

Analysis of market structures in the Danish broadband market

Study for Danish Business Authority

Authors:

Ilsa Godlovitch
Stefano Lucidi
Dr. Ulrich Stumpf

Contact Person:

Dr. Ulrich Stumpf,
u.stumpf@wik.org

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Executive summary

Background

In March 2013, the Danish Government launched a plan entitled “Better broadband and mobile coverage throughout Denmark”. As part of the plan, the *Danish Business Authority* (“DBA”), the *Ministry of Business and Growth* (“MBG”) and the *Danish Competition and Consumer Authority* (“DCCA”) initiated an investigation of competition problems in the fixed broadband market in Denmark. To inform the investigation, DBA has asked WIK-Consult (“WIK”) to assess the structure of the Danish fixed broadband market and its implications for the competitive situation. In this respect, DBA has commissioned WIK to analyze certain topics regarding vertical integration, horizontal integration and specific issues regarding fiber networks. Furthermore, DBA has asked WIK to identify and assess options – that go beyond the sector-specific regulation of competition - for solving the competition problems caused by the structure of the fixed broadband market. The present report provides the findings of our analysis.

Market structure and competition problems

The report points out a number of structural factors in the Danish broadband market which are unlikely to be conducive to sustainable competition, namely:

- A very high and stable concentration rate, with the incumbent TDC consistently leading its competitors by a large market share gap, both in broadband, TV and bundles;
- TDC operating, for the time being, the most important two infrastructures, copper/DSL and coax, and other players being limited to a regional footprint or being heavily dependent on access to TDC’s network infrastructure; Relatively high entry barriers, despite a comprehensive set of access obligations imposed on TDC in relation to wholesale unbundled local access and wholesale broadband access. The economies of scale related to the purchase of wholesale broadcasting channels create a further barrier.

The unfavorable structural conditions, for the time being, do not seem to have negatively affected market performance in terms of coverage, penetration and retail prices. However, it is doubtful whether, in the presence of largely unfavorable structural conditions, a good market performance can persist in the longer term.

Options for remedying competition problems

The report identifies and assesses a number of options for improving competition. The discussion of these options has been informed (in four out of five cases) by positive experiences in other countries. The options considered include the following:

- Municipalities could further facilitate the roll-out of passive infrastructure, notably ducts, and provide access to ducts of public utilities under their ownership (option 1);
- DBA (or another competent authority, as appropriate in Denmark) could impose symmetrical regulation of fiber terminating segments involving access to co-investment in, and rental of, such segments (option 2);
- Utility companies that have invested in, and operate, fiber networks could offer access on commercial terms (option 3);
- TDC could functionally separate its local access network and provide wholesale services under “Equivalence of Input” principles (option 4); and
- TDC could divest its cable assets (option 5).

Comparative assessment

The assessment shows that each option has its specific advantages and disadvantages. The following table provides a comparative view of

- Whether implementation of the option can be mandated or depends on a voluntary (i.e. commercial) decision of the operator(s);
- Whether, and to what extent, it likely increases infrastructure-based competition (potentially allowing removal of SMP regulation);
- Whether, and to what extent, it likely increases access-based competition;
- Whether there are one-off implementation costs; and
- Whether there are recurring implementation costs.

Table: Comparative assessment of options to improve competition in the Danish broadband market

No.	Option	Mandated or voluntary?	Competition benefits		Implementation costs	
			Increase of infrastructure-based competition?	Increase of access-based competition?	One-off implementation costs?	Recurring implementation costs?
1	Greater role for municipalities in fostering digital infrastructure readiness	Mandated	√	-	↑	↑
2	Symmetric FTTH terminating segment network sharing	Mandated	√	-	↑↑	↑↑
3	Access to fiber networks of utilities	Voluntary	-	√ ⁽¹⁾	↑	↑
4	Functional separation of TDC	Voluntary	-	√√	↑↑	↑↑
5	Divestiture of cable assets of TDC	Voluntary	√√√	√ ⁽²⁾	↑↑↑	-

Notation:

Competition benefits: √: Low benefits, √√: Medium benefits; √√√: High benefits.

Implementation costs: ↑: Low costs; ↑↑: Medium costs; ↑↑↑: High costs.

⁽¹⁾ If demand for access to fiber utilities came predominantly from TDC, a positive effect on access-based competition would not materialize.

⁽²⁾ If the increase of infrastructure-based competition led to the deregulation of wholesale access markets, access-based competition would decrease. In these circumstances, access-based competition would, however, become less important for overall effectiveness of competition and market performance.

Source: WIK

The results of the table can be summarised as follows:

Mandated versus voluntary:

Only two options can be mandated and therefore be regarded as genuine policy options: The first option is giving a greater role to municipalities in fostering digital infrastructure readiness. The second option is imposing symmetric FTTH terminating segment network sharing.

The other options considered lack a legal foundation and therefore cannot be imposed on a mandatory basis. They become relevant if they make commercial sense to the relevant operators, respectively company shareholders. This applies in relation to

access to fiber networks, but also to functional separation (unless imposed through SMP regulation, which was not considered) and divestiture of cable assets of TDC.

Promotion of infrastructure-based competition:

Divestiture of TDC's cable assets clearly fares best, when it comes to promoting infrastructure-based competition and dealing with the origin of much of the current competition problems. FTTH terminating segment network sharing potentially could also have an impact on infrastructure-based competition, it seems however that demand for it may be limited to TDC. Giving municipalities a greater role has a relevant, though limited, impact on infrastructure-based competition.

The other options – access to fiber networks of utilities and functional separation of TDC – are unlikely to contribute to a relevant extent to infrastructure-based competition.

Promotion of access-based competition:

Functional separation fares best in terms of promoting access-based competition. Access to fiber networks of utilities could potentially also provide a stimulus, but it remains to be seen whether operators other than TDC would express an interest in it. Arrangements between fiber utilities and TDC could be prohibited by the Danish Competition Authority if they give rise to competition problems.

Divestiture of cable assets of TDC, however, may also have a positive impact on access-based competition as it may improve TDC's incentives to upgrade its copper network with vectoring or roll out FTTH in cable areas and thus improve access products for competitors. In turn, if the creation of an independent cable operator lead to a significant enough increase in infrastructure-based competition, access-based competition would become less important for overall effectiveness of competition and market performance. This would likely lead to deregulation of wholesale access markets.

The other options – greater role of municipalities and FTTH terminating segment network sharing – do not to promote access-based competition. Their primary focus is on strengthening infrastructure-based competition.

One-off implementation costs:

All options create one-off implementation costs. Such costs are highest for divestiture of TDC's cable assets given the necessary reorganisation of TDC and the sales process or IPO (Initial Public Offering). The cost of implementing functional separation and FTTH terminating segment network sharing is also significant. Costs are lowest in case of a greater role of municipalities and access to utilities' fiber networks.

Recurring implementation costs:

Divestiture of cable assets of TDC, once completed, has no recurring costs. All other options create to a varying degree recurring implementation costs.

1 Introduction

In March 2013, the Danish Government launched a plan entitled “Better broadband and mobile coverage throughout Denmark”.¹ As part of the plan, the *Danish Business Authority* (“DBA”), the *Ministry of Business and Growth* (“MBG”) and the *Danish Competition and Consumer Authority* (“DCCA”) initiated an investigation of competition problems in the fixed broadband market in Denmark. The investigation goes beyond the market reviews conducted by the Danish Business Authority, which identify specific competition problems related to Significant Market Power (“SMP”) in wholesale markets and which lead to the imposition of a comprehensive set of access remedies.² The purpose of the investigation of the three public bodies is to put competition problems in the broadband market in a wider context and identify any actions beyond SMP regulation that may increase competition and thus contribute to a well-functioning market.

To inform the investigations, DBA has asked WIK-Consult (“WIK”) to assess the structure of the Danish fixed broadband market and its implications for the competitive situation. In this respect, DBA has asked WIK to analyse certain topics regarding vertical integration, horizontal integration and specific issues regarding fiber networks. Furthermore, DBA has asked WIK to identify options – that go beyond the sector-specific regulation of competition – for solving the competition problems caused by the structure of the fixed broadband market.

Based on positive experience in other countries, we have identified the following options for further assessment:

- Municipalities could further facilitate the roll-out of passive infrastructure, notably ducts, and provide access to ducts of public utilities under their ownership (option 1);
- DBA (or another competent authority, as appropriate in Denmark) could impose symmetrical regulation of fiber terminating segments involving access to co-investment in, and rental of, such segments (option 2);
- Utility companies that have invested in and operate fiber networks could offer access on commercial terms (option 3)³;

¹ Bedre bredbånd og mobildækning i hele Danmark, Marts 2013 (<http://www.evm.dk/~media/oem/pdf/2013/2013-publikationer/13-03-13-bedre-bredbaand-og-mobildaekning-til-hele-dk/13-03-2013-bedre-bredbaand.ashx>)

² DBA has addressed competition problems under its regulatory powers and imposed on TDC obligations related to its position of SMP in the markets for wholesale physical network infrastructure access (market 4 of the 2007 Relevant Markets Recommendation), wholesale broadband access (market 5), and terminating segments of wholesale leased lines (market 6).

³ Note that this option has been considered because of prior experience in Denmark. There is little experience outside Denmark on access to alternative operators’ fiber networks, for which commercial access is usually not available.

- TDC could functionally separate its local access network and provide wholesale services on an “Equivalence of Input” basis⁴ (option 4); and
- TDC could divest its cable assets (option 5).

The assessment uses standard competition analysis as well as a qualitative analysis of the benefits and costs of the options considered. We have used data provided by DBA as well as information drawn from various published studies. In addition, in order to further inform our analysis, we have carried out structured interviews with representatives of key stakeholders, including TDC, Telenor, TeliaSonera, Global Connect, Waoo!, SE/Stofa, Concepy, Boxer TV and the Danish Chamber of Commerce. Some of the interviewees provided additional written statements.

The present report provides the findings of our analysis. The report first assesses the structure of the Danish fixed broadband market and its implications for competition (section 2). It then addresses, in line with the terms of reference, the following issues: the impact of vertical integration on competition (section 3), the effect of horizontal integration (section 4) and the role of fiber networks owned by utility companies (section 5). The report concludes with an assessment of the pros and cons of various options, could potentially improve competition in the Danish broadband market (section 6).

⁴ “Equivalence of Inputs” means the provision of services and information to internal and third-party access seekers on the same terms and conditions, including price and quality of service levels, within the same time scales using the same systems and processes, and with the same degree of reliability and performance. See Article 6(g) *Commission Recommendation of 11.9.2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment*.

2 Structural conditions and performance of the broadband market

Section 2 provides relevant background and gives an overview of structural conditions of the Danish broadband market in terms of

- Number and type of players;
- Market concentration; and
- Entry barriers – in the light of access obligations imposed as a result of SMP regulation.

This is followed by an assessment of the performance of the broadband market in terms of

- Availability of fixed broadband – including choice between multiple infrastructures;
- Fixed broadband penetration; and
- Retail prices of fixed broadband

The section concludes with an assessment of the implications for competition.

2.1 Number and type of players

Seven companies currently provide broadband services to end users and businesses:⁵

- TDC,
- Telia Denmark,
- Telenor Denmark,
- Wao!,
- Nianet,
- Syd Energi (“SE”), and
- Global Connect.

Two operators are known to consider market entry:

- Concepy, and
- Boxer TV.

The providers of retail broadband services, their scope of products, and the underlying platforms and business models are summarised in Table 1 and described thereafter.

⁵ We neglect those with *de minimis* sales.

Table 1: Providers of broadband communications services to end users

Player	Major retail products	Platform(s)	Business model
TDC	Broadband, telephony, TV, OTT (marketed through "TDC", "Fullrate" and "YouSee" and other brands) Business communications services	Copper/xDSL, coax, fiber	End-to-end provision of services
Telenor	Broadband, telephony, OTT Business communications services	Copper/xDSL	Provision of services based on ULL, VULA and bitstream access
Telia	Broadband, telephony, TV ⁽¹⁾ , OTT Business communications services	Copper/xDSL	Provision of services based on ULL, VULA and bitstream access
Concepy ⁽²⁾	Potentially broadband, telephony, TV and/or OTT	Copper/xDSL	Provision of services based on ULL, VULA and bitstream access
Wao!	Broadband, telephony, TV, OTT	Fiber	End-to-end provision of services
Nianet	Business communications services	Fiber	End-to-end provision of services
SE/Stofa	Broadband, telephony, TV, OTT (marketed through SE and Stofa brands) Business communications services	Fiber, coax	End-to-end provision of services
GlobalConnect	Business communications services	Fiber	End-to-end provision of services
Boxer TV ⁽³⁾	TV, potentially broadband and voice	DTT	Pay TV provider Provision of broadband and voice based on resale

⁽¹⁾ Telia provides TV only to subscribers served on the basis of ULL.

⁽²⁾ Concepy is in a trial stage and a potential new entrant into fixed broadband and voice.

⁽³⁾ Boxer TV provides digital terrestrial television, and is a potential new entrant into fixed broadband and voice.

Source: WIK

TDC

TDC is the incumbent operator and the leading provider of fixed and mobile communications services to end users. In the fixed area, TDC offers a comprehensive portfolio of products including broadband, telephony, TV (stand-alone or bundled) and business communications services.

TDC provides fixed services over three infrastructures:

- A nationwide copper network, upgraded to xDSL and covering 98% of Danish homes and businesses with basic broadband (i.e. 2 Mbps download);
- A coax network, upgraded to DOCSIS 3, which covers 50% of homes and businesses;
- A fiber network, which covers 2% of homes and businesses. It is made up of two networks - a build-to-order (BTO) network and a FTTH network. The BTO

network is the oldest of TDC's fiber networks and serves primarily business customers. The FTTH network is primarily the network that TDC acquired from *DONG Energy* ("DONG") in 2009. The DONG network was a point-to-point network, but TDC is moving to a GPON topology. In 2013, TDC also acquired the fiber operator ComX which serves around 34,000 subscriber households in Copenhagen and North Zealand.⁶

Telenor Denmark

Telenor Denmark is a subsidiary of Norwegian telecommunications company Telenor (the Norwegian incumbent) and is active in fixed and mobile communications. Its fixed portfolio includes broadband, voice and OTT services primarily provided to residential users, but not TV. Telenor uses regulated wholesale products of TDC, notably unbundled local loops ("ULL"); VULA and bitstream access. Telenor Denmark itself is the result of various mergers (e.g. with Tiscali in 2005, Cybercity in 2005 and Tele2 in 2007).

Telia Denmark

Telia Denmark is owned by the international telecommunications group TeliaSonera (the Swedish incumbent). Similarly to Telenor, it is active in both fixed and mobile communications. It provides fixed broadband, voice, OTT and (to a limited extent) TV services predominantly to residential users. As in the case of Telenor, its services are based on ULL, VULA and bitstream access.

Concepy

Concepy is a potential new entrant planning to offer broadband and voice and potentially TV and/or OTT services to end users via ULL, VULA and bitstream access. Concepy has not entered the market yet and is still in a testing phase.

Wao!

Wao! was established in 2010 as a product and marketing house for the fiber access networks of 15 of Denmark's largest energy companies. Utilities that have deployed fiber networks are owned by cooperatives, not municipalities. The largest of the founding companies, Syd Energi (SE), withdrew from the Wao! platform in April 2014. Other fiber utilities have merged.⁷ Wao! sells broadband, voice, TV and OTT services to residential users. Fiber utilities deploy fiber mainly in their respective public utility area. The fiber networks selling retail broadband through Wao! are located in Jutland, Funen, North and South Zealand, Lolland and Falster.

⁶ TDC's fiber acquisitions were not subject to merger control proceedings as the acquired companies had a revenue of less than 100 mio. DKK.

⁷ The most significant, NRGi (network in Eastern Jutland) and SEAS-NVE (network in north-west Zealand), have recently merged their networks.

Nianet

Nianet was established in 2003 by the same Danish power utility companies, who also provide broadband services to residential users under the Waoo! brand. In contrast to Waoo!, Nianet provides business communications services to companies and institutions in the private and public sector.⁸

SE

Syd Energi ("SE") is the telecoms arm of an electricity company. SE provides broadband Internet access, voice, TV and OTT services to residential users over a fiber and a cable network. The cable network was acquired in 2013, when SE purchased Stofa from Ratos, a private equity fund that acquired Stofa from Telia in 2010. Stofa's cable network is concentrated in the major cities, especially in Jutland and Funen, while SE's fiber network is located in the southern part of Jutland.

GlobalConnect

GlobalConnect provides business communications services, notably solutions for data networking and housing. It is also a provider of wholesale services to other network operators. GlobalConnect's fiber network covers all of Denmark and parts of Sweden and Germany.

BoxerTV

BoxerTV ("Boxer") is a subsidiary of BoxerTV Access, a Swedish company which is owned by Teracom (which in turn is owned by the Swedish state). Boxer provides pay television channels since 2009, and in the future is planning to bundle its TV offer with broadband and voice services. Boxer provides TV over the digital terrestrial television network of its parent company, Teracom. Since Teracom operates only DTT infrastructure in Denmark, Boxer will need to resell the broadband and voice services of a telecoms operator.

2.2 Market concentration

The retail market for fixed broadband is highly concentrated. TDC, the market leader, enjoys a large, persistent market share of 60% in terms of subscriptions as is shown in Table 2. TDC is ahead of its next competitors by a substantial market share gap of 48%, respectively 51%.

Second largest operator is SE with a market share of 12% in 2013. SE's market share significantly increased after the acquisition of Stofa. Third largest competitor is Waoo!.

⁸ <http://www.nianet.dk/om-nianet/overview-in-english>

Thus the competition exerted on TDC mainly comes from infrastructure based operators.

The market shares of the two access-based competitors, Telenor and Telia, have more than halved over the past six years. Telenor's share has decreased from 15% to 7%, whereas Telia's share has fallen from 10% to less than 5%. It must however be noted that Telia's loss of market share was predominantly a result of selling Stofa, which operates a coax network, to the private equity fund Ratios. Together Telenor and Telia account for almost 12% of the broadband subscriptions.

Table 2: Subscriber numbers and market shares in fixed broadband market, 2008-2013

	H1/ 2008	H2/ 2008	H1/ 2009	H2/ 2009	H1/ 2010	H2/ 2010	H1/ 2011	H2/ 2011	H1/ 2012	H2/ 2012	H1/ 2013	H2/ 2013
TDC	1,174,894	1,160,674	1,303,234	1,315,012	1,317,836	1,323,509	1,300,941	1,307,532	1,334,234	1,351,481	1,358,723	1,391,156
SE	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	262,404	273,508
Stofa	(2)	(2)	(2)	(2)	(2)	148,611	151,238	176,422	179,846	186,747	(3)	(3)
Tele- nor	297,609	290,385	282,699	280,693	271,918	260,604	252,349	217,939	196,812	183,850	175,407	166,532
Telia	193,387	191,136	196,189	203,014	210,172	75,976	85,537	(4)	(4)	(4)	(4)	(4)
Others	343,636	384,017	269,128	281,622	314,085	341,520	356,456	483,578	469,770	496,107	465,217	469,110
Total	2,009,526	2,026,185	2,051,250	2,080,341	2,114,011	2,150,220	2,146,521	2,185,471	2,180,662	2,218,185	2,261,751	2,300,306

	H1/ 2008	H2/ 2008	H1/ 2009	H2/ 2009	H1/ 2010	H2/ 2010	H1/ 2011	H2/ 2011	H1/ 2012	H2/ 2012	H1/ 2013	H2/ 2013
TDC	58%	57%	64%	63%	62%	62%	61%	60%	61%	61%	60%	60%
SE	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	12%	12%
Stofa	(2)	(2)	(2)	(2)	(2)	7%	7%	8%	8%	8%	(3)	(3)
Tele- nor	15%	14%	14%	13%	13%	12%	12%	10%	9%	8%	8%	7%
Telia	10%	9%	10%	10%	10%	4%	4%	(4)	(4)	(4)	(4)	(4)
Others	17%	19%	13%	14%	15%	16%	17%	22%	22%	22%	21%	20%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Notes:

- (1) SE's subscribers, respectively market share, are included in "others". SE's market share was less than 3% until H1/2011 and less than 5% between H2/2011 and H2/2012.
- (2) Stofa was part of Telia until H1/2010 and its subscriber numbers, respectively market share, during that period are included in Telia's figures.
- (3) Stofa was acquired by SE and, since H1/2013, its subscriber numbers, respectively market share, is included in SE's figures.
- (4) Telia's subscriber numbers, respectively market share, are included in "others". Telia's market share was less than 5% during the relevant period.

Source: DBA

Compared to most other EU countries, the Danish broadband market is much more concentrated. While, in January 2014, TDC's market share was 59%, the market share

of incumbents was on average 42% in the EU.⁹ Only Cyprus and Luxemburg had incumbent market shares that were higher than in Denmark.

2.3 SMP regulation

Broadband networks give rise to substantial economies of scale, scope and density as well as sunk costs. The combination of these factors limits the replicability of networks and products by competitors. In the absence of ex ante regulation, the retail broadband market would be characterized by substantial barriers to entry. DBA - through the network access obligations imposed on TDC – has reduced these barriers. SMP regulation alone, however, has not been able to eliminate barriers to entry and create a more competitive market structure. This section describes the scope and pricing of regulated access products and the problems related to access.

