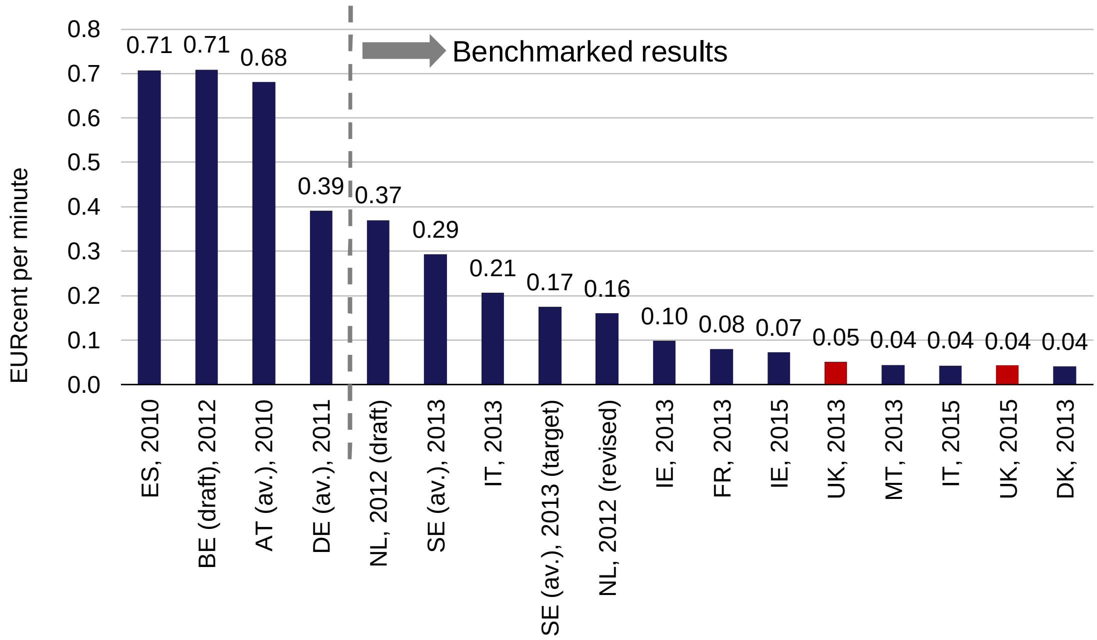
Conclusion

The long-term rate of cost recovery in the UK fixed model is significantly higher than the long-term rate of expenditure when compared to the UK mobile model. This has interesting dynamic implications as there is increasing competition and substitution between fixed and mobile services. In other fixed LRIC models, the long-term rate of cost recovery is closer to the rate of expenditure.

10 Implemented termination rate, adjustments and glide path

Figure 10.1 below, shows the termination rates implemented in 12 Western European markets.

Figure 10.1: Termination rates implemented in EU countries [Source: Analysys Mason, 2013]



Of those markets presented in Figure 10.1, only a handful have chosen to apply a pure LRIC in the calculation of their termination rates published for 2013 or earlier, namely:

- UK
- Malta
- Denmark
- Ireland
- the Netherlands.

The regulators in Sweden and Italy have stated the intention to move towards pure LRIC; however, the rates quoted for years up to and including 2013, in Figure 10.1 above, are not yet at this (lower) level.

For the remaining markets, the termination rate is set at a level that is higher than the pure LRIC, through the application of an adjustment (e.g. allowance, glide-path) or the choice of the LRAIC+ methodology. This is outlined in the following section.

10.1 Approaches for prices set higher than the pure LRIC termination rate

As part of the narrowband market review consultation, issued on 5 February 2013, Ofcom re-iterated its intention to apply a pure LRIC methodology to fixed termination rate costing. However, in several other markets, the termination rate has not been set at the pure LRIC level.

In the Netherlands, the rate has been set on a LRAIC+ basis as a result of a successful court challenge by KPN. In its February 2012 decision[24], the EC commented on the significant difference (131%) between this figure and the pure LRIC model output of EURc0.16/min, and the lack of economic justification provided by OPTA. The EC has stated that this choice of BU-LRIC plus pricing is liable to result in "*competitive distortions between fixed and mobile markets and/or between operators with asymmetric market shares and traffic flows*".