2.3.1 Scope of wholesale products

DBA has found TDC to have Significant Market Power (“SMP”) in two wholesale markets related to residential broadband products:

- Wholesale physical network infrastructure access (Market 4 of the Relevant Markets Recommendation¹⁰); and
- Wholesale broadband access (Market 5).

The competition problems related to SMP at wholesale level have led DBA to impose on TDC a comprehensive set of access products, encompassing unbundled local access, virtual unbundled local access (“VULA”), access to civil engineering and backhaul (all imposed in the Market 4 decision), and wholesale broadband access (Market 5 decision). Major access products are listed in Table 3 and described in the sections thereafter.

TDC is subject to a “stand still” obligation for its NGA wholesale products, i.e. TDC has to withhold new NGA wholesale products from internal or external provision for a specified period. The purpose of the “stand still” obligation is to ensure that alternative operators have equal access to information about new NGA wholesale products in order to develop their own end-user products based on the new wholesale product.

⁹ http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?action=display&doc_id=5935

¹⁰ See *Commission Recommendation of 17 December 2007 on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services.*

Table 3: Scope of regulated wholesale products of TDC

Wholesale category	Wholesale product	Platform		
		Copper	Fiber	Cable
Duct access	Duct access in backhaul sections	√	√	
Unbundled local access	SLU	√ ⁽¹⁾		
	LLU	√ ⁽²⁾	√ ⁽³⁾	
VULA	VULA uncontended	√ ⁽⁴⁾		
	VULA contended, layer 2	√		
	VULA contended, layer 3	√		
Bitstream access	Bitstream access, layer 2	√	√	
	Bitstream access, layer 3	√	√	√
	Bitstream access, national	√	√	√

Notes:

⁽¹⁾ Encompasses access to fully unbundled copper subloop and shared access.

⁽²⁾ Encompasses access to fully unbundled copper loop and shared access.

⁽³⁾ In case of P2P architecture.

⁽⁴⁾ DSLAM at street cabinet or central office.

Source: DBA

2.3.1.1 Access to backhaul

TDC is obliged to grant access to the backhaul section of its copper and fiber access network from advanced connection points to a higher lying point in the network in two forms:

- Access to ducts in backhaul sections;
- Access to rental of dark fiber in backhaul sections.

TDC is not subject to an obligation to provide duct access in the drop sections of its copper and fiber access network. A substantial share of copper cables is directly buried into the ground.

Duct access to TDC's cable network is not addressed by any obligations as cable is not included in Market 4.

2.3.1.2 Copper access

Unbundled local access

TDC must provide access to unbundled copper loops, including dual pair bonding.¹¹ Unbundling of the copper loop comprises unbundling of the higher frequency part of the loop (shared access) as well as unbundling of the full loop. Unbundled access, in principle, also covers subloops though there is very little use of it. From 1 January 2015, the subloop unbundling obligation will be abandoned for areas, where TDC applies vectoring at street cabinets and where access would prevent the realisation of the benefits of vectoring.

VULA

TDC is obliged to offer VULA in local exchange areas, where a street cabinet has been deployed/established. VULA must be provided in two versions:

- *A contended version where capacity is shared:* Contended VULA is different from bitstream as it gives alternative operators the possibility to change transmission speeds, contention and quality and to supervise and carry out certain maintenance functions.¹²
- *An uncontended version with dedicated connection and guaranteed speed:* The uncontended version of VULA differs from the corresponding contended version by a higher level of transparency (e.g. the possibility for the alternative operators to use different transmission protocols) in addition to control of the degree of contention.¹³

VULA must be made available at different locations and layers (layer 2 and layer 3) and with all the functionalities used by alternative operators for offering innovative services, such as video on demand (VOD). The uncontended version must additionally be made available on the backside of DSLAMs at MDFs and street cabinets.

For uncontended VULA, TDC is additionally obliged to offer backhaul between street cabinet and local exchange.

TDC is currently implementing vectoring technology in many of its street cabinets. Vectoring is a form of signal processing, which reduces the crosstalk between copper pairs and neighboring lines, thus allowing significantly higher and more predictable speeds. TDC expects that a total of 650,000 lines may ultimately benefit from the use of vectoring since they have an attenuation of less than 10 dB. Approximately 400,000 of these lines have an attenuation of less than 5 dB and will be able to provide speeds up

¹¹ Dual pair bonding increases the speed of products offered compared to traditional broadband products which use a single copper pair.

¹² Contended VULA is available since June 2013.

¹³ Uncontended VULA is available since December 2013.

to 100 Mbps download and 30 Mbps upload. TDC is obliged to notify the intended use of vectoring six months prior to the upgrade.¹⁴

TDC must offer VULA to alternative operators with the higher and more predictable speeds made possible by the use of VDSL2 vectoring at the street cabinet.¹⁵ Where TDC deploys vectoring technology at the street cabinet, the subloop unbundling obligation will be abandoned if such access prevents the realization of the benefits of vectoring. In order to be effective, vectoring requires that all lines are centrally managed from the same DSLAM. This is not yet possible with the currently available technology for multiple operators. It would therefore be technically inefficient to operate vectoring together with sub-loop unbundling.

Following a reasonable request by an alternative operator, TDC is obliged to deploy vectoring and provide VULA even if it would not decide to deploy vectoring itself. The purpose of this requirement is to act against any incentives of TDC to limit the use of vectoring to street cabinets outside the footprint of its cable coax network in order to foreclose competition on NGA.

Due to the fact that, certain customer premise equipment (CPE) may interfere with the use of vectoring, TDC must prepare a white list of vectoring compatible CPEs. Alternative operators are only allowed to use CPEs from this white list.

In case of forced migrations of alternative operators from SLU to VULA, TDC is obliged to pay compensation for stranded investments in form of a one-off payment per line. No such compensation has to be paid to alternative operators requesting vectoring.

Bitstream access

TDC is obliged to offer bitstream access on its copper network at the first Layer 2 switch (about 1,000 handover sites), at the first Layer 3 switch and with national handover. The obligation covers connections with dual pair bonding. Furthermore, it includes multicasting functionality which would allow alternative operators to provide IPTV.

¹⁴ 18 months prior to upgrade in cases where alternative operators are already present at the street cabinet and do not agree to the upgrade.

¹⁵ In Denmark, a draft decision regarding the use of vectoring at the full loop (at central offices) has been out for consultation. Based on the incoming responses, it has been decided to carry out further analysis to be able to assess the competition issues with regard to this specific situation before a decision may be made.

2.3.1.3 Fiber access

Unbundled local access

TDC's unbundling obligation extends to its fiber network. TDC is obliged to offer access to unbundled fiber regardless of the topology used (whether point-to-point or point-to-multipoint). DBA additionally imposed on TDC an obligation to construct, at the request of an alternative operator, a drop cable connecting the end customer with the near-by fiber network (up to 30 m of length). This is because TDC extends the fiber connection to the end customer only at the time of signing a contract with the end-user. The drop cable obligation means that TDC must install such connections as a wholesale service, when alternative operators requests so.

VULA

DBA has not imposed fiber VULA. Alternative operators have stated that they do not find fiber VULA interesting for the time being.

Bitstream access

TDC is mandated to offer bitstream access on its fiber network at layer 2, layer 3 and at national level. The obligation also requires TDC to provide alternative operators with the drop cables if end users are not yet connected to TDC's fiber network.

2.3.1.4 Cable access

Bitstream access

TDC is obliged to offer bitstream access on its coax network at layer 3 and at national level. In contrast to copper/fiber bitstream, TDC is not obliged to provide on its coax network bitstream access with multicasting functionality.

Resale TV

In a draft Market 5 decision consulted in June 2014, DBA proposed to impose on TDC an obligation to make its TV channels available for resale. The resale offer is tied to using cable bitstream access for providing broadband services to the respective end-user. Thus the YouSee's basic TV package and premium channels cannot be purchased and resold on a stand-alone basis.

Furthermore, TDC must ensure that access seekers get the same terms and prices for content as TDC have themselves. This only applies to the relevant rights for analogue and clear (unencrypted) digital pay-TV channels placed in their basic TV package. For TV channels that are not part of the basic TV package (and therefore not mandatory for the broadband connection) access seekers must negotiate their own terms.

2.3.2 Pricing of wholesale products

Cost orientation obligation

TDC's wholesale prices of duct access and dark fiber, unbundled local access and bitstream access are cost oriented and based on long-run average incremental costs ("LRAIC"). As of January 1, 2015, VULA prices will also be fully based on the (revised) LRAIC model.

The current wholesale prices are shown in Table 4. The following is worth noting:

- The wholesale charge for bitstream access via cable is 7.4% above the charge of copper bitstream. The fiber bitstream prices are more than twice the price of copper bitstream.¹⁶
- Uncontended and contended layer 2 VULA are cheaper than LLU.¹⁷

Table 4: Price of wholesale products of TDC, June 2014 (in DKK per line per year)

Wholesale category	Wholesale product	Platform		
		Copper	Fiber	Cable
Unbundled local access	SLU	322 ⁽¹⁾ - 643 ⁽²⁾		
	LLU	369 ⁽³⁾ - 737 ⁽⁴⁾	na	
VULA	VULA uncontended	441 ⁽⁵⁾ - 474 ⁽⁶⁾		
	VULA contended, layer 2	668		
	VULA contended, layer 3	822		
Bitstream access	Bitstream access, layer 2	777	2,239 ⁽⁷⁾ - 2,934 ⁽⁸⁾	
	Bitstream access, layer 3	931	2,317 ⁽⁷⁾ - 3,012 ⁽⁸⁾	1,000
	Bitstream access, national	na	na	

Notes:

- (1) Shared access to unbundled copper subloop
- (2) Full access to unbundled copper subloop.
- (3) Shared access to unbundled copper loop
- (4) Full access to unbundled copper loop.
- (5) DSLAM at street cabinet. The alternative operator pays an additional fixed fee of DKK 108 for each DSLAM where it buys uncontended VULA.
- (6) DSLAM at central office. The alternative operator pays an additional fixed fee of DKK 108 for each DSLAM where it buys uncontended VULA.
- (7) Inside DONG area.
- (8) Outside DONG area.

Source: DBA

¹⁶ The regulated bitstream price is, however, expected to drop significantly as of 1 January 2015.

¹⁷ According to DBA, the shift to a revised cost model approach for VULA at the beginning of 2015 will not lead to a price increase.

“No margin squeeze” obligation

TDC is subject to an obligation not to initiate margin squeezes between the retail prices and the wholesale prices for unbundled local access or bitstream access. TDC's prices for single play (stand-alone broadband) and double play (broadband bundled with telephony) must fulfill two conditions:

- *Individual test:* Alternative operators must be able to replicate TDC's prices and campaigns on individual products. This so-called “individual test” is forward looking and performed whenever TDC launches new products, prices and campaigns in the market. TDC's revenue from individual retail products must equal or exceed the wholesale charge plus the incremental costs of a reasonably efficient operator (“REO”). In case of a negative margin, TDC must lower its wholesale prices and/or increase its retail prices to avoid the squeeze.
- *Total test:* Alternative operators must be able to achieve a positive profit on the entire portfolio of broadband products (consisting of single play and double play products). Once a year, the actual TDC revenue is compared with the wholesale cost plus the incremental cost of a reasonably efficient operator using the volumes actually sold by TDC. In case of a negative margin, TDC must lower its wholesale prices to eliminate the squeeze. The adjusted wholesale prices apply until the total test is re-performed the following year.

The obligation not to initiate a price squeeze does not prevent TDC to meet price competition with regard to relevant, comparable broadband products in the retail market. If competitors undercut TDC in a geographically limited area, TDC is only allowed to reduce its prices in that same geographical area. By the same token, if an alternative operator lowers a retail price for a campaign period, TDC is only allowed to meet the price competition during this campaign period.

2.3.3 Use of wholesale access products

In 2013, TDC provided 418,547 wholesale lines to alternative operators. As is shown in Table 5, 58.2% were unbundled local access lines and 41.8% were bitstream access lines. Compared to the previous year, the share of local loop unbundling has significantly decreased, while the share of bitstream access lines has increased.

A reason is TDC's upgrading of the copper network with FTTC/VDSL. Alternative operators do not have the scale to justify investment in FTTC and to migrate from the full copper loop to the subloop. While they can continue to provide ADSL or VDSL from the MDF, doing so entails a severe speed disadvantage compared to TDC. Alternative operators therefore have an incentive to move from LLU to VDSL bitstream or VULA.

Table 5: Use of wholesale products of TDC

Wholesale product		2012	2013
		Number of lines	Number of lines
Unbundled local access	LLU	248,046	227,104
	LLU shared	21,733	16,409
	SLU and SLU shared	316	239
	Unbundled fiber access	na	na
VULA	VULA at DSLAM, layer 2, layer 3	0	0
Bitstream access	Bitstream access layer 2 - copper	0	0
	Bitstream access layer 3 - copper	145,627	163,641
	Bitstream access national - copper	0	0
	Bitstream access layer 2 – fiber in DONG area	0	0
	Bitstream access layer 2 – fiber in rest of country	0	0
	Bitstream access layer 3 – fiber in DONG area	11,172	11,154
	Bitstream access layer 3 – fiber in rest of country	0	0
	Bitstream access national - fiber	0	0
	Bitstream access layer 3 - coax	0	0
Total LLU/SLU/VULA		270,095	243,752
Total bitstream		156,799	174,795
Total wholesale lines		426,894	418,547

Wholesale product		2012	2013
		Share of lines	Share of lines
Unbundled local access	LLU	58.1%	54.3%
	LLU shared	5.1%	3.9%
	SLU and SLU shared	0.1%	0.1%
	Unbundled fiber access	na	na
VULA	VULA at DSLAM, layer 2, layer 3	0.0%	0.0%
Bitstream access	Bitstream access layer 2 - copper	0.0%	0.0%
	Bitstream access layer 3 – copper	34.1%	39.1%
	Bitstream access national - copper	0%	0%
	Bitstream access layer 2 – fiber in DONG area	0.0%	0.0%
	Bitstream access layer 2 – fiber in rest of country	0.0%	0.0%
	Bitstream access layer 3 – fiber in DONG area	2.6%	2.7%
	Bitstream access layer 3 – fiber in rest of country	0.0%	0.0%
	Bitstream access national - fiber	0%	0%
	Bitstream access layer 3 - coax	0.0%	0.0%
Total LLU/SLU/VULA		63.3%	58.2%
Total bitstream		36.7%	41.8%
Total wholesale lines		100.0%	100.0%

Source: TDC

2.3.3.1 Unbundled local access

In 2013, TDC provided 243,752 unbundled copper lines to alternative operators. The large majority of unbundled lines were fully unbundled copper loops as is shown in Table 5. Shared unbundled local loops play a decreasing role, and subloop unbundling has remained *de minimis*.

Use of fiber access has been virtually non-existent. The major reasons are the relatively high charges of fiber access (see Table 4 above) in combination with a limited willingness of residential customers to pay a premium for broadband speeds of 100 Mbps and more. It should also be noted that the footprint of TDC's fiber network is geographically very limited.

2.3.3.2 VULA

TDC introduced contended VULA in June 2013 and uncontended VULA in December 2013. After initial technical problems, VULA has witnessed an uptake. As of 1 July 2014, alternative operators had already approximately 45,000 VULA connections, so far generally of the contended version. The introduction of vectoring at the street cabinet will further promote migration to VULA.¹⁸

A regulated fiber VULA product has not been imposed given the lack of interest from the alternative operators.

2.3.3.3 Bitstream access

In 2013, TDC provided 174,795 bitstream lines. The large majority of bitstream access is provided over copper with ADSL/VDSL technology.

Fiber bitstream accounts only for small numbers. According to alternative operators, a major reason are the relatively high wholesale prices for TDC's fiber bitstream product, including for multicasting, which do not allow offering attractive prices to end users (see Table 4 above). Moreover, mixing or switching between wholesale platforms creates complexity both at end-user and wholesale level. Alternative operators prefer to focus on a single platform, namely DSL.

There is no use of cable bitstream, though a regulated offer exists. Bitstream over TDC's coax network remains unattractive to alternative operators for the following reasons:

- Alternative operators can use the cable bitstream product only for end users that have a TV subscription. Alternative operators cannot offer the TV service themselves. This may change in the future, as DBA has proposed to impose a

¹⁸ The amendment covering vectoring at the street cabinet enters into force on 1 January 2015.

resale TV obligation on TDC, which was consulted in June 2014. It must be noted that TDC must ensure that access seekers get the same terms and prices for content as TDC. However, this only applies to the relevant rights for analogue and clear (unencrypted) digital pay-TV channels placed in their basic TV package. For TV channels that are not part of the basic TV package, a resale offer is subject to alternative operators striking an agreement with the broadcasters who own the content rights.

- Alternative operators have also claimed that the bitstream charge does not allow competitive retail offers. The regulated bitstream price is, however, expected to drop significantly as of January 1, 2015.
- Mixing or changing wholesale platforms creates complexity both at end-user and wholesale level.

SMP regulation, while providing for mandated access on all three platforms operated by TDC, has not eliminated barriers to entry to the Danish retail broadband market.

2.4 Availability and coverage

Despite the high level of market concentration and the persistent entry barriers, Denmark fares well in terms of broadband coverage, both in absolute terms and compared to other European countries.

Speeds

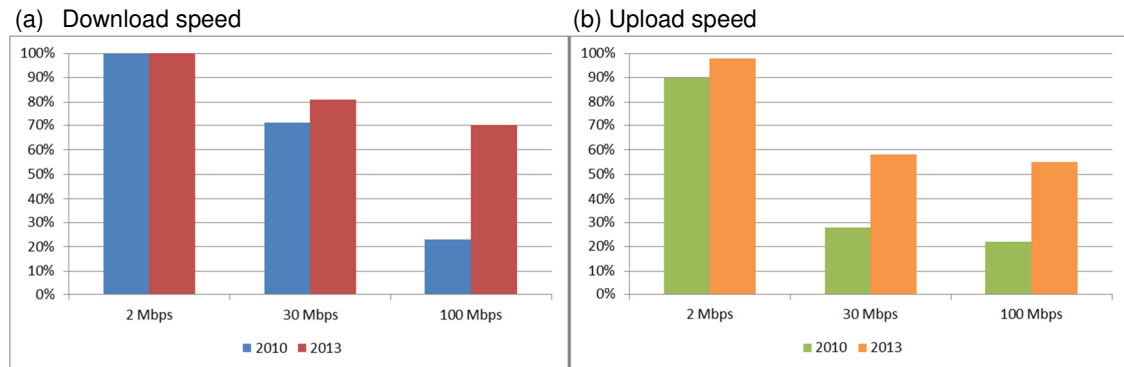
Denmark is well covered with standard broadband as Figure 1 shows. A connection with at least 2Mbps download is available to 99.9% of homes and businesses, and 2 Mbps upload speed is available to 98%.¹⁹

Moreover, Denmark is increasingly covered with NGA infrastructure. Speeds of 30 Mbps are now available to more than 80% of homes and businesses for download, respectively almost 60% of homes and businesses for upload. Thus, Denmark has clearly advanced towards the respective EU and Danish policy targets.

Very high speed coverage with 100 Mbps and more has also substantially risen. While, in 2010, download speeds of 100 Mbps were available to 23% of households, this rate increased to 70% in 2013. In terms of upload speeds, there has also been significant improvement: In 2013, 55% of households had access to upload speeds of 100 Mbps, an increase of 33 percentage points compared to 2010.

¹⁹ See DBA, Broadband Mapping 2013, p.4.

Figure 1: Coverage – Percentage of households and businesses passed by a fixed broadband network enabling 2, 30 and 100Mbps speed, 2010 and 2013



Note: The coverage figures include households and businesses. On 1 January 2013, the number of homes in Denmark was 2.6 million and the number of businesses was 284,000. This added up to a total of 2.89 million homes and businesses.

Source: DBA

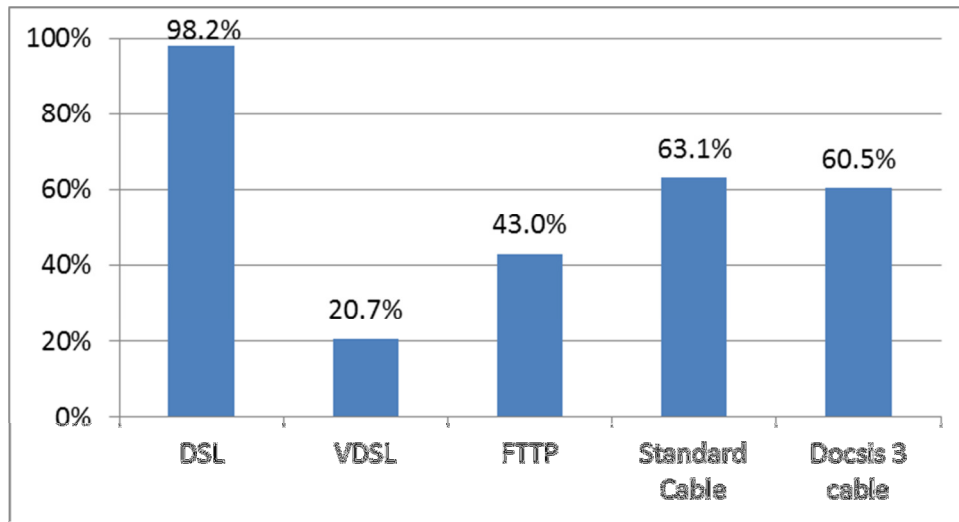
Compared to other European countries Denmark fares very well in terms of NGA coverage. In January 2014, 82.6% of Danish homes and businesses had access to NGA with speeds of 30 Mbps and more compared to an EU average of 61.8%.²⁰

Technologies

DSL is the most widespread fixed broadband technology as is shown in Figure 2. It is available to more than 98% of Danish households and businesses. In 2012, VDSL was available to 20.7% of homes and businesses, while DOCSIS3 achieved a coverage rate of 60% and fiber of 43%. For mid-2013, DBA's data show coverage rates for DSL of 98%, cable 63% and fiber 43%.