In Sweden, as a result of continuing with the last step of the existing (LRAIC+) glide path, the rate is much higher than the calculated pure LRIC. We note that there are also the following mark-ups applied in the Hybrid model's calculation of core service costs, as can be seen in Figure 10.2 below, and some of these may (or may not) be applicable to the wholesale termination increment.

Category	Adjustment
Loss on debtors (bad debts)	1.00%
Common business costs	3.04%
Working capital	0.00%
Commercial non-network costs (overheads)	34.10%
Interconnection calls	0.26%

Figure 10.2: Summary of adjustments applied to the calculation of core service costs in the Swedish hybrid model [Source: Swedish fixed LRIC model, 2012]

In France, the model calculated rate is 0.07c and the rate applied is 0.08c. No specific justification for this adjustment is provided. The EC's decision in July 2011[25] states that the fixed termination rates are set "*in reference to the long-run incremental costs of fixed call termination for effective generic operator over the period considered by this decision*" as opposed to at the actual output of the model. The EC made no comment regarding this difference and no further details are available.

10.2 Glide paths applied to the implementation of the new termination rate

In order to avoid a disruptive 'shock' change when introducing revised termination rates, several regulatory authorities have chosen to graduate the implementation of these changes in the form of a glide path. This involves a gradual transition (often over several years) from historical levels to the rate determined through the cost modelling exercise.

24 See Commission decision concerning case NL/2012/1284: Call termination on individual public telephone networks provided at fixed location in the Netherlands

25 See Commission decision concerning Case FR/2011/1234: access to the public telephone network at a fixed location for residential and non-residential customers in France

There is minimal support from the EC for the practice of setting glide paths, particularly given the 2009 Termination Rate Recommendation, stating that the new fixed termination rates should be in place by 31 December 2012. This is illustrated by the EC responses to the notification of proposed termination rates by the respective regulators.

Ofcom is proposing a glide path of six weeks, covering the period from the publication of the rates in mid-August to the implementation of the modelled pure LRIC fixed termination rates on 1 October 2013. The duration of this glide path is attributed to the need to bring fixed termination rates to a pure LRIC level as soon as possible[26] while still "*sufficient to allow CPs to make the necessary changes to the levels of their charges*".

Nevertheless, several markets have retained glide paths of varying lengths. Figure 10.3 summarises this, and additional detail is provided below.

Country	Length of glide path	Start date	End date
UK	6 weeks	Mid-August	1 October 2013
France	15 months	October 2011	January 2013
the Netherlands (proposed)	27 months	2nd half 2010	September 2012
Sweden	7 years	2008	2014
Italy	4 years	January 2012	January 2015
Ireland	1 year	July 2012	July 2013
Malta	6 months	January 2013	July 2013

Figure 10.3: Summary of glide-paths applied to the implementation of fixed termination rates [Source: Analysys Mason, 2013]

France

In 2011, ARCEP set out its proposed fixed termination rates for the period October 2011 to January 2013 using a stepped glide path towards the pure LRIC target level as shown in Figure 10.4 below.

Date of implementation	Implemented rate (EURc/min)
October 2011	0.30
July 2012	0.15
January 2013	0.08

Figure 10.4: FTR glide path applied in France [Source: EC decision FR/2011/1234, 2011]

ARCEP has stated that this multi-year glide path is appropriate "*in particular in the phase of transition towards a NGN architecture*". The early initiation of this glide path by ARCEP has aided compliance with the target of cost-efficient, symmetric termination rates by 31 December 2012, as set out by the EC Recommendation.

26 Ofcom have stated that the implementation of such rates will be beneficial for competition as well as promoting allocative efficiency.

The Netherlands

In OPTA's 2010 submission to the EC and its subsequent decision,[27] a glide path was proposed that not only moved termination rates to a pure LRIC-based target level, but also aligned the fixed termination rates to be implemented across local and regional levels. This proposed glide path covered the period from mid-2010 to September 2012 and is shown in Figure 10.5 below.

Proposed date of implementation	Proposed regional rate (EURc/min)	Proposed local rate (EURc/min)
H2 2010	0.71	0.50
H1 2011	0.71	0.52
H2 2011	0.72	0.53
1 January 2012	0.59	0.59
1 September 2012	0.45	0.45

Figure 10.5: FTR glide path proposed in 2010 for the Netherlands [Source: EC decision NL/2010/1079, 2010]

However, this decision was overruled on 31 August 2011 by the Trade and Industry Appeal Tribunal, and OPTA was ordered to take a new decision regarding fixed termination rates based on BU LRAIC+. In the interim period (between the annulment of the 2010 decision and the entry into force of OPTA's new decision on 1 May 2012) prices were held at the levels of the second half of 2011: EURc0.72 per minute for regional traffic and EURc0.53 per minute for local traffic.

Sweden

The regulated rates published by Sweden do not follow a glide path, but rather change as a result of a migration between two models based on different network technologies as discussed in Section 4 above.

PTS has argued to maintain this approach, despite the late implementation of a fixed termination rate that fully reflects the EC's Termination Rates Recommendation, in order "*to ensure regulatory predictability*".

In 2012, an additional layer of complexity was added to the approach in that the fixed termination rate results from the NGN model used in the weighting from 2013 onwards are to be calculated using a pure LRIC approach, thereby not including common costs. The EC has invited PTS to revisit this approach such that it is brought "*in line with the Termination Rates Recommendation*".

Italy

In the EC's decision of January 2013,[28] AGCOM set out a proposed approach to an efficient pure LRIC-based fixed termination rate covering the years 2012–2015. These proposed prices are set as

27 See Commission decision concerning case NL/2010/1079: Call termination on individual public telephone networks provided at a fixed location

28 See Commission decision concerning Case IT/2013/1415: Price related remedies on the markets for call origination, call termination and call transit on individual public telephone networks provided at a fixed location in Italy

"*a weighted average FTR which would result from a termination rate set for 2012 (TDM network, including also common costs) and a pure BU-LRIC-based termination rate in the IP network*". This is in fact a migration between models based upon different technologies and as such is discussed in more detail in Section 4 above.

AGCOM has justified this approach based on its belief that it will encourage operators to become gradually efficient and migrate rapidly to IP technology. However, the Commission does not agree with AGCOM's justification for the delay in the implementation of an NGN pure-LRIC-based fixed termination rate to January 2015, well beyond the January 2013 date in the EC's Recommendation, and has requested a review of this decision by AGCOM.

Ireland

As outlined in the EC's decision of November 2012,[29] ComReg plans to move from the current fixed termination rates, as implemented at 1 July 2012 to a pure BU-LRIC-based fixed termination rate at 1 July 2013. ComReg believes that this 12-month period will "*give providers sufficient time to adjust their forecasts and other relevant data*". The EC has pointed out that the release of the Termination Rates Recommendation in 2009 has given operators plenty of time to adjust their expectations and has encouraged ComReg to implement pure BU-LRIC fixed termination rates at the earlier date of 1 January 2013, in line with the recommendation.

Malta

The EC published a decision in December 2012[30] regarding the termination rates in Malta in which a glide path to a cost-efficient fixed termination rate was set out, as shown in Figure 10.6.

Date of implementation	Implemented rate (EURc/min)
1 January 2013	0.3803
1 July 2013	0.0443

Figure 10.6: FTR glide path applied in Malta [Source: EC decision, 2012]

This glide path and the delayed implementation of a pure LRIC-based fixed termination rate (beyond the deadline in the EC's Termination Rates Recommendation) was justified on the basis that the model was completed late and the MCA, as a small regulator, has limited resources. Additionally it was stated that the large reduction from the 2012 fixed termination rates, to those calculated by the pure LRIC model (almost 94%), would have been likely to have a significant negative impact on operators, given the small domestic market.

29 See Commission decision concerning: Case IE/2012/1372 — Call termination on individual public telephone networks provided at a fixed location in Ireland — Remedies

30 See Commission decision concerning Cases MT/2012/1401-1402: Cost model and review of rates in the markets for call origination on the public telephone network provided at a fixed location and for call termination on individual public telephone networks provided at a fixed location

Conclusion

Glide paths for the introduction of the new fixed termination rates have been applied in some of the countries in question, though the duration varies considerably. The shortest glide path is in the UK, at 6 weeks, followed by Malta, at 6 months. At the other end of the range, the Swedish regulator is using a seven-year transition (ending in 2014). The EC Recommendation states that new fixed termination rates should be in place by 31 December 2012; all of the glide paths end after this date, with the latest (Italy) ending in January 2015.