²⁰ European Commission, Implementation of the EU regulatory framework for electronic communications – 2014 (Commission Staff Working Document), p. 82.

Figure 2: Coverage by technology – Percentage of households passed by a fixed broadband technology, 2012



Source: Point Topic, Broadband Coverage in Europe in 2012.

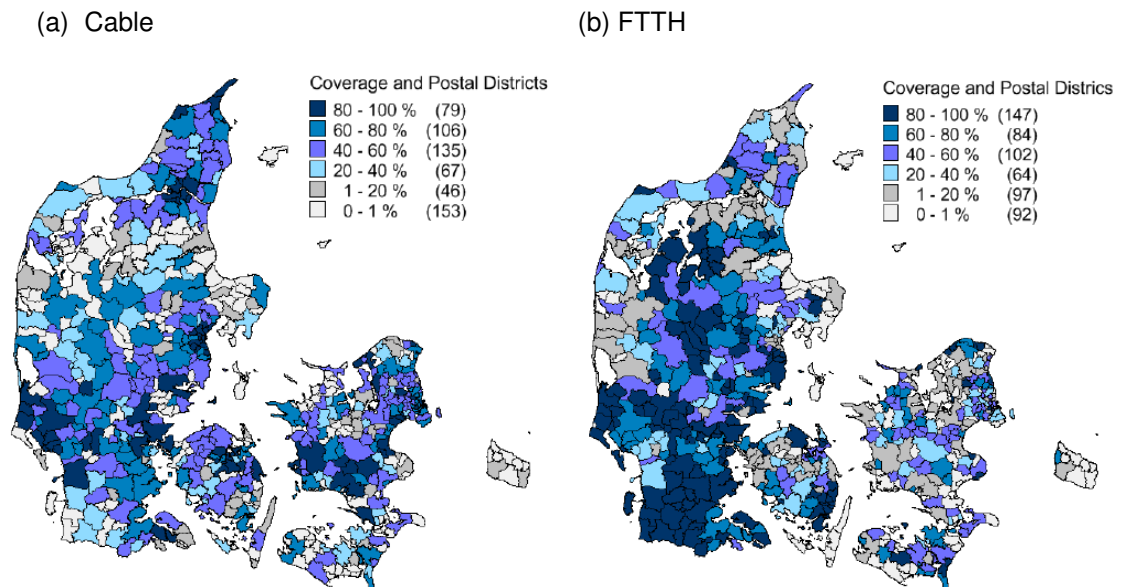
As is shown in Figure 3, roll-out of cable and fiber is marked by significant regional differences:

- Cable coverage is provided by TDC (YouSee) and SE (Stofa). It is highest in and around the largest cities in Denmark.
- Fiber coverage is mainly based on the deployment of utilities. Fiber is prevalent in large parts of Jutland and certain areas of Funen and Zealand. The fiber utilities have deployed fiber mainly in their respective public utility areas.²¹ A substantial part of fiber networks are rolled out in areas, where there is little or no cable coverage. The former DONG Energy's fiber network has been acquired by TDC in 2009. The DONG network is mainly concentrated in parts of Copenhagen and in Northern and Eastern Zealand. In 2013, TDC also acquired the fiber (and cable) operator ComX which serves around 34,000 subscriber households in Copenhagen and North Zealand.²²

²¹ SE in Southern Jutland and SEAS-NVE on Zealand are also active outside their home base.

²² TDC's fiber acquisitions were not subject to merger control proceedings as the acquired companies had a revenue of less than 100 mio. DKK.

Figure 3: Coverage of cable and FTTH by zip code, mid-2013



Source: DBA, Broadband Mapping 2013, p. 12, 13

Compared to other European countries, Denmark fares very well in terms of FTTP²³ coverage (43% versus EU average of 12%) and cable Docsis 3 coverage (61% versus EU average of 39%).²⁴ In both technologies, Denmark is ahead of many other Member States.

Consumer choice

An important indicator of infrastructure competition is access of end users to multiple platforms²⁵. While it is known that 98% of homes have access to DSL, 63% to a coax network and 43% to a fiber network (mid-2013), there is no precise information on the extent of network overlap. Thus we can only roughly estimate how many Danes can benefit from access to three, two or only a single platform.

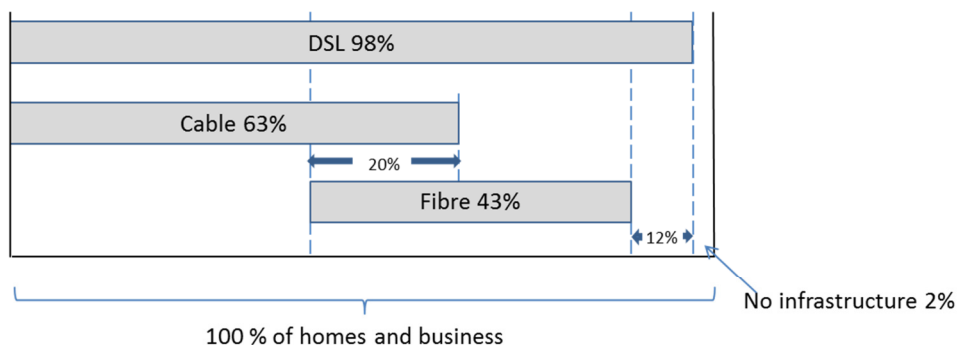
The estimation is illustrated in Figure 4. Given that DSL is almost nationwide, it is clear that cable networks overlap with DSL. The same is true for fiber networks, which overlap with DSL. However, only sketchy information exists regarding how many households benefit from *both* cable *and* fiber (in addition to DSL). Based on the available information our best guess is that roughly 20% of homes and businesses may benefit from both cable and fiber (in addition to DSL). This is depicted in Figure 4.

²³ FTTP = Fiber-to-the-home, covers both fiber-to-the-home (FTTH) and fiber-to-the-office (FTTO).

²⁴ Point Topic, Broadband Coverage in Europe in 2012, pp. 80 ff.

²⁵ In the context of this analysis, only fixed network broadband has been considered.

Figure 4: Overlap of infrastructures (lower bound for overlap of DSL, cable and fiber)



Source: WIK

With the assumption that 20% of homes have access to both cable and fiber in addition to DSL, and taking into account that 2% are not be passed by any fixed broadband infrastructure, the rest of the picture can be deducted (see **Fejl! Et bogmærke kan ikke henvise til sig selv.**):

- 43% will have access to both DSL and cable,
- 23% will have access to both DSL and fiber, and
- 12% will have only access to DSL.

Table 6: Availability of broadband infrastructures to end-users

Number of available platforms	Technology	% of homes and business
3	DSL, cable & fiber	20%
2	DSL & cable	43%
2	DSL & fiber	23%
1	DSL only	12%
0	None	2%
All		100%

Source: WIK estimate

It should be noted that much of the overlap between DSL and cable does not allow consumers a competitive choice regarding fixed network broadband as TDC is integrated into both. There is also a slight overlap of SE's fiber network with its (Stofa) cable network.

2.5 Penetration

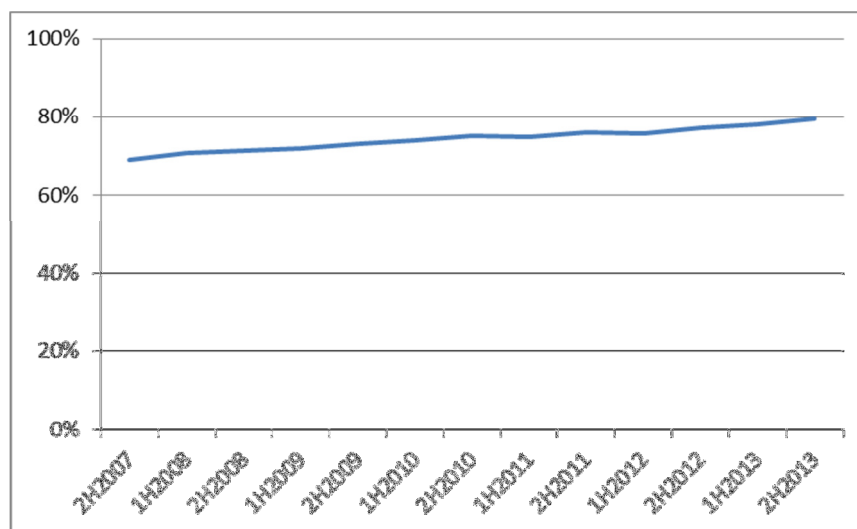
Denmark is almost fully penetrated with broadband. It also fares well for speeds of 30Mbps, but - like other EU countries - has a weak penetration with speeds of

100Mbps. Thus the good NGA coverage has not yet transformed into more widespread usage.

Speeds

At the end of 2013, there were 2.3 million fixed broadband subscriptions, which corresponds to a penetration rate of 80% of Danish homes and businesses (see Figure 5).²⁶

Figure 5: Penetration – Share of households & businesses with a fixed broadband subscription, 2007-2013



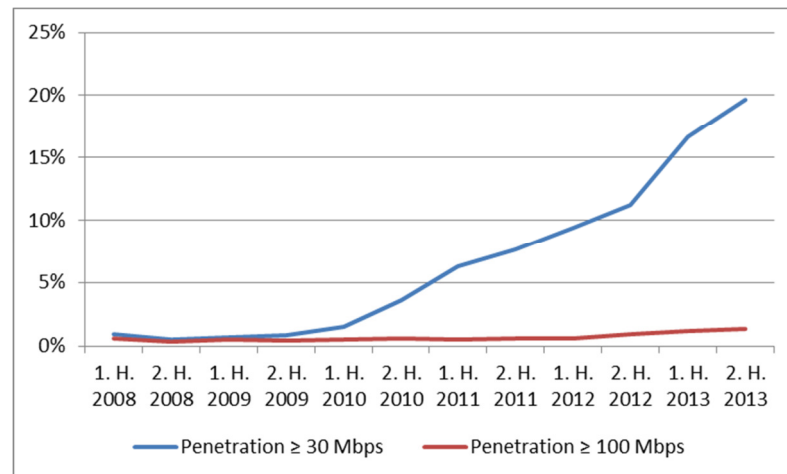
Note: Besides households, the penetration figures also include businesses.

Source: DBA

Denmark has also witnessed an increase in penetration of NGA broadband. At the end of 2013, 19.8% of Danish households and businesses subscribed to a fixed broadband connection with a (download) speed of 30Mbps or more (see Figure 6). In contrast, demand for connections with very high speeds of 100Mbps has remained very weak with a penetration rate of only 1.3%.

²⁶ In 2013, the total number of homes was 2.6 million and the number of businesses was around 280 thousand according to Statistics Denmark.

Figure 6: Penetration by speed – Percentage of households & businesses with a fixed broadband subscription up to 30 Mbps respectively 100 Mbps, 2008-13



Note: The penetration figures also include businesses.

Source: DBA

Denmark has one of the highest household penetration rates for standard broadband. Only two EU countries, Netherlands and UK, had a higher rate Q1/2013. However, in terms of connections with at least 30 Mbps, Denmark only occupies a middle rank.²⁷

Penetration figures based on population (rather than households) provide the following picture:²⁸ Denmark has the highest fixed broadband penetration rate in the EU. In January 2014, there were 41.1 broadband subscriptions per 100 inhabitants, while in the EU the average penetration rate was only 29.8%. For NGA penetration, Denmark fares better if penetration is based on population: 10.3% of Danes had a broadband connection with at least 30 Mbps, while the EU average stood at 6.3%. The situation is much less favorable in ultrafast broadband. Only 0.7% of Danes had subscribed to a broadband connection of 100Mbps or more, while the EU average was 1.6%.

Technologies

Figure 7a shows the number and shares of fixed broadband subscriptions by technology. While the share of cable and fiber has increased since 2009, the share of DSL has decreased. In 2013, 51% of the subscribers in Denmark use xDSL, while cable is used by 28% and FTTH by 13% of the subscribers.

²⁷ See Ofcom, The European Broadband Scorecard, Research Document, 12 March 2014, p. 31.

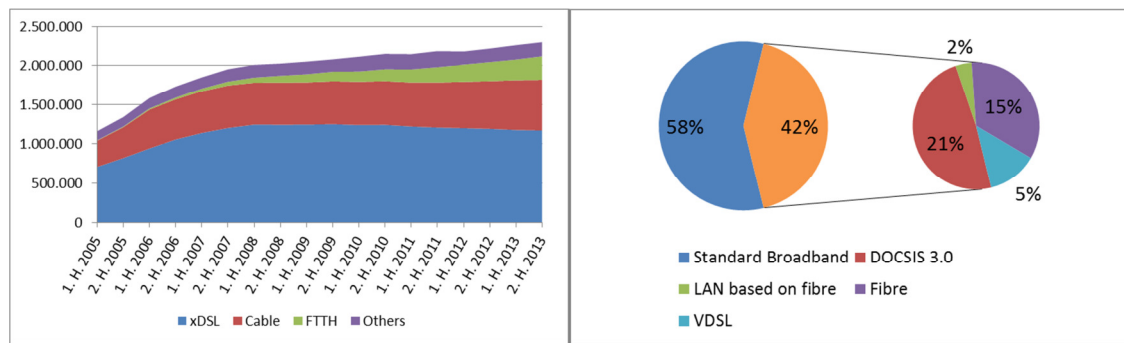
²⁸ http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?action=display&doc_id=5935

At the end of 2013, 42% of fixed broadband subscriptions were based on NGA technologies. Cable connections upgraded to DOCSIS 3.0 accounted for 21% of all connections, fiber for 15% and VDSL for 5% (Figure 7b).

Figure 7: Broadband subscriptions by technology, 2003-2013

(a) 2005-2013

(b) End 2013

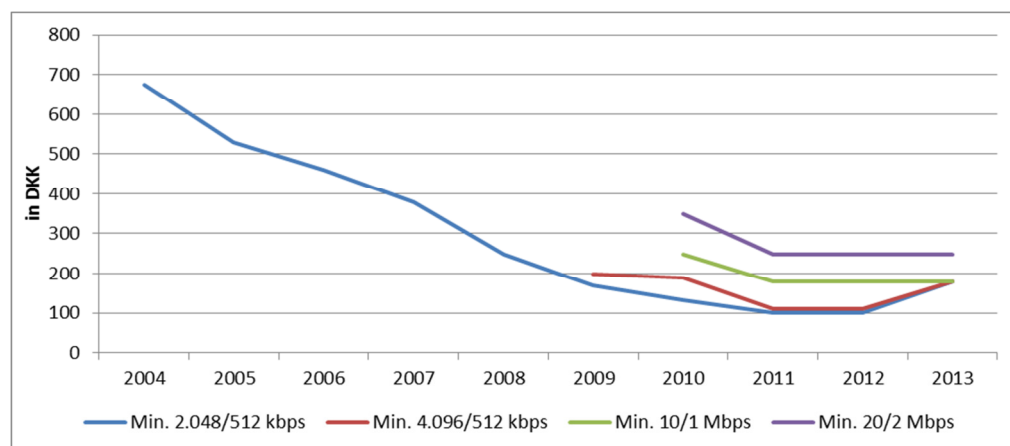


Source: Erhvervsstyrelsen, Telestatistik, Andet halvår 2013

2.6 Retail prices

So far, the relatively high market concentration has not stood against a favorable development of fixed broadband prices. In fact, prices have dropped significantly during the past years. Figure 8 shows the price development of the cheapest broadband contracts for different bandwidths.

Figure 8: Price of cheapest fixed broadband subscriptions (DKK), 2004-2013



Download/upload speed ⁽¹⁾	2004-2013	2009-2013	2010-2013
2.048/512 kbit/s	-78.1%	-3.6%	+25.2%
4.096/512 kbit/s		-18.2%	-12.6%
10/1 Mbit/s			-26.2%
20/2 Mbit/s			-34.0%

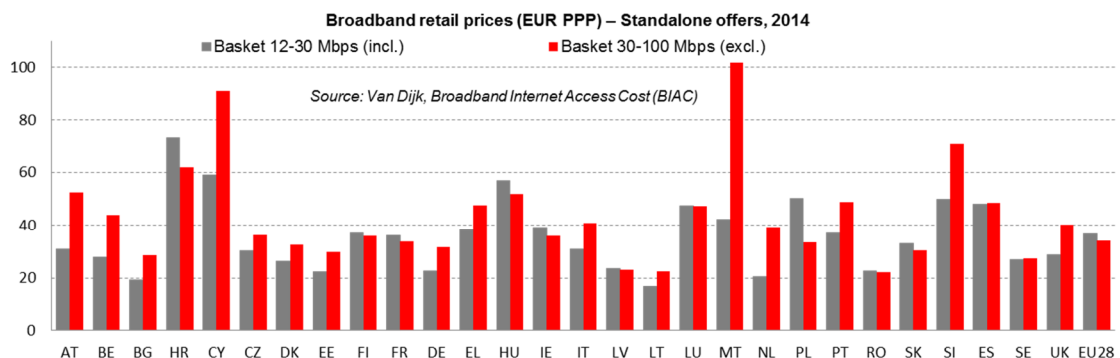
⁽¹⁾ Advertised speed

Source: Erhvervsstyrelsen, Telestatistik, Andet halvår 2013

Compared to other EU countries, Denmark fares well in terms of broadband prices.²⁹ The van Dijk study carried out for the European Commission shows that, while never being the cheapest, Danish prices are for many broadband categories relatively favourable.

Figure 9 shows the median prices (calculated on Purchasing Power Parity) for stand-alone broadband with 12 to 30Mbps of download speed in the EU. The median prices vary between €22 and €102 for a standalone offer with a download speed between 30 and 100 Mbps. The median prices were the lowest in Romania (€22), Lithuania (€22) and Latvia (€23). Denmark, while not the cheapest, fares quite well in this comparison.

Figure 9: Broadband retail prices (Euro PPP), stand-alone broadband offers, 2014



Source: European Commission, Broadband Markets, Digital Agenda Scoreboard 2014, (http://www.google.de/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CCkQFjAB&url=http%3A%2F%2Fec.europa.eu%2Finformation_society%2Fnewsroom%2Fcf%2Fdae%2Fdocument.cfm%3Fdoc_id%3D5810&ei=4-z6U4fqCsflaqLtqfAG&usq=AFQjCNEhm50kFOkERra63B4JTPHIH_zGUQ&bvm=bv.73612305.d.ZWU&cad=rja).

2.7 Summary

The assessment of the market structure reveals structural factors that are unlikely to be conducive to sustainable competition, namely

- A very high and stable concentration rate, with the incumbent TDC consistently leading its competitors by a large market share gap, both in broadband, TV and bundles;

²⁹ Surveyed categories include stand-alone broadband, double play and triple play bundles for varies speeds. See Van Dijk, Broadband Internet access cost (BIAC) 2013: Prices as at 1-15 February 2013. See also the summary provided it in Communications Committee, Broadband access in the EU: situation at 1 July 2013, p. 28-33.

- TDC operating, for the time being, the most important two infrastructures, copper/DSL and coax, and other players being limited to a regional footprint or being heavily dependent on access to TDC's network infrastructure;
- Relatively high entry barriers despite a comprehensive set of access obligations imposed on TDC in relation to wholesale unbundled local access and wholesale broadband access. The economies of scale related to the purchase of wholesale broadcasting channels create a further barrier.

The unfavorable structural conditions, for the time being, do not seem to have negatively affected market performance:

- Standard broadband is available to virtually every home and business in Denmark. The country is also well covered with broadband networks allowing speeds of 30Mbps and more. Network roll-out or upgrade for speeds of 100Mbps has progressed well.
- Standard broadband is highly penetrated. Take-up of NGA broadband is satisfactory. Worrying from a policy point of view is the very low household take-up of very high speeds of 100Mbps and more, but this may also be a direct effect of weak demand and low willingness to pay for such speeds.
- Retail prices of fixed broadband have declined over the last years, and in a European comparison, Denmark fares well.

However, it is doubtful whether in the presence of largely unfavorable structural conditions the good market performance will persist in the longer term. Quite to the contrary, the current market structure stands against sustainable competition and is unlikely to promote consumer welfare in the longer run. The following sections 3-5 address in more detail some of the structural problems related to vertical and horizontal integration and look at the role of fiber utilities as a procompetitive factor.

3 Vertical integration and competition in the broadband market

Section 3 assesses the reasons for the strong degree of vertical integration in the broadband market and looks at the advantages and disadvantages of opening up the vertical value chain through access.

3.1 Advantages and disadvantages of vertical integration

The value chain in broadband - simplified and neglecting content – includes:

- the (passive) local loop,
- active components,
- aggregation network,
- core network,
- global Internet connectivity, and
- retailing.

If broadband is bundled with television, there is a second value chain on the television side comprising:

- content rights,
- broadcasting channels,
- wholesale aggregation of channels into packages and
- retailing television (packages of channels) together with broadband.

The TV value chain is further explored in section 4, this section focuses on the broadband value chain.

Broadband operators in the Danish broadband market are vertically integrated into the broadband value chain to varying degrees as is shown in Table 7.

- TDC is integrated into all stages of the value chain and, only for global Internet connectivity (access to www), partially depends on peering and transit arrangements with other operators.
- The utilities under the Waoo! brand are also vertically integrated, except for global Internet connectivity.
- Telia and Telenor do not own local loop infrastructure and depend on access to unbundled local loops and bitstream access at higher network levels. Though benefitting from international infrastructure of their parent companies, they also depend on peering and transit arrangements as any other operator in Denmark.

Table 7: Degree of vertical integration in the Danish residential broadband market

Company	Platform	Local loop	Active components	Aggregation network	Core network	Internet connectivity	Retailing
TDC	Copper/DSL, cable, fiber	√	√	√	√	(√)	√
SE	Cable, fiber	√	√	√	√		√
Other utilities ¹⁾	Fiber	√	√	√	√		√ ¹⁾
Telia	Copper/DSL		(√) ²⁾	√	√	(√) ³⁾	√
Telenor	Copper/DSL		(√) ³⁾	√	√	(√) ³⁾	√

¹⁾ Under Waoo! brand.

²⁾ Telenor and Telia rent the ULL and VULA for part of their customers, for the other part they use bitstream access.

³⁾ Telenor and Telia can use international infrastructure of their parent companies.

Source: DBA

Vertical integration entails advantages and disadvantages, both at the firm and the macroeconomic level. These are outlined in the following (neglecting global Internet connectivity where all companies depend on peering and transit arrangements with other operators).

Firm level perspective

A major advantage of vertical integration at the firm level is the savings from internalizing transaction processes between different levels of the value chain within a single company. In addition, it is claimed that vertically integrated companies are better able to link network investment to end-user preferences, since the company's retail and network arms may directly interact if under common ownership. This is particularly relevant for NGA investment.

Another advantage at the firm level is the market power that firms may gain as a result of vertical integration. This gain to a firm is highest if elements of the value chain are integrated that exhibit large economies of scale, scope and density in combination with sunk costs, and are thus difficult or impossible to replicate, as is the case for local access networks. A major source of a vertically integrated firm's market power is control of local access infrastructure, in particular if it covers the whole country. An operator even with limited geographical footprint may be able to deteriorate terms and prices for individual customers if these do not have the option to switch to a competing infrastructure. An incumbent operator with infrastructure(s) that cover(s) the whole country will be able to significantly influence market outcomes.

Macroeconomic perspective

Transaction cost savings from internalizing market processes and the better linkage of network investment to end-user preferences also represent clear macroeconomic benefits.

In turn, a clear disadvantage is the market power that vertically integrated companies derive from control of local access networks that are subject to large economies of scale and scope in combination with sunk costs. Such market power can be used to discriminate against non-integrated competitors by refusing access, delaying access, degrading quality of access, and applying margin squeezes. Such strategies negatively impact the ability of non-integrated operators to technically and economically replicate the vertically integrated operator's retail products. They deteriorate competition in the retail market and may result in foreclose of the market to new entrants.

3.2 Whether it matters if the infrastructure is closed or open

It clearly matters whether infrastructure is closed or open. Given the lack of replicability of local access infrastructures, only 2-3 operators may be able to compete on an end-to-end basis and in lower density regions not more than a single operator may be financially viable. In these circumstances, competition on an end-to-end basis will not be effective. Rather, choice for consumers and competition at the retail level will strongly depend on the provision of network access.

Operators owning infrastructure that is difficult to replicate may provide access as a result of regulatory obligations or on commercial grounds. This section focuses on regulated access of operators with SMP in upstream levels of the vertical value chain. Commercial access to fiber networks of utilities is addressed further down in sections 5 and 6.3 of the report, symmetrical access regulation of the fiber terminating segment is addressed in section 6.2.

Regulators address competition problems related to SMP at the upstream stages of the value chain by access obligations. Network access obligations eliminate abuses of market power that a vertically integrated operator may be inclined to commit in the absence of ex ante regulation. Relevant obligations encompass:

- Access on reasonable demand;
- A reference offer and other transparency obligation such as Key Performance Indicators (KPIs);
- Non-discrimination based on Equivalence of Output or Equivalence of Input principles,³⁰ in severe cases functional separation. In case of functional

³⁰ Equivalence of Inputs (EoI) means the provision of services and information to internal and third-party access seekers on the same terms and conditions, including price and quality of service levels, within the same time scales using the same systems and processes, and with the same degree of reliability

separation, an operator transfers activities related to the local access network, including the provision of wholesale local access products, to an independently operating business unit. This business unit supplies access products and services to all undertakings (including other business units within the same parent company) under Equivalence of Input conditions, i.e., on the same timescales, terms and conditions, including price and service levels, and by means of the same systems and processes.

- Price control based on cost orientation or retail-minus, coupled with an obligation not to apply margin squeezes;
- Accounting separation.

With the exception of functional separation, DBA has imposed such obligations on TDC to address its position of SMP in the markets for wholesale physical network infrastructure access (Market 4) and wholesale broadband access (Market 5).

Network access obligations do not put into question the firm-level benefits of vertical integration related to transaction cost savings. As integrated operators will continue to provide their own services to end-users, such services can compete with access-based services of non-integrated operators.

Regulated network access entails clear benefits in terms of competition. In the absence of any regulated access, retail markets would be unlikely to be effectively competitive, at least in the lower density areas. Only with regulated access, barriers to entry to the retail markets are reduced, though they may not be eliminated as we have argued in the Danish context. Access-based competition on retail markets increases choice and improves consumer welfare.

Although offering wholesale access does not need undermine the cost efficiencies inherent in vertical integration, it is not costless. Significant regulatory effort may be needed to maintain access obligations. If not perfectly calibrated (for example in terms of price), access obligations may undermine investment incentives. Importantly, also, mandating access at the level of networks and services does not address the underlying issue of lack of economic replicability of the underlying infrastructure. It thus addresses the symptoms, but not necessarily the structural cause of competition problems.

and performance. Equivalence of Output (EoO) means the provision to access seekers of wholesale inputs comparable, in terms of functionality and price, to those the SMP operator provides internally to its own downstream businesses albeit using potentially different systems and processes. See Art. 3(g) and (h) *Commission Recommendation of 11.9.2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment*.

4 Horizontal integration and competition in the broadband market

4.1 Impact of horizontal integration on the competitive situation

Horizontal integration of broadband and television services goes along with economic advantages at firm and macroeconomic level, but may also have negative effects on competition in broadband and television markets, and ultimately on consumer welfare. Such competition concerns are related to bundling which is explored in section 4.

4.1.1 Offers of bundles

Table 8 shows to what extent operators in Denmark offer triple play bundles consisting of broadband, voice and television:

- TDC offers triple play bundles over its copper/DSL and coax network. While for cable subscribers basic television and broadband/voice are subject to separate contracts, we would nevertheless qualify this as a form of bundling - provided that broadband is tied to a basic television subscription and cannot be purchased as a stand-alone service. TDC also offers triple play over fiber, but - given the low coverage and the low-key marketing of fiber products - it plays a minor role.
- SE, similar to TDC, provides triple play services on two infrastructures, fiber and cable. The other utilities - through Waoo! - provide triple play over fiber.
- Among the access-based competitors only Telia provides triple play with television; the offer is limited to its ULL-based customers. Telenor does not offer television.
- Other TV service providers include Viasat and CanalDigital, which provide DTH satellite services, as well as Boxer TV, which offers services over a DTT network. These operators, are TV service providers without any own broadband infrastructure.

Table 8: Offers of bundles of broadband, voice and TV

Company	Brand	Platform	Broadband	Voice	Pay-TV
TDC	YouSee	Cable	✓	✓	✓
	TDCTV	IPTV/DSL	✓	✓	✓
SE	Stofa	Cable	✓	✓	✓
	SE	IPTV/Fiber	✓	✓	✓
Regional utilities	Wao!	IPTV/Fiber	✓	✓	✓
Telia	Telia	IPTV/DSL	✓	✓	✓ ⁽¹⁾
Telenor	Telenor	IPTV/DSL	✓	✓	
Concepy⁽²⁾	Concepy	IPTV/DSL	✓	✓	⁽²⁾
Boxer⁽³⁾	Boxer	DTT			✓
Viasat	Viasat	DTH satellite			✓
Canal Digital	Canal Digital	DTH satellite			✓

Notes:

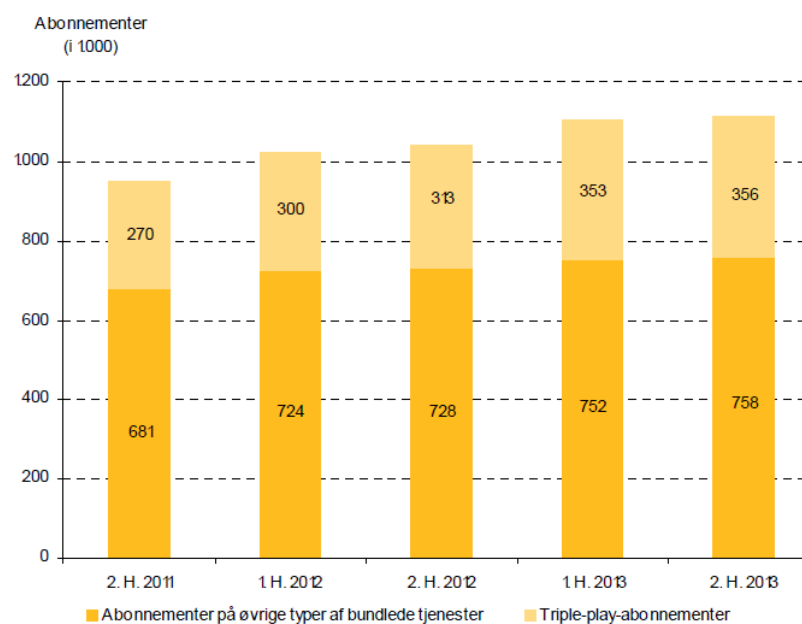
⁽¹⁾ Telia offers TV services only to ULL-based customers.⁽²⁾ Potential new entrant. Not clear whether Concepy, in case of market entry, would offer pay-TV.⁽³⁾ Potential new entrant.

Source: WIK; company websites

4.1.2 Use of bundles

The total number of landline subscriptions to bundled services increased by 17.1% from 951,000 at the end of 2011 to 1,114,000 at the end of 2013 – see Figure 10. During the same period triple play subscriptions rose by 32.0%, while subscriptions to other bundled services increased by 11.3%.

Figure 10: Number of subscriptions to bundles (triple play, other bundles)

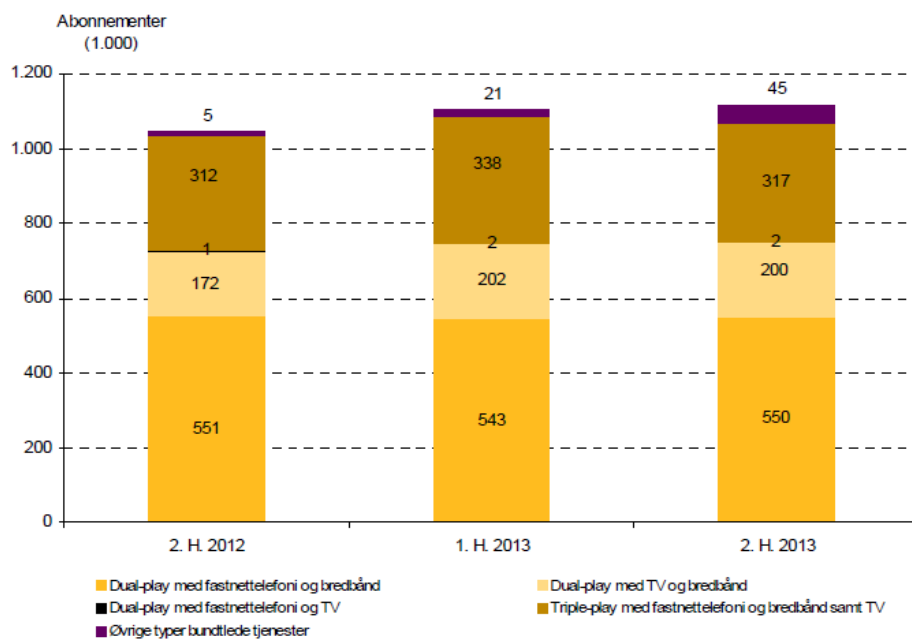


Source: Erhvervsstyrelsen, Telestatistik, Andet halvår 2013

In late 2013, there were 519,000 subscriptions to bundles that include TV together with fixed telephony and/or broadband, which corresponds to a share of 46.6% of all subscriptions to bundles - see Figure 11. This is the same share as in the year before, when 485,000 out of 1,041,000 subscriptions were bundles with TV.

Triple-play subscriptions that include TV together with fixed telephony and broadband accounted for 317,000 subscriptions in late 2013 or 28.5% of subscriptions to bundles. It should be noted that the share of triple play subscriptions actually went down compared to the year before, when triple play still accounted for 30%.

Figure 11: Number of subscriptions to bundles by type of bundle



Source: Erhvervsstyrelsen, Telestatistik, Andet halvår 2013

While the above market trend suggests that the demand for bundles with TV may stagnate, other data shows that this may not have fully affected TDC:

- The share of TDC/Fullrate broadband lines with triple play out of all TDC/Fullrate broadband lines increased from 2012 to 2014 from 28.1% to 36.5% (some of the bundles may include mobile rather than TV).
- During the same period the share of YouSee TV lines³¹ with triple play out of all TV lines remained stable at around 6.5%, while the share of dual play with TV increased from 36.4% to 40.0%.³²

³¹ Includes Dansk Kabel-TV and ComX.

³² TDC fact sheet.

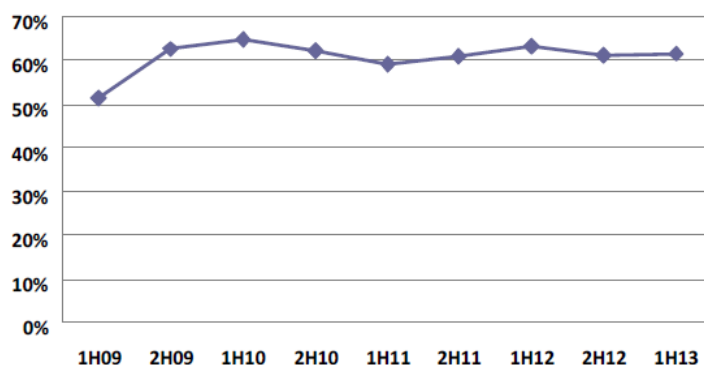
4.1.3 Concentration

Concentration in triple play

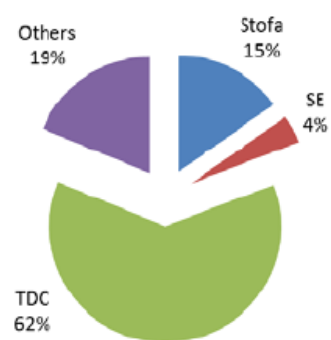
There is a high and persistent concentration in triple play bundles, as Figure 12 shows. TDC is by far the market leader with 62% of triple play subscriptions in late 2013. The fiber utilities follow with a substantial gap in market shares: SE/Stofa has 19% of triple customers, while Waoo! is included in “others”.

Figure 12: Market shares for triple play fixed line subscriptions

(a) TDC (2009-13)



(b) TDC and competitors (2H/2013)



Source: DBA

Concentration in TV

Concentration in TV is somewhat lower than in broadband, though TDC is also the market leader by a clear margin – see Table 9:

- TDC is the largest TV service provider in Denmark with an overall market share of 52% (cable brand YouSee has 45% and TDC's IPTV offer has 7%).
- Similarly to broadband, there is a huge market share gap between TDC and its competitors. SE is the second largest competitor with a market share of 15%, predominantly with customers on the Stofa cable network and to a small extent on fiber.
- Boxer is the third largest TV provider in Denmark with a market share of 14%. Boxer TV purchased a DTT license in 2008 and started pay TV services in 2009.
- Next are two providers of DTH satellite television, Viasat and CanalDigital, with 6% and 4% market share in the TV market.
- The fiber utility companies, marketing their services under the Waoo! Brand, offer TV services to about half of their 260,000 broadband customers.
- TDC's access-based competitors, Telenor and Telia do not play a role. Telia only offers TV to a small number of ULL-based customers. Telenor does not offer TV at all.

Table 9: Market shares in TV by operator and platform used

Company/brand	TV market share					
	Cable	DSL	Fiber	DTT	DTH satellite	Total
TDC/YouSee	45%	7%	0,3%	-	-	52%
SE/Stofa	14%	-	1%	-	-	15%
Boxer	-	-	-	14%	-	14%
Viasat	-	-	-	-	6%	6%
CanalDigital	-	-	-	-	4%	4%
Wao!	-	-	3%	-	-	4%
Telia	-	1%	-	-	-	1%
Telenor	-	-	-	-	-	0%
Other	6%		-	-	-	6%
Total	65%	8%	4%	14%	10%	100% ⁽¹⁾

Note:

⁽¹⁾ Sum does not round to 100% because of rounding error.

Source: Anders Jensen (TDC), Danish TV market, presentation 2013; WIK

4.1.4 Competition problems

4.1.4.1 “Technical” replicability of TV services – Broadcasting transmission

A first competition problem is the low degree of replicability of triple play services. TDC operates two major infrastructures capable of providing broadband and broadcasting transmission - DSL and cable - which are difficult to duplicate due to the economies of scale, scope and density as well as the sunk costs involved.

Only two other operators can rely on end-to-end infrastructures capable of providing broadband and broadcasting transmission, namely Wao!, which relies on the fiber networks of its member firms, and SE, which has both a fiber and (through Stofa) a cable network. The coverage of these service providers, however, is only regional.

Other broadband service providers need to rely on wholesale access offers from TDC both for broadband and TV services. The access regulations in place, however, so far do not seem to ensure replicability of television services on any of the three platforms used by TDC:

- **TV over copper:** The TV component, in principle, can be replicated on a copper/VDSL platform with ULL or multicast bitstream access. However, the ULL-based business model that Telia and Telenor rely on is no longer sustainable given the migration of TDC to NGA and the longer term dismantling of local exchanges. While alternative operators can currently continue to provide broadband services and television from MDFs, there is a clear quality of service

disadvantage of alternative operators compared to TDC's VDSL service.³³ Moreover, the multicast bitstream access model does not seem to be financially viable because of insufficient scale of access-based competitors. Multicast prices involve significant scale advantages. Alternative operators do not have the necessary market share to benefit from similar per line costs as TDC. Alternative operators have therefore refrained from using multicast bitstream to provide TV services. Access-based competitors may ultimately switch to a business model based on (uncontended) VULA. This would allow, in principle, to offer TV provided the uncontended bandwidth is sufficiently high to support the simultaneous broadcast of multiple channels, including with HD quality.

- TV over cable: So far, cable bitstream access has not been an option for replicating triple play services. Alternative operators can purchase cable bitstream only for end-users, which have a TV subscription from YouSee. It should be noted that DBA, in June 2014, consulted on a draft measure that would oblige TDC to offer its YouSee TV channels to alternative operators on a resale basis. Furthermore, TDC should ensure that access seekers get the same terms and prices for content as TDC. However this only applies to the relevant rights for analogue and clear (unencrypted) digital pay-TV channels placed in their basic TV package. For TV channels that are not part of the basic TV package a resale offer is subject to alternative operators striking an agreement with the broadcasters who own the content rights.
- TV over fiber: Access to TDC's fiber network is not a viable alternative for replicating TV services. Regulated access to TDC's fiber network is generally not attractive to rely on, because of the relatively high level of charges. Wholesale fiber access thus does not play a role neither for TV nor for broadband. Moreover, the TDC network lacks coverage and, given TDC's focus on cable and DSL upgrade, also is hardly expanded.

There are also "pure" TV service providers which do not dispose of any broadband infrastructure and which are unable to benefit from regulated network access. Viasat and CanalDigital provide DTH satellite services on the basis of renting satellite transponder capacity. Boxer provides services over the DTT network of Teracom, an affiliated operator. These companies would need to resale TDC's or another operator's broadband and voice services in order to provide triple play. This solution would require a commercially negotiated resale agreement.

³³ Telia is the only operator that provides TV over unbundled local loops.

4.1.4.2 “Technical” replicability of TV services – TV packages

On the content side, it is instructive to distinguish between broadcasters, aggregators and TV service providers:

- Broadcasters produce channels based on own content and content of third parties (notably movies and sports events), for which they need to purchase the relevant rights. Key broadcasters in Denmark include DR (public), TV2 (public), Viasat (owned by Swedish company MTG), sbstv (owned by US media company Discovery), and CMore (owned by Swedish media group Bonnier).
- Wholesale aggregators (also called pay TV platform operators or distributors) aggregate individual channels, which they obtain from broadcasters, into basic and premium packages. Wholesale aggregators in Denmark include TDC/YouSee, SE/Stofa, Waoo!, Telia, Viasat, CanalDigital and Boxer. Viasat is the only wholesale aggregator that is also vertically integrated into broadcasting, i.e. Viasat also includes own channels into its wholesale packages.
- TV service providers offer basic and premium packages to end users. TV service provision and wholesale aggregation is vertically integrated in Denmark, i.e. TDC/YouSee, SE/Stofa, Waoo!, Telia, Viasat, CanalDigital and Boxer both aggregate the channels into packages and provide the packages to end-users. The TV service provider Viasat is also vertically integrated into the production of broadcasting channels.

Table 10 shows the major Danish broadcasters, their major channels and viewing time share.

Table 10: Viewing time share of major channels, Q1-Q3/2012

Broadcaster	Channels	Viewing time share
TV2	TV2, TV2 Charlie, TV2 News, TV2 Zulu	35%
DR	DR1, DR2	28%
Viasat	TV3, TV3+	11%
sbstv	5'eren, 4'eren	10%
Other	...	16%
Total		100% ⁽¹⁾

Notes:

⁽¹⁾ Sum does not exactly round to 100% because of rounding errors.

Source: Anders Jensen (TDC), Danish TV market, presentation 2013; WIK

Broadcasters generate revenues by selling television channels to aggregators (pay TV platform operators). Each broadcaster has an incentive to license its channels to *all* pay TV platform operators *as long as* this maximises revenues. A competition problem may occur if a broadcaster with exclusive content (e.g. a sports channel with major football rights) licenses its channel only to a selected pay platform operator if the latter is able to exploit this exclusivity by strengthening its position in the retail TV market, *and* provided there is a mechanism for the broadcaster to participate in the extra profits associated with retail exclusivity. This mechanism certainly may exist, where a broadcaster is

vertically integrated into the retail provision of TV services or where a broadcaster can strike an agreement with an unaffiliated TV service provider with a similar effect.

The Danish Competition Authority monitors the situation in relation to football rights and has imposed certain commitments in relation to the sale of media rights to the Danish football league to broadcasters.

There is evidence that the TV packages provided by TDC/YouSee may not be fully replicable by all competitors. Viasat has imposed certain restrictions on operators such as Waoo! and SE/Stofa with regard to the distribution of its channels on an IPTV platform (The restrictions do not apply to Stofa regarding its cable customers.) In contrast to TDC/YouSee, TV platform operators such as Waoo! and SE/Stofa are, at least with regard to their IPTV customers, not able to unbundle the Viasat TV packages and integrate them into their own packages. If Waoo! and SE/Stofa would like to offer Viasat channels to their IPTV customers, they would have to resort to reselling Viasat's TV packages. This situation has resulted from the negotiations between the parties. To what extent the problems in the replicability of TV services provided by TDC/YouSee represent a concern under competition law was outside the scope of our study.

4.1.4.3 Economic replicability of TV services.

Another competition problem may be the lack of economic replicability of TDC's bundles of broadband and TV services. This would be the case if TDC's average revenue from a bundle that includes TV does not cover the sum of

- TDC's wholesale charges for access to its copper or cable platform,
- TDC's license cost of broadcasting channels,
- TDC's or a reasonable efficient operator's downstream cost i.e. (retailing and downstream network cost).

An important issue is TDC's license cost of broadcasting channels. TDC can exert bargaining power, when negotiating wholesale prices for broadcasting channels. TDC has approx. 1.384 million TV customers (mostly YouSee)³⁴ and is able to negotiate lower prices for its channels than other TV service providers. The price advantage of TDC over its competitors often cited by industry sources is between 20% and 30%.

Since TDC has lower licensing costs of TV channels as well as lower costs for the downstream activities (network costs and retailing) than any alternative operator, it may squeeze their margins. While DBA carries out margin squeeze tests, these are currently limited to stand-alone broadband and double play products of broadband and voice, but do not include bundles with TV. The economic replicability of bundles with TV is therefore not being monitored and may well be jeopardized.

³⁴ TDC Factsheet.

4.1.4.4 OTT as a substitute to linear TV?

In Denmark, like in other Nordic countries, there is already a strong uptake of OTT services, notably audio and video streaming services:

- Netflix and HBO entered the market in 2012 and had considerable growth rates since then.³⁵ Netflix already provides services to about one third of the population.
- TDC and broadcasters like DR, TV2, Viasat and sbstv provide streaming services such as on-demand access to shows and movies.

An emerging question is whether customers already regard over-the-top (“OTT”) services as a substitute for linear TV services, such that an operator could substitute one for the other. Some indications are already there:

- Average viewing time for linear television is stagnating,³⁶ while consumption of OTT services is increasing.
- The share of subscriptions to bundles of broadband and TV is no longer rising and stagnated from 2012 to 2013 at 46.6%.³⁷
- TDC data shows that the share of subscriptions with not more than “entry level” TV has risen from 23.6% in 2012 to 26.3% in 2013.³⁸
- Telenor and Telia seem to focus on OTT. E.g., Telenor has a partnership with Netflix and WiMP Music. Telia has a partnership with HBO Nordic and Spotify.³⁹

Overall however, for the time being, the majority of customers still seems to use OTT as a complement to, rather than a substitute for, linear TV, and would not regard OTT as a substitute for TV services. This is also reflected in the fact that TV service providers - TDC, SE and Waoo! - have entered into partnerships with OTT providers. E.g. Waoo! partners with Netflix, TV 2 and Viasat to carry their streaming services.⁴⁰ It therefore seems premature to conclude that bundling of broadband with television no longer can give rise to competition problems.

4.2 Impact of TDC’s ownership of cable assets

TDC, besides its copper and fiber platform (with 98% respectively 2% of homes covered), is also integrated into cable (50% of homes). TDC is in fact the only incumbent telecoms operator in the EU which still owns the historical, now upgraded

³⁵ <http://zone.tmcnet.com/topics/articles/350754-netflix-grows-dramatically-nordic-countries.htm>

³⁶ Anders Jensen (TDC,) Danish TV market, presentation 2013.

³⁷ Erhvervsstyrelsen, Telestatistik, Andet halvår 2013.

³⁸ TDC factsheet.

³⁹ <http://www.broadbandtvnews.com/2013/02/08/hbo-goes-live-in-denmark/>

⁴⁰ <http://advanced-television.com/2013/11/01/netflix-adds-3rd-cable-partner/>

cable network. The common ownership of copper/fiber and cable infrastructure entails negative consequences for investment and competition:

- It eliminates infrastructure competition between copper/fiber and cable; and
- It may, under certain conditions, reduce access-based competition

that would otherwise exist if platforms were owned and managed by separate companies. The negative impact on competition results from TDC's incentives to prioritize cable over copper upgrade and fiber roll-out. This is explained in more detail in the following.

Infrastructure-based competition

The ownership of cable network infrastructure reduces TDC's incentives to invest into upgrading its copper network with FTTC/VDSL2 and vectoring in areas where there is cable infrastructure. It should, however, be noted that investment decisions may not always be a clear-cut exercise since the distribution of copper and coax is mixed, i.e. one street may have coax and the parallel street may be provisioned by DSL. We would therefore expect that there may well be overlapping areas of network upgrades. Nevertheless, TDC's plans for upgrading its copper network with vectoring technology suggest that incentives exist to start this primarily in areas with no cable coverage. TDC's vectoring deployment plans give a lower priority to areas, where more than 75% of the addresses have access to coax with speeds of 100Mbps.

In case of separate ownership of cable infrastructure, incumbents clearly have an incentive to upgrade their copper networks across the territory and in particular in areas where there is cable coverage. Common ownership of copper and cable assets leads to the opposite situation, with a lower priority for vectoring and a lower degree of infrastructure competition in cable areas.

Ownership of an extensive cable network may also reduce TDC's incentives to invest into fiber in areas with cable coverage. TDC has hardly invested in FTTH, except when buying the fiber networks of DONG Energy (2009) and ComX (2013). Moreover, competitors have claimed that TDC mainly uses the DONG fiber network as a feeder net to support higher bandwidth and expand footprint on copper (FTTC) and cable networks (node splitting), but less so for FTTH. This all suggests that TDC's ownership of cable has reduced the extent of infrastructure competition compared to a situation with separate ownership of the cable platform.

Access-based competition

TDC's incentives to prioritize copper upgrade with vectoring in areas with no cable coverage may also be problematic for access-based competition. Alternative operators which rely on access to TDC's copper network (ULL, VULA or bitstream) may face delays in the upgrade of the speeds necessary to compete with cable. This is a regulatory challenge that DBA has tried to address in two ways.

First, DBA obliged TDC to offer access to its cable network. The cable access obligation that has been imposed, however, is unlikely to render cable access a good wholesale substitute for copper access for a number of reasons:

- Physical unbundling is technically not feasible for cable networks given that bandwidth is shared between individual subscribers.
- Alternative operators can use the cable bitstream product only for end users that have a TV subscription. Alternative operators thus cannot offer dual play or triple play bundles with television. This may, however, change in the future, as DBA has proposed to impose a resale TV obligation on TV, which was consulted in June 2014. Finally, alternative operators have claimed that the wholesale charge of cable bitstream is too high. The regulated price is, however, expected to drop significantly as of January 1, 2015.
- Mixing or changing wholesale platforms creates complexity both at end-user and wholesale level. Alternative operators therefore tend to focus on a single platform, namely DSL.

Second, DBA recently obliged TDC to meet reasonable requests from the alternative operators regarding vectoring. Thus, in principle, TDC is obliged to deploy vectoring and provide VULA even if it would not decide to deploy vectoring itself. The purpose of this requirement is to act against any incentives of TDC to limit the use of vectoring to street cabinets outside the footprint of its cable coax network in order to foreclose competition on NGA. It remains to be seen to what extent the vectoring obligation can be effectively implemented to become a driver for vectoring upgrade in cable areas.

Note that the stated negative impact of TDC's common ownership of copper and cable platforms on access-based competition is a valid argument only if the alternative scenario - separate ownership - would not go along with a sufficient increase of infrastructure-based competition that justifies the deregulation of wholesale access markets. If the creation of an independent cable operator led to a significant enough increase in infrastructure-based competition, access-based competition would become less important for the overall effectiveness of competition and market performance. This would justify deregulation of wholesale access markets and a likely (and unproblematic) decrease in access-based competition.

5 Fiber networks owned by utility companies and competition in the broadband market

Section 5 looks at the impact utilities have on competition in the Danish broadband market. It addresses the importance of utilities for competition in the current market environment, where utilities compete for consumers and businesses with end-to-end broadband services. The section also looks at incentives for commercial access to fiber networks. By “commercial access” is meant the provision of access on freely negotiated terms, conditions and prices.

5.1 Impact of utility companies with closed fiber networks on competition

Utility companies have become an important competitive force in the Danish broadband market, with a focus on providing broadband as well as double play and triple play bundles to residential users.

The fiber networks cover large parts of Denmark. In mid-2013, 43% of Danish households were passed by a fiber network. Note that this figure also includes the DONG network acquired by TDC in 2009.⁴¹ Figure 13 shows the geographical distribution of the utilities in 2010, when SE still marketed its services under the Wao! brand. The fiber networks under the Wao! brand are concentrated in Jutland, Funen, North and South Zealand, Lolland and Falster.

⁴¹ “Passed by” has a different meaning than in many other EU countries. Fiber operators in Denmark extend the fiber connection to the end user, ie install the drop cable, only at the time of signing a contract with end users for the provision of broadband services over fiber.

Figure 13: Utility companies investing in fiber networks, 2010



Source: Danish Energy Association in FTTH Council (2011), Case Study Collection, p. 10.

The fact that SE and the utilities under the Wao! brand are the only players in the residential broadband market that compete against TDC in infrastructure makes them particularly important for market outcomes. The competitive impact of independent fiber networks has been somewhat weakened by TDC's acquisitions of DONG Energy and ComX, which have infrastructure in Copenhagen and North Zealand.⁴²

Utilities have significant longer term growth potential stemming from the fact that they can offer very high, symmetric speeds. However, they have also some disadvantages that slow down their progress:

- Compared to TDC, they are of much more limited scale. This results in higher (per subscriber) network and retailing costs.

⁴² TDC can acquire companies with a turnover of less than 100 million DKK without going through a merger approval procedure. See Article 12.1 (i) *Competition Act* (<http://en.kfst.dk/Competition/~media/KFST/English%20kfstdk/Competition/Legislation/Engelsk%20udgave%20af%20lovbekendtgørelse%207002013.pdf>)

- The utilities also have higher (per subscriber) license costs for broadcasting channels.⁴³

5.2 Advantages and drawbacks of commercial access to fiber networks

Would commercial access to fiber networks increase the utilities' impact on competition? By "commercial access" is meant the provision of access on freely negotiated terms, conditions and prices. Under commercial access, terms and prices could differ between access seekers and they would usually not be made transparent. Fiber utilities could also make agreements with preferred partners and refuse access to others. Commercial should therefore not be confounded with "open access".⁴⁴

Demand for access could take several forms:

- Service providers without own network infrastructure could express a demand for reselling the utilities' broadband services, stand alone or bundled with the utilities' television and voice services.
- Other network operators could ask for bitstream access, possibly with multicasting functionality to allow the provision of television. Given the economies of scale involved in multicasting, it is however doubtful whether there is a demand for multicasting from smaller operators.
- Other network operators could demand access to unbundled fiber (where point to point architecture is used) or to the fiber terminating segment (in-building cabling from a distribution point). TDC could have a demand for such forms of access in areas, where they do not have fiber. The two access-based competitors, Telenor and Telia, could regard unbundled access as an option as their ULL-based business model is jeopardised following the migration of TDC to FTTC and the longer term dismantling of local exchanges.

The utilities' incentives to provide commercial access

Whether the utilities have an incentive to supply wholesale access on a commercial basis will depend on whether it is profit enhancing. The impact of commercial access on the utilities' profits is the net result of the following effects:

⁴³ See section 4.2.2.

⁴⁴ By open access is meant the provision of access on fair and reasonable terms, for which there is some degree of transparency and non-discrimination. Open access is usually the result of regulatory obligations of varying nature, e.g. obligations under the SMP framework, obligations under state aid rules or, more rarely, commitments under merger regulations. As an OECD study has pointed out, voluntary "open access" agreements remain relatively rare. The available evidence indicates that the incentive for commercial network providers to grant access to its infrastructure on *open* terms remains fairly low. See OECD (2013), "Broadband Networks and Open Access", OECD Digital Economy Papers, No. 218, (OECD Publishing <http://dx.doi.org/10.1787/5k49ggz7cmmr-en>).

- **Expansion benefits:** Access agreements may expand the addressable market by promoting broadband to new consumer segments. This could be done by “no frills” offers, fashionable brands, or particular value added offers. In fact, a market expansion effect is not unlikely as the potential demand for very high and symmetrical speeds is largely untapped. Only 1.5% of households in Denmark have so far subscribed to a connection with speeds of 100Mbps or more. Access agreements could also assist in the expansion of fiber footprints by ensuring the quicker realization of a sufficient penetration. The expansion effect would increase the utilities’ profits.
- **Cannibalization costs:** Access agreements may create competition for the utilities’ own subscribers and cannibalize their subscriber base. Utilities currently have a fiber specific competitive advantage in terms of very high, symmetric speeds. If utilities entered into access arrangements, they may get outcompeted by wholesale customers which would then be able to offer the same product to end-users. The cannibalization effect decreases the utilities’ profits. The cannibalization effect could be particularly relevant in case of access arrangements with TDC.
- **Implementation costs:** Opening up fiber networks requires implementation of a wholesale interface and, except for resale, access points. While this is a straightforward exercise in the case of a single company such as SE, it could be a more complex issue in case of the other utilities which cooperate under the Wao! brand. In case of Wao!, the utilities - for commercial reasons - may want to harmonize access conditions and define common wholesale products as well as establish a joint wholesale arm for marketing the wholesale services. In other words, the utilities may see the need to create a “Wao! wholesale” in addition to the existing “Wao! retail”. The implementation costs of a wholesale platform are unlikely to be a decisive factor in the case of SE. It will however play a role for the many utilities under the Wao! brand if these would want to harmonise their wholesale offers.

From an analytical point of view, utilities have an incentive to negotiate commercial access arrangements, where these are profit enhancing, in other words, where the added profits from the expansion effect outweigh the implementation costs and the profit loss from the cannibalization effect. We believe that there is a case for such access arrangements, as they may help to tap into potential demand for very high and symmetric speeds with lower prices and/or better targeted offers. Since the expansion effect is heavily dependent on demand and willingness to pay for very high speed symmetric broadband, utilities may however feel that the time is not yet ripe to enter into access arrangements. It is also debatable which companies would represent attractive access partners for the fiber utilities. In the case of TDC, there may be an important cannibalization effect. In addition, there could be competition concerns about an access partnership with TDC.

Impact of access arrangements on competition

Access arrangements between fiber utilities and service providers with no infrastructure (pure resellers) or operators that do not have local access infrastructure (e.g. traditional

access-based competitors such as Telenor and Telia) would promote competition. In contrast, if fiber utilities entered into access arrangements with TDC, the impact of competition needs to be carefully assessed. Such agreements could potentially undermine the existing infrastructure competition between TDC (predominantly DSL/cable) and the utilities (fiber). TDC is likely to enjoy a market dominating position in the retail broadband market, which would possibly be further strengthened if TDC can benefit from access to the utilities' fiber networks.

6 Options beyond SMP regulation to improve competition in the broadband market

The preceding sections have shown that, despite the comprehensive set of SMP remedies imposed on TDC, the structure of the Danish broadband market remains problematic. It is likely that, over the longer term, the market structure characterized by TDC's control of copper and cable and its dominant position in the retail market could have a negative impact on market performance.

We have identified and assessed a number of options other than the SMP remedies already imposed by DBA for improving competition. The discussion of these options has been informed by positive experiences in other countries. The options considered in section 6 include the following:

- Municipalities could facilitate the roll-out of passive infrastructure, notably ducts, and provide access to ducts of public utilities under their ownership (option 1);
- DBA (or another competent authority, as appropriate in Denmark) could impose symmetrical regulation of fiber terminating segments involving access to co-investment in, and rental of, such segments (option 2);
- Utility companies that have invested in and operate fiber networks could offer access on commercial terms (option 3);
- TDC could functionally separate its local access network and provide wholesale services on an "Equivalence of Input" basis (option 4); and
- TDC could divest its cable assets (option 5).

In the following, we describe the option and why we have selected it, we assess its pros and cons, describe the experience from other countries and discuss the relevance of the option in the Danish context.

6.1 Municipalities to play a greater role in supporting digital infrastructure deployment (option 1)

6.1.1 Description of option

Danish municipalities could potentially play an important role in supporting the deployment of digital infrastructure. They are responsible for setting the conditions associated with planning approval for new buildings and renovations and for approving 'rights of way' for physical infrastructure. Where they own local utilities - primarily relating to water and sewage⁴⁵ - they also control the associated duct infrastructure.

⁴⁵ Our understanding is that the majority of electricity utilities have been fully privatized.

This responsibility means that they could in principle support fast broadband deployment by easing planning for deployment, installing or requiring the installation of ducts or fiber in new build properties and by offering access to their own facilities on attractive terms.

We have identified this option because of positive experience in a number of EU countries, notably Portugal in relation to ensuring NGN-ready in-house wiring, mapping, mandated access to passive infrastructure and co-ordination of civil engineering works. Sweden and Finland have developed good practices in civil engineering co-ordination, Germany in mapping and France and Spain in fiber in-house wiring.

Moreover, an EU Directive has recently been adopted⁴⁶ which will require all member states by 1 January 2016 to adopt policies to reduce the administrative burden and cost of infrastructure deployment (*Directive on Measures to Reduce the Cost of Deploying High-speed Electronic Communications*, hereafter also termed the “EU Infrastructure Directive”). Alongside an obligation for all network operators (including not only telecoms operators but also operators of energy networks and those distributing water) to meet reasonable requests for duct access, the Directive requires member states to:

1. Ensure that all new buildings or renovations after 31 December 2016 must be equipped with a high-speed-ready in-building physical infrastructure;
2. Ensure that those responsible for the transport of utilities such as water must offer access to their physical infrastructure on fair and reasonable terms and at a reasonable price;
3. Ensure that operators which undertake civil works fully or partially financed by public means should meet reasonable requests for co-ordination of these works;
4. Ensure that information is available about civil works permits from a single point with the potential for applications to be made from a single point.
5. Ensure that communications providers have the right to access any existing in-building physical infrastructure on fair terms and conditions, including price.

Good practice in supporting infrastructure deployment has been observed in some areas of Denmark. For example, the Nexia Nordic Broadband City Index⁴⁷, notes that most Danish municipalities have a digging information system and require network operators to coordinate their digging and deny digging in the same area/duct for a time period of 3 to 5 years. However, we understand that there may still be scope for further improvement, drawing lessons from neighboring countries and elsewhere in Europe.

⁴⁶ *Directive on measures to reduce the cost of deploying high-speed electronic communication networks*. Provisional text at <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0061>.

⁴⁷ Nexia, Nordic Broadband City Index: How cities facilitate a digital future, June 2012, p. 28 (http://www.google.de/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CDMQFjAA&url=http%3A%2F%2Fa5.mndcdn.com%2Fimage%2Fupload%2Ft_attachment%2Fwen06fka12adrp4up3en.pdf&ei=kxPJU_OvM4LBOeLgKAH&usg=AFQjCNGzMYRQOmV5KjvL3hleeEORFDGACA&bvm=bv.71198958.d.ZWU&cad=rja)

This policy option considers a scenario whereby the EU Directive is transposed into national law⁴⁸ in a way which gives municipalities a core responsibility to support fiber deployment in the planning process, co-digging and in access to existing ducts. Municipalities could also act in advance of such legal requirements by incorporating these measures into their current practices. In this context, we consider five approaches:

1. The requirement to make new dwellings 'high-speed-ready'

If not already ensured (which we understand is largely the case in Denmark), municipalities could of their own volition, or following adoption of EU legislation, require that all new buildings, including multi-dwelling units be made high-speed-ready through the pre-installation of fiber infrastructure and/or ducting to facilitate such infrastructure.

2. Comprehensive information exchange and mapping on infrastructure availability

The former *Danish Enterprise and Construction Agency*⁴⁹ implemented a national internet portal, "The Danish Register of Underground Cable Owners"⁵⁰ to record details of existing physical underground infrastructure. Local governments as well as companies wishing to lay down cables use this portal, which is now administered by the Ministry of Housing, Urban and Rural Affairs.⁵¹ However, we understand that the register provides only limited information and would not be sufficient to allow interested operators to verify the availability of ducts for specific network roll-out plans. The implementation of a comprehensive mapping scheme, such as has been introduced eg for the ducts of Portugal Telecom, could help to operationalize this option, if there is sufficient demand to cover the costs of such a solution.⁵²

3. Municipal duct and fiber deployment

Until recently, Danish municipalities did not play a role in the roll-out of passive infrastructure for use by third parties. However, in January 2014, the DBA adopted guidance on the interpretation of the Business Growth Act⁵³, which signaled that municipalities can support the roll-out of telecommunications infrastructure including through constructing or tendering for the construction of passive infrastructure such as ducts and masts, for the use of any interested operator. It is not yet clear how widely this option has been used. A more pro-active approach could be followed, if there is demand for such a solution. There could also be consideration as to whether, as

⁴⁸ Deadline for transposition is 1 January 2016

⁴⁹ The Danish Enterprise and Construction Agency was merged with two other agencies into the Danish Business Authority (DBA).

⁵⁰ www.ler.dk.

⁵¹ ECTA Regulatory Scorecard 2009, Annex V Denmark, p. 9.

⁵² See section 6.1.3.2.

⁵³ *DBA Guidance on the interpretation of the Business Growth Act January 2014* (<http://erhvervsstyrelsen.dk/file/448701/vejledning.pdf>)

practiced in Sweden, municipalities could themselves install dark fiber on an open access basis.

4. Rental of ducts and fiber owned by municipalities or subsidiary utilities

In addition to the construction of new ducts, municipalities could facilitate access to ducts of their subsidiary water and sewage utilities, as will be required following implementation of the EU Infrastructure Directive. The Nexia Index found that in 2012 in contrast with Sweden, there was no rental of ducts or fiber by Danish utilities.⁵⁴ It is unclear whether this is due to lack of suitable offers or lack of demand.

5. Digging requirements

Another issue affecting deployment costs concerns requirements around rights of way, such as permission to use microtrenching, the required depth for digging and re-surfacing obligations. The Nexia Index noted varying practices across the countries they surveyed, with implications for deployment costs. A review of guidelines on such measures, to see if any restrictions are objectively justified, could be relevant.

6.1.2 Pros and cons

Whether the options to boost the role of municipalities bring net benefits depends largely on the costs of implementing the options in relation to the likely uptake of these solutions and consequent increased roll-out of infrastructure. These may vary depending on the solution.

Two of the options seem in general to offer advantages with relatively little cost:

- There seem to be few disadvantages with taking measures to make new buildings fiber-ready. Indeed, we understand this may already be standard practice and will soon in any event become a legal requirement across the EU.
- The administrative cost of reviewing guidelines concerning digging requirements would seem to be low, and could give operators additional options when deciding whether and where to install infrastructure.

The other three options which concern the provision of detailed information, the promotion of the role of municipalities in deploying and renting ducts, and potentially fiber, entail greater costs and/or potential disadvantages.

- Experience in Portugal suggests that live mapping could be helpful in facilitating shared duct usage. However, the costs of establishing and maintaining a

⁵⁴ Nexia, Nordic Broadband City Index: How cities facilitate a digital future, June 2012, p. 28.

system, applying to all players in the market could be significant and therefore could only be justified in the presence of clear demand.

- The construction of ducts by municipalities and rental of such (alongside rental of access to ducts of municipally owned utilities) could lower costs for those planning to deploy infrastructure, but taking pro-active measures in this regard is likely to be justifiable only in the presence of demand and if it is the most efficient means to ensure such access (as compared for example with SMP regulation of TDC ducts).
- The construction of dark fiber by municipalities (on commercial terms and/or with public subsidies) could in theory provide an alternative option to TDC especially in areas not currently served by competing fiber utilities. However, it carries the risk of potentially crowding out private sector investment in cases where this might materialise.

6.1.3 Selected countries experience

The most comprehensive source of data concerning the current application of measures which could be taken by municipalities to boost broadband deployment is included in the March 2013 impact assessment to the European Commission's proposals for what became the *Directive on Measures to Reduce the Cost of Deploying High-speed Electronic Communications* ⁵⁵.

Table 1 of Annex III of the *Impact assessment* summarizes best practice in a number of areas. Portugal was considered to have best practice in a number of areas including ensuring NGN-ready in-house wiring, mapping, mandated access to passive infrastructure and co-ordination of civil engineering works. The existing status in most other countries was mixed, although Sweden and Finland were considered to have good practice in civil engineering co-ordination, Germany in mapping and France and Spain in fiber in-house wiring. We take selected cases to illustrate best practice for each of the options.

6.1.3.1 Equipping new buildings with fiber – the case of Spain

In Spain, legislation adopted in 2011⁵⁶ provides that constructors of new (and refurbished) buildings must install passive NGA infrastructure such as fiber or coaxial cables that connect each apartment to the in-building distribution frame, often housed in the basement of multi-dwelling units. The regulations apply to all buildings that have

⁵⁵ European Commission, *Impact assessment accompanying the proposal for a Regulation to reduce the cost of deploying high-speed electronic communications networks* (<http://ec.europa.eu/digital-agenda/en/news/impact-assessment-accompanying-document-proposal-regulation-european-parliament-and-council>)

⁵⁶ Royal Decree 346/2011 (March 2011) Order ITC 1644/2011 (June 2011).

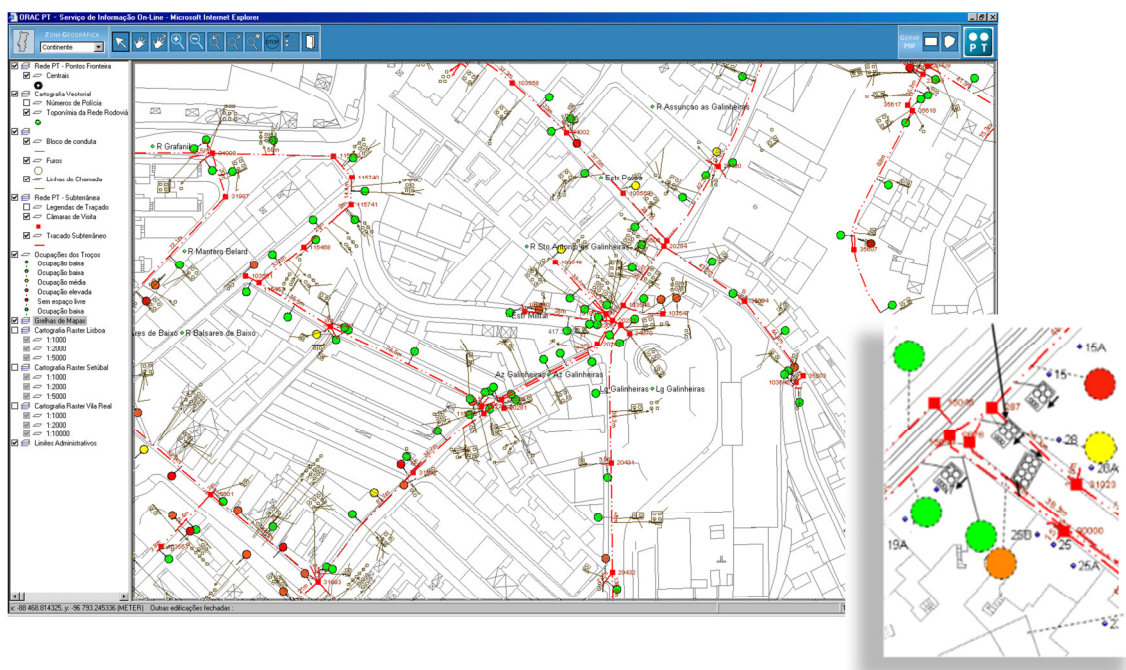
„horizontal properties“ – that is, where there are multiple owners – and so includes office blocks and businesses as well as multi-dwelling units. Before new construction projects are approved, a consultation must take place between the construction firm and the broadband operators in the local area, and this is supervised by the Ministry of Industry, Trade and Tourism. The consultation must assess which NGA deployments are in the local region, and thus determine what type of infrastructure will be suitable for deployment within that building. If there is infrastructure competition in the area (e.g. both cable and FTTH), then more than one type of technology must be deployed in the building. Deploying multiple infrastructures is more expensive than just one, but the Ministry believes this is necessary from a competition perspective. However, a key aim of the consultation is to avoid inappropriate in-building deployments that will never be used, and thus would be inefficient. Service competition is also supported by the requirement for fiber operators to share the in-building fiber network. With the exception of Digital Terrestrial Television (DTT), where amplifiers are installed, normally only passive infrastructure is installed. However, regulations also extend into individual dwellings, with a minimum number of sockets per apartment specified for new construction projects.

There are also construction standards published by *Telecommunication Engineering College* under which buildings constructed after 1995 should be made ready for copper and cable. Any operator which reaches the building has the opportunity to provide services to any of its households. For buildings constructed after April 2011 this regulation has been updated to include fiber cables.

6.1.3.2 Infrastructure mapping – the case of Portugal

In 2009, ANACOM, the Portuguese regulator, mandated the use of a *Centralised Information System* (“CIS”), a central infrastructure atlas aimed at reducing the cost of deploying new electronic communications equipment. Providing and regularly updating information is mandatory for all organizations that own or operate infrastructure suitable for accommodating electronic communication infrastructure (including roads, railways, water and gas infrastructure). This requirement applies to local authorities, state-owned companies, utility companies, electronic communications companies and any other bodies that may own relevant infrastructure. Further obligations are applied to the incumbent, Portugal Telecom (PT), which must also provide information on available space within its ducts. Figure 14 shows an illustration of PT’s live mapping information.

Figure 14: Portugal Telecom live mapping of duct availability



Source: ANACOM Presentation, March 2014

6.1.3.3 Co-ordinated digging and duct access – the case of Portugal

Portugal's Central Information System is intended to support the provision of information on planned public works to facilitate shared digging.

The law stipulates that the performance of works which enable the construction or expansion of infrastructure suitable for the accommodation of electronic communication networks be made public so that electronic communication companies can become associated with the planned work. This is an obligation applicable generally to public sector companies and electronic communication companies. The notice must contain information on the characteristics of the intervention to be performed, the period envisaged for its completion, charges and other conditions to be observed, as well as the deadline for joining the work and point of contact for obtaining clarifications, as well as any provisions affecting future interventions in the area covered by the notification.

In accordance with *Decree-Law no. 123/2009*, notice of the performance of works must be given on the CIS, 20 days before the start of execution, and the deadline for joining the work is 15 days following the date of the notice.

At the time when data was collected for the European Commission's Impact Assessment, the CIS had not yet become operational. However, it was noted that tender specifications had been drawn up for the design and management of the CIS,

with support from a Multidisciplinary Working Group involving experts in inspections (inspection of telecommunications infrastructure in buildings), information systems, infrastructure regulation and legal. In the public tender to award the CIS⁵⁷, a value of four million Euro was considered as a base price for the cost of developing and establishing the system. To understand potential ongoing costs, it is also relevant to consider the charges levied for use of the operational PT duct mapping system. Operators accessing the system are charged an annual price of €1,390 to view information for each district, up to a maximum of €92,578 for all 20 districts⁵⁸. This price is however based on relatively significant usage of the system.

Alongside rules for co-deployment, the laws state that all existing ducts that are suitable for the provision of electronic communications networks must be made available to operators. This includes:

- infrastructure owned by the state, local authorities and Autonomous Regions;
- infrastructure owned by entities under the supervision of the state, local authorities and Autonomous Regions;
- public infrastructure and utility companies such as water, gas, transport and sewerage companies, as well as roads, railways and ports.

ANACOM is empowered to determine the terms under which passive infrastructure can be shared, and has established regulations in this regard.

Access to these ducts is defined as the owner making available physical infrastructures such as buildings, ducts, masts, inspection chambers, manholes and cabinets for the purpose of the accommodation, setting up and removal, and maintenance of electronic communications transmission systems, equipment and resources. The cost of access varies depending on who owns the infrastructure. For example, ANACOM sets the prices for access to local authority-owned infrastructure, whilst electronic communication companies must charge each other cost-oriented prices.

These access rules relate to existing infrastructure. No specifications are imposed on operators deploying new ducts. Instead, the deploying operator is obliged to consult with other operators to determine if any other operator is interested in deploying along that route. If they are, the deploying operator must install ducts that are suitable for sharing; if they are not, then the duct operator is free to choose which type of duct is deployed.

⁵⁷ Portugal's Official Gazette (Diário da República) of 23 November 2010.

⁵⁸ ANACOM Presentation March 2014

6.1.3.4 Municipalities constructing ducts

The Commission's Impact Assessment did not consider the scenario of municipalities constructing their own ducts. Nexia's 2012 Nordic Broadband City Index, however, reports that while at the time no Danish municipalities reported digging their own ducts, some of the Norwegian municipalities did, and many of the Swedish municipalities did.

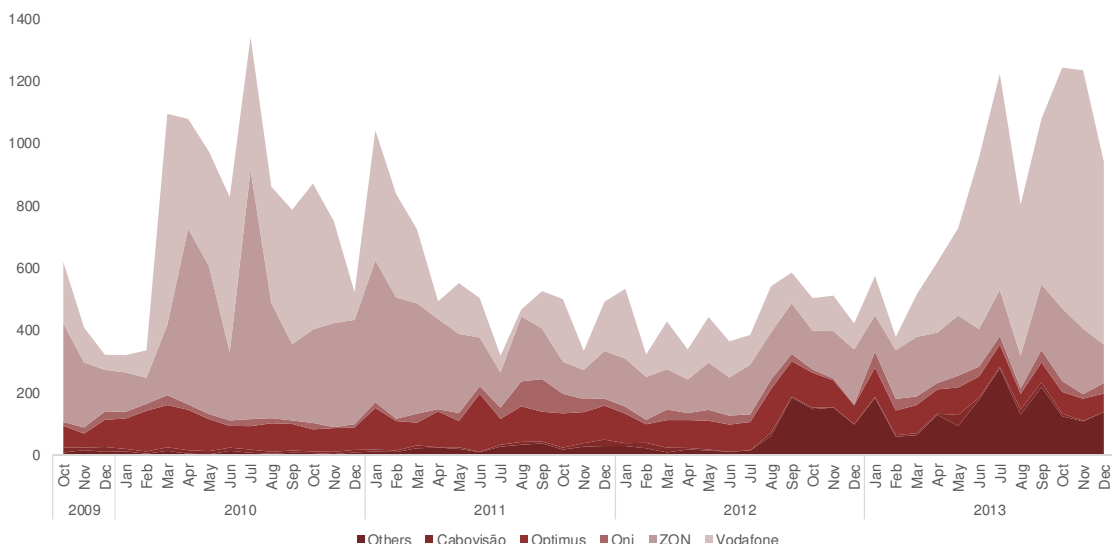
6.1.3.5 Effects of municipalities interventions

Very little concrete data is available linking the interventions of municipalities, for example on requiring buildings to be 'fiber-ready', deploying or sharing ducts, and the outcomes for NGA deployment and infrastructure competition.

In Portugal, duct access is considered by ANACOM to have been a major contributor to the deployment of NGA by the cable company ZON (which has always historically deployed cables within PT ducts and continued to do so post demerger from PT) and other operators such as Optimus (since merged with ZON) and Vodafone.

However, recent data from ANACOM suggests that demand has been most extensive for access to Portugal Telecom's ducts (see Figure 15). ANACOM considers that these are most likely to be related to SMP duct access obligations of PT, which set detailed rules on pricing and provisioning, rather than from symmetric obligations which applied to PT alongside utilities and municipalities. Likewise, it seems that live mapping of PT's duct availability may have played a greater role in supporting deployment than wider infrastructure mapping.

Figure 15: Installation requests answered for PT ducts



Source: ANACOM presentation March 2014

The experience of Portugal at least suggests that some caution is warranted in ascribing benefits to the sharing of utility ducts over and beyond those that could be

gained from SMP regulation of the incumbent duct infrastructure, where this can be made effective (i.e. where infrastructure is ducted and there is sufficient availability). At the very least, there appears to be limited experience of the effective usage of symmetric duct obligations, although this could change, following the implementation of the EU Directive on Measures to Reduce the Cost of Deploying High-speed Electronic Communications.

The effect of making buildings fiber-ready and ensuring access to in-building wiring can also not readily be quantified, although it seems fair to conclude that, provisions in Portugal and Spain are likely to have been supportive towards fiber deployment.

6.1.4 Relevance of option in Danish context

Actions that could be taken by municipalities to support NGA roll-out are most likely to be beneficial to operators planning to deploy their own fiber infrastructure. In Denmark this includes the fiber utilities and providers of business fiber access (e.g. GlobalConnect). Measures to lower the cost of infrastructure deployment could also be beneficial for mobile operators intending to install their own fiber backhaul for LTE, and could be relevant for TDC in case TDC decided to expand its fiber network.

An advantage of this option is that it could support an expansion in infrastructure-based competition, which is currently limited to certain areas of Denmark. We also note that, if as understood, TDC's copper and coax access networks are not fully ducted, it may be especially relevant to pursue non-SMP measures to support infrastructure deployment, since SMP-based duct access obligations, which have played a significant role in supporting infrastructure-based competition in countries such as Portugal, Spain and France, are unlikely to be relevant (at least to the same degree) in Denmark.

There are however several important caveats, which may place limits on the benefits that can be achieved in practice with the support of municipalities:

- The scope of further viable FTTP deployment may be limited given the already extensive existing coverage of more than 40% of households. However, these measures could remain useful in municipalities in which fiber has not yet been deployed or by facilitating drop cable installation to support further take-up in the existing fiber footprint
- We understand from market participants that there is already good practice in Denmark from municipalities on certain of these measures. For example, there is already a strong history of co-digging, and new buildings are typically fiber-ready.
- Even if municipalities adopted administrative measures such as those we describe to facilitate commercial fiber deployment, laying parallel infrastructure remains costly, and is therefore likely to be geographically limited. In this context it is unlikely by itself to provide a magic bullet towards promoting competition for high speed broadband across the whole territory of Denmark.

- For measures such as live mapping or duct construction which incur implementation costs or raise administrative costs, the relative costs also need to be weighed up against demand from Danish operators. There may be demand from operators focused on the business segment, but it is not clear that there is significant demand in Denmark for the use of ducts for mass-market residential fiber deployment.

We understand that municipalities have already been given guidance concerning the important role they can play in supporting digital infrastructure. The EU Directive on Measures to Reduce the Cost of Deploying High-speed Electronic Communications will require all network operators to meet reasonable requests for duct access, the sharing of in-building wiring and introduce obligations for buildings and renovations to be made high-speed-ready (if this is not already the case). Guidance on these issues may be useful. In addition, the following policy options may have some relevance in a Danish context:

- Providing best practice guidelines to minimise the cost of digging. This could include consideration of the required depth of trenches, permissibility of micro-trenching, as well as co-digging procedures.
- The development of a comprehensive mapping tool to support the co-ordination of digging as well as duct access – if there is sufficient demand to cover the costs of such a tool.

6.2 Fiber terminating segment network sharing and access (option 2)

6.2.1 Description of option

Access obligations applied under the SMP regime are by implication *asymmetric* – i.e. they apply only to the SMP operator, typically the incumbent SMP obligations also usually involve *short term rental* of assets and/or services such as the rental of unbundled loops or wholesale broadband access.

In contrast, a provision introduced in the revisions to the EU telecommunications framework of 2009 allows for a national authority to impose *symmetric* obligations (ie obligations on all operators, not just those designated with SMP) for the *sharing* of wiring in cases where it is economically inefficient or impractical to duplicate this infrastructure. Article 12 of the revised *EU Framework Directive for Electronic Communications*⁵⁹ states that:

Member States shall ensure that national authorities, after an appropriate period of public consultation during which all interested parties are given the

⁵⁹ Directive 2002/21/EC as amended by Directive 2009/140/EC

opportunity to state their views... have the power to impose obligations in relation to the sharing of wiring inside buildings or up to the first concentration point or distribution point where this is located outside the building, on the holders of rights [to install facilities on, over or under public or private property] and/or on the owner of such wiring, where this is justified on the grounds that duplication of such infrastructure would be economically inefficient or physically impracticable. Such sharing or co-ordination arrangements may include rules for apportioning the costs of facility or property sharing adjusted for risk where appropriate.

In practice, the provisions should enable the relevant authorities to stipulate obligations on all operators which have installed or might install fiber access networks to offer 'sharing' for the 'terminating' portion of the network up to the first concentration point, both for prospective and pre-existing fiber wiring. Sharing could be interpreted to mean not just rental as is typically imposed under SMP regulation, but potentially co-financing of such infrastructure for example by means of Indefeasible Rights of Use (IRU). The EU Directive allows for the authority to set rules over how costs are apportioned in such sharing arrangements.

Although the EU Directive is silent on this question, in France, national legislation implementing these provisions⁶⁰ also enables the regulatory authority to stipulate the connection point – referred to in France as the 'point de mutualisation'. ARCEP may thus define the portion of the fiber access network which is 'point to point', enabling physical access and full control over the network at that point by co-investing operators. ARCEP issued decisions in this respect in 2009 and 2010⁶¹.

Insofar as this option allows several operators to use the same fiber infrastructure potentially under conditions established by the relevant authority, it could be viewed as replacing any fiber unbundling (i.e. rental) obligations which might apply to a single operator designated with SMP.

If fiber terminating sharing results in infrastructure competition in the provision of downstream fast broadband services, it could also obviate the need for regulated access to fiber-based 'bitstream' services, which might otherwise be mandated in the context of market 5.⁶²

Based on the positive experience in France and the legal framework provided by Article 12 of the revised *EU Framework Directive for Electronic Communications* we have identified fiber terminating segment network sharing and access as another option to be assessed in the Danish context.

⁶⁰ French Law n° 2008-776 of 4 August 2008 on the modernization of the economy.

⁶¹ Decisions of the Authority no. 2009-1106 and no. 2010-1312 of 22 December 2009 and 14 December 2010 respectively, adopted pursuant to Article L. 34-8-3 CPCE.

⁶² Wholesale central access as proposed in the draft revised *Commission Recommendation on Relevant Markets*.

6.2.2 Pros and cons

The potential advantages of fiber terminating segment sharing mostly relate to the improved long-term competitive market structures that may arise from this option alongside the efficiency inherent in infrastructure sharing as compared with duplication. In turn, improved competition could enable regulatory forbearance downstream reducing regulatory costs and uncertainty. The main potential disadvantages are the significant set-up costs of establishing an effective regime and risks inherent for competition and/or investment if the regulatory regime is not appropriately calibrated. The effectiveness of this option also crucially depends on the interest and willingness of multiple parties to ‘co-invest’ as an alternative to running proprietary networks or relying on regulated access (i.e. network rental).

In summary, advantages of symmetric FTTH terminating segment sharing include the following:

- FTTH terminating segment sharing minimises inefficient duplication of costly fiber terminating segments.
- It addresses the problem of enduring economic bottlenecks in a holistic way by setting guidelines for all parties investing in fiber access networks – i.e. potentially utilities alongside the incumbent and alternative operators.
- It may encourage investment by alternative operators in fiber access if it reduces the risk of overbuild by the incumbent or other established investors.
- If it proves successful in enabling infrastructure competition, a fiber network sharing regime could ultimately transform an existing competition regime based on regulated rental of copper to a system of co-ownership, providing stability for operators in the market.
- If it enables stable infrastructure competition, downstream regulation could potentially be relaxed, reducing regulatory costs and uncertainty.

Potential disadvantages of symmetric FTTH terminating segment sharing include the following:

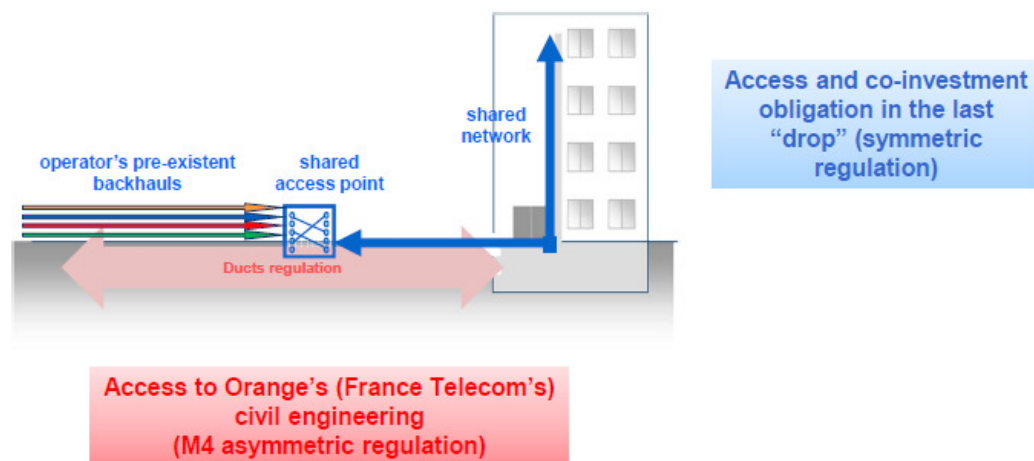
- Developing an FTTH network sharing model is likely to be time-consuming in the initial phases for the relevant authorities and all parties involved in inputting into the process.
- If inappropriately calibrated, especially as regards pricing, such a scheme could either limit investment in FTTH (if pricing rules prevent fair cost recovery) or limit competition in fast broadband (if pricing is not attractive for competitors and other SMP access options are removed or relaxed)
- The sale of long-term rights of use (Indefeasible Rights of Use, or “IRUs”) covering a portion of fixed infrastructure is consistent with business models for mass-market provision of fast broadband. It is likely to be less favorable compared with existing access regulation for smaller broadband and specialist business providers, which lack the requisite scale.

- Moving towards a symmetric regime may imply a change from existing approaches to fiber regulation under SMP regulation. Regulatory changes could lead to uncertainty and create new winners and losers.
- The effectiveness of this model is dependent on the willingness of all parties with an interest in fast broadband services to co-invest.

6.2.3 Selected countries experience: France

In France, an innovative approach has been followed towards the regulation of FTTH, which combines asymmetric duct access regulation (in the context of market 4 of the *Commission Recommendation on Relevant Markets*), with a symmetric regime, based on article 12 of the *EU Framework Directive* (as transposed into French law), which is designed to facilitate co-financing in FTTH. Figure 16 shows how duct access, which enables all operators to invest in FTTH, operates in parallel with rules on co-financing of a shared 'drop' or 'terminating' segment of the fiber line, which avoids uneconomic duplication of this part of the network.

Figure 16: ARCEP's FTTH regulation



Source: ARCEP

6.2.3.1 Implementation of 'symmetric terminating segment' access

ARCEP requires all operators deploying vertical FTTH networks within buildings (i.e. in-building wiring) to offer to other operators in a transparent and non-discriminatory manner passive access to the terminating segment of the fiber under reasonable technical and economic conditions.⁶³ Offers should include:

⁶³ ARCEP Decisions n° 2009-1106 et n° 2010-1312, which implement condition 34-8-3 of the French CPCE law.

- An offer to participate in the co-financing of FTTH lines for example through a long term right of use (IRU), both from the start of the investment and subsequently
- An offer of passive access rental.

ARCEP has identified the points of connection for 'mutualisation' (network sharing), on the basis of an assessment of the economic feasibility of network duplication in different areas. The connection point in areas identified by ARCEP as 'very dense' zones should be:

- At the base of the building for buildings hosting more than 12 households or offices; or
- At a point aggregating 100 lines for buildings hosting less than 12 households or offices (in accordance with the Jan 21 ARCEP Recommendation).

The connection point in 'less dense' areas must be:

- At a point aggregating at least 1.000 lines or;
- At a point aggregating at least 300 lines if dark fiber backhaul is made available from this point to a point aggregating 1.000 lines.

In January 2014, ARCEP took a decision to reduce the areas considered as 'very dense', based on observations of the operation of the regime. The number of high density districts was reduced from 148 municipalities representing around 6 mio. households to 106 municipalities (5.5 mio. households – fewer than 17% of the total).

Several bilateral agreements have been signed on the basis of the symmetric mutualisation regime, including an agreement between Orange and SFR (15 Nov 2011) and Free and Orange (July 2011). ARCEP has resolved a number of disputes in relation to the terms and conditions of these agreements. In practice the connection points have either been at locations aggregating several thousand lines (in the case of Iliad's P2P deployments), or at locations aggregating between 300-2,000 lines, with extension cables offered on a voluntary basis.

6.2.3.2 Pricing of FTTH network sharing

A key aspect in which ARCEP has been called on to resolve disputes relates to the pricing of co-financing (and other access) options in the symmetric FTTP sharing regime.

ARCEP has set out general guidelines which stipulate that the pricing conditions of access to the terminating segment of optical fiber networks must be reasonable and

respect the principles of non-discrimination, objectivity, relevance and efficiency.⁶⁴ In addition, the rate of return on capital employed for the determination of the tariff conditions must take into account risk and give an incentive to the investing operator.

ARCEP normally requires that three options are made available under 'mutualisation' agreements. These include:

- Co-financing in advance of the investment;
- Co-financing after the investment; and
- Rented access.

Co-financing is based on long term IRUs (indefeasible rights of use) over a portion of the relevant lines. In very dense areas where the mutualisation point is at the base of the building, financing is shared equally amongst participating operators. Elsewhere, in less dense areas (with a few exceptions), co-financing is available in slices covering 5% of lines addressable from the mutualisation point.

The precise terms of the network sharing agreements are confidential amongst the parties. However, the use of IRUs may imply the sale for a fixed up-front fee of a contractual right of use that may be seen as a capital investment (rather than rental, which would constitute operational expenditure). IRUs are normally treated as a form of property right and as such are typically tradable.

In order to foster 'convergence' in the approaches taken, ARCEP issued a draft pricing model for co-investment in less dense areas in May 2014.

It is also important to note that, under separate decisions relating to SMP remedies⁶⁵, ARCEP made the pricing of duct access relatively more attractive for fiber use by allocating the duct costs for fiber (vs copper) on the basis of the relative retail market share of fiber vs copper customers. During the initial period, while fiber take-up is low, this would result in relatively low duct access charges for operators investing in fiber. These charges would increase as the market matures and fiber take-up increases. ARCEP also progressively increased the lifetime for ducts from 40 to 50 years, whilst reducing the lifetime for copper from 25 to 13 years on the expectation of a transition to modern technologies.

6.2.3.3 Outcomes of duct access and FTTP sharing in the French market

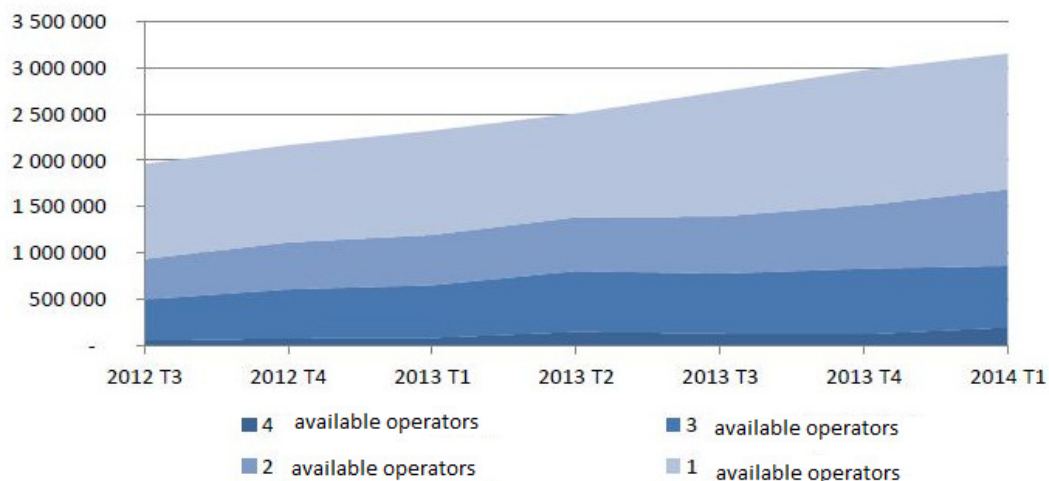
At the end of first quarter 2014, 11.4 mio. French households had access to technologies allowing 30Mbit/s or more, of which 3.154 mio. had access to FTTH

⁶⁴ ARECP decisions no. 2009-1106 and no. 2010-1312.

⁶⁵ ARCEP 2010 Decision concerning duct access pricing (http://www.arcep.fr/index.php?id=8571&L=1&tx_gsactualite_pi1%5Buid%5D=1331&tx_gsactualite_pi1%5BbackID%5D=1&cHash=30fb7a7d5e). See also ARCEP Decision 2012-2007.

technology (12.5% of all households), the majority in dense areas. Within these households, ARCEP figures show that more than half had access to more than two fiber offers on the basis of FTTP network sharing and around one quarter had access to 3 or more FTTH offers.

Figure 17: Number of operators present via an FTTH sharing offer in France



Source: ARCEP Wholesale Broadband Observatory Q1 2014 (published May 2014)

When considering that cable is also present in many of the dense areas in which FTTH has been installed, it seems probable that many if not most of those served by FTTH have a choice of at least two providers of fast broadband and in many cases three or more.

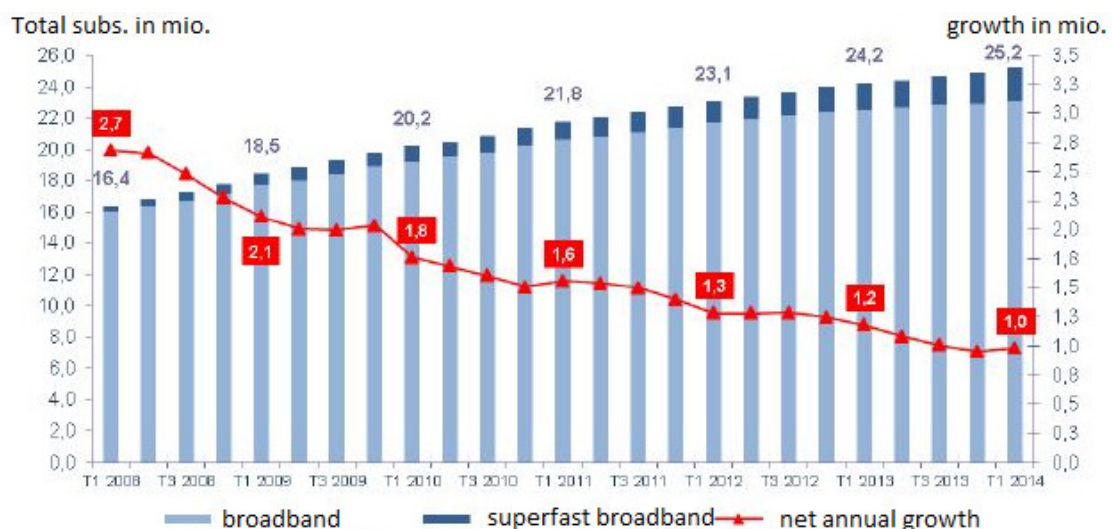
This seems to be a positive outcome for the degree of choice available via infrastructure-based competition in fast broadband. However, there are some important caveats:

- The overall deployment of FTTH in France remains relatively limited and is confined mostly to dense urban areas.
- Choice in FTTH is mostly present in dense areas where multiple operators have rolled out parallel fiber to apartment buildings and offices – the shared portion of the network in these areas is confined to in-building wiring.
- The presence of cost-effective sewer access in Paris may have contributed to competitive developments in this area rather than the co-investment regime per se (although the rule to share in-building wiring remains important in this context). That said, data from ARCEP suggests that sharing in less dense areas is expanding.
- The degree of choice in FTTH going forward may, in absence of remedies relating to this, be affected by the expected merger of cable operator Numericable with FTTH/mobile provider SFR, as the merged entity is likely to have overlapping fast networks in some areas.

- There is relatively limited service-based choice on fast broadband networks. This may be affected by the lack of regulated access to fiber bitstream in France.

Although progress has been made with FTTH roll-out in France, take-up of FTTH (and fast broadband generally) has thus far been limited. At the end of March, there were 2.2 mio. very high-speed broadband subscriptions in France out of a total of 25.2 mio. broadband subscribers overall. Of these, 0.64 mio. (29%) were based on end-to-end fiber, with the remainder of high speed lines primarily served by or via the cable operator Numericable. This means that only 20% of households served with FTTH were subscribing as of March 2014. However, although overall FTTH subscriptions were relatively low, the numbers represent an increase of around 70% on the previous year. In contrast fast cable subscriptions were slowing with a growth of around 18% on the previous year.

Figure 18: Number of subscriptions in France for broadband and fast broadband



Source: ARCEP Retail Broadband Observatory, May 2014

6.2.4 Relevance of option in Danish context

Symmetric fiber terminating segment sharing (over and beyond the sharing of in-building wiring) is typically most relevant where the following conditions are met:

1. FTTH has not yet been deployed or there are substantial areas where it is commercially viable, but is not yet deployed.
2. There are multiple operators with an interest in nationwide service coverage engaging or wishing to engage in the deployment of FTTH access networks.
3. Economics of network deployment mean that it would not be viable to deploy fiber terminating segments in parallel. This may particularly be the case in the

absence of effective duct access and in lower density areas characterized by single houses or smaller apartments rather than large apartment buildings and offices.

Some of these conditions seem to be met in the Danish context:

- The absence of available ducts for the copper and coax access networks combined with relatively low population densities⁶⁶ mean that it is unlikely that duplication of fiber access networks would be viable (with some potential exceptions for high-value customers). Competition on FTTH, should that be considered necessary, is therefore likely to require some form of network sharing or access.
- There is at least one operator - TDC - which might have an interest in broadening its fiber service offering thereby potentially providing a retail competitor to existing fiber utilities

However, there are a number of factors which may make symmetric regulation of the terminating segment less relevant in a Danish context:

- FTTH has already been deployed to significant parts of Denmark – Point Topic suggests coverage of more than 40%, although this includes homes passed, which do not have a drop wire connection. This means that the scope for stimulating a ‘first mover’ race may be less pronounced than in countries where FTTH was limited at the time of its introduction. In order to assess what potential additional benefits could be gained from incentivizing first-mover investment in FTTH, it could be useful to assess what proportion of Denmark would be viable for the commercial deployment of FTTH, beyond currently served areas.
- There is likely to be an absence of demand from competing operators:
 - Members of Wao! are mostly small scale and do not actively compete with each other at the retail level. Indeed Wao! was established as a common brand to present offerings of multiple companies as being complementary rather than competing.
 - SE, which operates a fiber network in southern Jutland and which recently acquired cable operator Stofa, may not see overall benefits from such a scheme if it entails opening its proprietary network to others.
 - Because installing fiber to connect to the fiber terminating segment requires substantial investments, it seems unlikely that current access-based operators in Denmark would be attracted by such a regime. This still leaves the potential for an entrant to adopt this strategy, but without

⁶⁶ OECD 2008 dataset on metropolitan areas cites Copenhagen as having a population density of 480 persons per square km compared with 960 in Paris.

existing scale through a relatively high broadband market share, it is doubtful that such a strategy would be viable.

- TDC could benefit from such a scheme, but this may reduce rather than increase infrastructure-based competition, as TDC could transfer its focus from existing copper and coax towards fiber access on current competitors. At the same time, it is not clear whether such a scheme would change TDC's incentives as regards utilizing and/or expanding the fiber networks it acquired from DONG Energy and ComX, especially if others do not demand co-investment on such networks under a symmetric framework.

If this analysis is correct, regulation of fiber terminating segment access may actually weaken competition and reduce incentives for TDC to invest in upgrading its existing coax and/or copper networks in areas served by fiber utilities.

However, the effects and thereby potential relevance of this remedy could change if:

- It is found that there is significant additional scope for viable FTTH roll-out which could be supported by measures which aim to foster co-investment; and/or
- Players other than TDC including one or more of the fiber utilities themselves express an interest in co-investing under this model.

We understand that in Denmark, the responsibility for applying article 12(3) of the *EU Framework Directive for electronic communications* rests not with DBA, but rather with the the Danish Building and Preservation Authorities.⁶⁷ Moreover, under the existing transposition of the EU Directives into Danish law, their power is restricted to mandating the sharing only of in-building wiring, and not wiring up to the first concentration point⁶⁸.

In order to cater for a scenario in which there is sufficient demand for co-investment on fiber to consider symmetric obligations in this context, it may be useful to consider consolidating the powers for implementing symmetric measures under article 12(3) with the DBA and extending them so as to enable sharing up to the first concentration point. This would be consistent with the potential for these measures (which are essentially economic in nature) to affect competition in the sector. In practice this could perhaps be done in the context of transposing the EU Infrastructure Directive, which includes a more limited variant of the symmetrical obligation covering sharing of in-building wiring⁶⁹.

⁶⁷ Executive Order no 384 of 21 April 2011

⁶⁸ Executive Order no. 384 of 21 Apr 2011 on Co-ordinated Use of Network Elements in Electronic Communications Networks and Associated Facilities and Wiring inside buildings Chapter 4(8)

⁶⁹ Article 9 *EU Directive on Measures to Reduce the Cost of Deploying High-speed Electronic Communications*.

6.3 Access to fiber networks of utilities (option 3)

6.3.1 Description of option

Utilities, in principle, could offer commercial access to their fiber networks. By commercial access is meant the provision of access on freely negotiated terms, conditions and charges to preferred access seekers. We do not address here regulated open access to fiber networks, which is not an option under the current legal framework. Regulated access would require that utilities have a position of SMP (which is unlikely to be the case even if regional markets, rather than a national market, were defined) or a symmetrical regime is implemented (which is only possible for fiber terminating segments subject to certain legal amendments - this was dealt with in section 6.2).

Commercial access could, in principle, take several forms:

- A resale offer for the utilities' broadband services, stand alone or bundled with the utilities' television and voice services;
- A bitstream access offer, possibly with multicasting functionality to allow the provision of television; and/or
- Access to unbundled fiber (where point to point architecture is used).

In contrast to the other options identified in this report, there is little experience in Europe on commercial access to alternative operators' fiber networks. In fact, relevant experience seems to be limited to Denmark itself, where during a brief period fiber utilities offered network access to other operators. We have further considered this option, because of some potentially positive effects on competition.

6.3.2 Pros and cons

Commercial access to fiber companies' networks can have advantages from a competition point of view. Put in general terms, access arrangements can strengthen competitors of the incumbent in the market for retail broadband, in particular, if access partners are allowed to offer bundles including television. Such access could benefit resellers (operators with no broadband infrastructure) or network operators (with no local access infrastructure in the relevant geographical area). An increase of access-based competition made possible by fiber access could also provide a competitive stimulus for the incumbent to geographically expand its own geographical fiber footprint and improve its fiber-based products. More competition could ultimately lead to a higher penetration with connections of very high and symmetrical speeds. Such an outcome would promote the policy objective of each home having access to a 100Mbps/download and 30Mbps/upload connection.

However, there are also potential disadvantages that could arise from access to fiber networks. If fiber companies entered into an access arrangement with the incumbent, the impact on competition could be negative. Such agreements could undermine

existing infrastructure competition between DSL/cable and fiber. Access arrangements between the fiber companies and the incumbent would be subject to Competition Law scrutiny. Whether they are approvable, would depend on the concrete terms of the agreement.

6.3.3 Selected countries experience

There is very little evidence in the EU on fiber companies offering commercial access and its impact on competition. Fiber companies (other than the incumbents which are subject to SMP obligations) usually keep their networks closed, presumably because they do not expect access relationships to enhance profits at this stage of market development. In fact, one of the few experiences with commercial access is from Denmark, where utilities at the early stages briefly offered network access to other operators.

Existing access arrangements in Europa, where they exist, are based on symmetrical regulation or state aid rules:

- Access to fiber terminating segments, e.g. in France, Portugal and Spain, is based on a symmetric regime.⁷⁰
- Other access arrangements, to the extent they exist in Europe, are based on state aid rules. Para. (23) of the EU State Aid Guidelines⁷¹ stipulates that “.. a publicly funded network set up within the context of an SGEI⁷² should be available to all interested operators. Accordingly, the recognition of an SGEI mission for broadband deployment should be based on the provision of a passive, neutral and open infrastructure. Such a network should provide access seekers with all possible forms of network access and allow effective competition at the retail level, ensuring the provision of competitive and affordable services to end-users.” Para. 80(a) sets out that wholesale access must be offered to subsidized networks in all relevant forms. Apart from bitstream access and unbundled access to the local loop and sub-loop, the access obligation should also include the right to use ducts and poles, dark fiber or street cabinets.

⁷⁰ See section 6.2.3.

⁷¹ See *Communication from the Commission, EU Guidelines for the application of State aid rules in relation to the rapid deployment of broadband networks* (2013/C 25/01). (http://www.google.de/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0CC0QFjAB&url=http%3A%2F%2Fec.europa.eu%2Fcompetition%2Fstate_aid%2Flegislation%2Fbroadband_guidelines_en.pdf&ei=JCrJU7OvNle7Oab9gKgG&usq=AFQjCNEsIE84RXv_gXOIjz-IMq-GnABYQ&bvm=bv.71198958.d.ZWU&cad=rja)

⁷² SGEI: Service of general economic interest.

6.3.4 Relevance of option in Danish context

Commercial access agreements of fiber utilities with other network operators or resellers are a possibility in the Danish context. However, fiber utilities would need to have a commercial incentive to enter into such access arrangements. The answer to this question is not obvious at the current stage of market development.

- While access arrangements can help to expand the broadband market for utilities and increase network utilization (which increases the utilities' profits), there is also a cannibalization effect (which can decrease profits depending on the level of the access charge). The expansion effect, which would provide the prime incentive for entering into access agreements, is heavily dependent on consumers' demand and willingness to pay for very high-speed symmetrical broadband. Given the uncertainty about demand, utilities may feel that time is not yet ripe to enter into access arrangements.
- In addition, utilities under the Waoo! brand may face the challenge of harmonizing access products between fiber utilities and establishing a common wholesale platform (a form of "Waoo! wholesale").

Commercial access arrangements, if they were concluded, could increase competition in the Danish broadband market. This clearly would be the case if alternative operators (e.g. Telenor, Telia and Concepy) or resellers could benefit from them. In turn, an access arrangement between fiber utilities and TDC could reduce infrastructure competition. Access arrangements with TDC would need to be scrutinized under Article 6 of the Danish Competition Act and cleared by the Danish Competition Authority. The outcome would depend on the details of the arrangement and cannot be predicted here on a general level.

6.4 Functional separation of TDC (option 4)

6.4.1 Description of option

A further option is functional separation of the local access network of TDC and related wholesale services. While we address this option only in form of a voluntary separation, it is nevertheless instructive to summarize the conditions under which mandatory separation may be imposed under the SMP framework. The defining characteristics are also identical, independent of whether functional separation is voluntary or mandated.

In the revised Electronic Communications Framework of 2009, a new provision was added enabling NRAs in some circumstances to impose mandatory functional

separation on operators with enduring market power. Article 13a of the Access Directive⁷³ provides that:

“Where the national regulatory authority concludes that the appropriate obligations imposed under Articles 9 to 13 have failed to achieve effective competition and that there are important and persisting competition problems and/or market failures identified in relation to the wholesale provision of certain access product markets, it may, as an exceptional measure ... impose an obligation on vertically integrated undertakings to place activities related to the wholesale provision of relevant access products in an independently operating business entity. That business entity shall supply access products and services to all undertakings, including to other business entities within the parent company, on the same timescales, terms and conditions, including those relating to price and service levels and by means of the same systems and processes.”

In effect, functional separation as defined in EU law, provides for:

- (i) An organisational separation of the part of the business which is subject to enduring bottlenecks; and
- (ii) ‘Equivalence of Input’ (EoI) (i.e. use of the same systems as well as terms and conditions) for products internally and externally offered by the functionally separated business unit.

It should be noted in this context that, even in the absence of functional separation, EoI may in principle be mandated as an application of the standard obligation for ‘non-discrimination’, as outlined in Article 10 of the Access Directive. EoI has indeed been advocated as a suitable mechanism for implementing non-discrimination in the context of the 2013 Commission Recommendation on cost methodologies and non-discrimination⁷⁴. This means that the only distinguishing feature of functional separation from the standard remedy toolkit is the organisational separation of the entity and associated changes in governance.

The evidential requirements needed to justify mandated functional separation are relatively strong. Prime amongst these are:

- (i) Evidence that other access obligations such as non-discrimination obligations applied under the EU framework have failed to achieve effective competition.

⁷³ Directive 2002/19/EC as amended by Directive 2009/140/EC.

⁷⁴ Commission Recommendation of September 2013 on consistent non-discrimination and costing methodologies (http://ec.europa.eu/smart-regulation/impact/ia_carried_out/docs/ia_2013/c_2013_5761_en.pdf).

- (ii) Reasoned assessment that there is little or no prospect of effective and sustainable infrastructure-based competition within a reasonable timeframe; and
- (iii) Analysis justifying that the obligation would be the most efficient means to enforce remedies aimed at addressing the competition problems identified.

An important practical issue concerning the application of functional separation is the choice of which assets to place within the separated business unit or entity. This decision should in principle be guided by where the enduring economic bottleneck is perceived to lie, and will affect the wholesale products supplied by the separated unit. If there is a 'soft' separation (ie only business organization) as in the UK, amending the boundary of the separated unit may be more straightforward than if a separate legal entity is established.

The *Access Directive* also contains provisions detailing the implications of voluntary separation on the approach towards access regulation. Article 13b of the *Access Directive* provides that:

"Undertakings which have been designated as having significant market power ... shall inform the NRA in advance ... in order to allow the NRA to assess the effect of the intended transaction, when they intend to transfer their local access network assets or a substantial part thereof to a separate legal entity under different ownership, or to establish a separate business entity, in order to provide to all retail providers, including its own retail divisions, fully equivalent access products."

The Directive requires NRAs to conduct a co-ordinated analysis of different markets related to the access network and maintain, remove or change obligations in effect taking into account the impact of any voluntary separation. The implication may be that if separation strengthens the effectiveness of regulatory conditions surrounding core bottlenecks, it might foster competition, thereby enabling some deregulation of downstream markets.

Voluntary functional separation has occurred in the UK and Sweden. As the experience notably in the UK has been positive in terms of improving access conditions and stimulating access-based competition, we assess this option in more detail here.

6.4.2 Pros and cons

Functional separation has the benefit of providing a clear structure under which regulated access products are provided. If governance structures are effective, it could also be helpful in changing the incentives of the wholesale division of the SMP operator to foster more equal treatment of service providers. The main disadvantages relate to the set-up costs both of the NRA and regulated operator, and questions over whether the benefits of changed governance structures of themselves (versus measures such as EoI) are sufficient to outweigh these costs. While functional separation (and EoI)

may improve enforcement of non-price discrimination, there are questions over whether functional separation of itself is sufficient to address 'price discrimination' (i.e. margin squeeze). In addition, there is speculation that establishing a structure which aims to offer access to 'enduring bottlenecks' may prove to be a self-fulfilling prophecy, potentially encouraging a longer-term reliance on access rather than infrastructure-based competition.

In summary, potential advantages include:

- Clear structure for the enforcement of ex ante regulation.
- Potential to change incentives of the SMP operator towards equal treatment.
- Strong enforcement of (non-price) non-discrimination potentially boosting competition in downstream wholesale and retail markets (although this could also be done to some degree through EoI obligations in the absence of functional separation).
- Structure inherently supports equivalent availability and access to new and upgraded access products (e.g. NGA) if the separated unit includes fiber as well as copper assets in the access network.
- Consequent increases in competition may permit some (potentially geographic) deregulation of downstream markets (e.g. wholesale broadband access)
- Structural improvements which enforce non-discrimination could also reduce the burden of regulatory oversight and enforcement for non-discrimination after the initial set-up period.
- The separation may reduce incentives for the SMP operator to consider only the needs of its downstream operation as regards network upgrades for different infrastructures (e.g. DOCSIS3 and FTTx) because in principle product enhancement requests from all retail providers would need to be treated in an equivalent manner. However, this advantage would not apply if the retail market share of the SMP operator is substantially higher than those of other players.

Potential disadvantages include:

- High regulatory costs in establishing the new regime.
- Potentially high costs for the affected operator. It would need to be assessed whether these are outweighed by the competitive benefits and potential future cost reductions due to structurally improved enforcement.
- Functional separation does not preclude margin squeezes or potential excessive pricing and therefore does not obviate the need to maintain existing price control and/or margin squeeze obligations.
- Creates (at least perceived) bias towards ongoing service competition. May affect incentives towards infrastructure-based competition (where viable).
- Unlike measures such as network sharing or infrastructure access cost reductions, functional separation does not address underlying issue of economic bottlenecks caused by high sunk costs and economies of scale. It is therefore likely to embed regulation long term.

- May address symptoms, but not the root cause of competition problems stemming from ownership of parallel infrastructures.

6.4.3 Selected countries experience

6.4.3.1 UK

In 2005, the incumbent BT made commitments to Ofcom for the functional separation of its regulated access business (the ‘Undertakings’⁷⁵).

Scope of the separated unit

The Undertakings set out the assets which are held (in virtual terms) by BT Openreach. The relevant provisions state that: “Except as otherwise agreed with Ofcom, Openreach shall control and operate the assets contained within the Physical Layer of BT’s Access Network and the Physical Layer of BT’s Backhaul network including such items needed to support these assets, such as line testing and remote diagnostics.” The Physical Layer is defined as the “duct, fiber, copper and other non-electronic assets in an Electronic Communications Network”.

In practice, the main product supplied via Openreach is LLU – i.e. physical access to copper access. Since the introduction of an access obligation for ducts for residential purposes, duct access has also been made available by Openreach.

For FTTC and FTTP products, the Undertakings noted that there may be some need for Openreach to have access to the Transmission Layer of the network. In addition, commitments were made that Openreach should follow an EoI approach to such products including as regards consultation, pre-launch notification and SLAs⁷⁶. In June 2009, Ofcom agreed, following consultation, to a variation in BT’s Undertakings⁷⁷ which allows Openreach to control and operate the access electronics required for FTTC.

Ethernet leased lines, Optical Spectrum Access⁷⁸ and Wholesale Line Rental (WLR) are also offered via Openreach.

Other regulated and unregulated wholesale products including bitstream are offered through a division downstream of Openreach called BT Wholesale⁷⁹. In principle, BT

⁷⁵ Consolidated BT Undertakings (<http://stakeholders.ofcom.org.uk/binaries/telecoms/policy/bt/consolidated.pdf>).

⁷⁶ See section 11 of the Undertakings.

⁷⁷ Ofcom variation to BT’s undertakings relating to FTTC (<http://stakeholders.ofcom.org.uk/consultations/fttc/statement/>).

⁷⁸ High speed lines using DWDM technology.

⁷⁹ BT Wholesale (<https://www.btwholesale.com/pages/static/homepage/index.htm>).

Wholesale uses Openreach products in order to build services with additional components or service offerings.

Main features of functional separation in the UK

The main features of the separation regime in the UK are:

- The provision of services on the basis of 'Equivalence of Input'. Unless permitted otherwise, regulated services supplied by Openreach must be provided and maintained using the same systems to other operators as to BT's downstream businesses.
- The separation of governance of the regulated access business. Although it remains part of the same legal entity as the remainder of BT, Openreach is operated as a separate business unit, with its own staff and headquarters. The incentive schemes of Openreach staff are based on Openreach's performance rather than that of the wider group.
- The creation of an 'Equality of Access Board' (EAB)⁸⁰, which oversees the implementation of BT's Commitments. The EAB is chaired by a member of BT's Board, and includes an operational manager from within BT. However, the remaining three members of the Board, making up the majority, are independent. The main role of the Board is to monitor, report and advise BT on its compliance with the Undertakings, with a particular focus on the application of the principle of the 'Equivalence of Inputs' and operation of Openreach. Amongst other duties, the EAB acts as on complaints brought to it by communications service providers, and produce an annual report⁸¹ which highlights how breaches have been rectified. In this sense it provides an internal 'appeal' mechanism by which providers can seek redress against perceived discrimination by BT.

Structure of BT

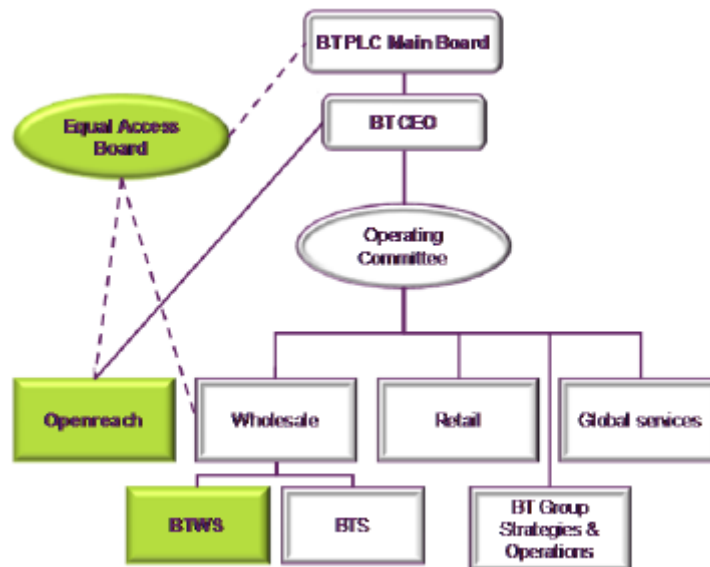
Openreach operates as a standalone profit and loss division of BT Group. Its CEO is selected by and reports to the BT Group CEO. However, its independence from other BT divisions is reinforced by the approach regarding incentivisation of its staff and by the Equality of Access Board (EAB), which reports on performance against the Undertakings and can assess potential breaches. It is independent of the BT Board.

⁸⁰ Openreach Equality of Access Board
(<http://www.btplc.com/Thegroup/Ourcompany/Theboard/Boardcommittees/EqualityofAccessBoard/EqualityofAccessBoard.htm>)

⁸¹ EAB Annual Report 2014
(http://www.btplc.com/Thegroup/Ourcompany/Theboard/Boardcommittees/EqualityofAccessBoard/Publications/EAB_Annual_Report_2014.pdf)

Moreover, another distinction is that the Openreach CEO is not permitted to be a member of (although can attend) the Operating committee of BT Group, which is Chaired by the BT CEO and is the main decision-making body.

Figure 19: Structure of functional separation of BT



Source: BEREC Guidance on functional separation – Annex I Feb 2011

([http://www.erg.eu/streaming/BoR%20\(10\)%2044%20Rev1b%20BEREC%20Guidance_on_FS_Anex_final.pdf?contentId=547128&field=ATTACHED_FILE](http://www.erg.eu/streaming/BoR%20(10)%2044%20Rev1b%20BEREC%20Guidance_on_FS_Anex_final.pdf?contentId=547128&field=ATTACHED_FILE))

Legal basis for BT's functional separation

BT's undertakings were implemented before (and in some respects provided an inspiration for) the provisions later adopted in the revised EU Framework on Electronic Communications, which allow NRAs to mandate functional separation in certain circumstances. In this context they were not implemented under ex ante legislation applying to the electronic communications sector.

Rather the BT Undertakings were agreed between BT and Ofcom under competition law in lieu of a reference to the UK Competition Authority, then known as the 'Competition Commission'⁸², which could have imposed the structural separation of BT. This means that although the commitments were voluntarily entered into, they arose as a result of a strong (and presumably credible) regulatory threat. Ofcom was able to make this reference and agree to the Undertakings by virtue of the fact that under UK law, it has concurrent powers in the telecommunications sector with the competition authority under competition law.

⁸² Competition Commission (<https://www.gov.uk/government/organisations/competition-commission>). Its functions have now been transferred to the UK Competition and Markets Authority ("CMA")

Aims of functional separation in the UK

According to Ofcom, the main aim of functional separation in the UK was to address perceived discrimination between BT's retail divisions and those of alternative operators for 'non-price' terms – such as the conditions for ordering regulated access products as well as subsequent service levels (fault repair etc). Another important objective was to secure equivalent access to new products such that BT's downstream businesses would have the same information at the same time about new wholesale products as other operators, thereby providing some safeguards against foreclosure.

A key goal at the time when functional separation was introduced was to support competition in broadband on the basis of local loop unbundling, which had experienced relatively low take-up following its introduction. However, the BT Undertakings were designed in a way that captured other regulated products including business access products such as 'Ethernet leased lines' (although these were exempted from EoI obligations). Although NGA deployments were yet not anticipated in 2005, the Undertakings were intended to be forward-looking and therefore encompass any upgrades to the access network such as the deployment of next generation fiber access networks closer to the customer.

Other actions by Ofcom to boost competition

Although it is perhaps the best-known of recent developments in the UK that were intended to promote competition, functional separation was not the only action that was taken around 2005. Ofcom also undertook a significant review of the valuation of BT's copper access network which was finalized in August 2005⁸³. This resulted in a change in the approach to valuing assets, including ducts and copper, installed prior to 1997 and led to price reductions for LLU line rental of around 25% as shown in **Fejl! Henvisningskilde ikke fundet.**Table 11.

Table 11: UK LLU prices before and after the copper cost review (€)

		August 2004	October 2005
Full LLU	Connection	129.00	51.00
	Monthly Rental	12.90	9.80
Shared LLU	Connection	123.00	51.00
	Monthly Rental	3.30	1.90

Source: European Commission (2006)

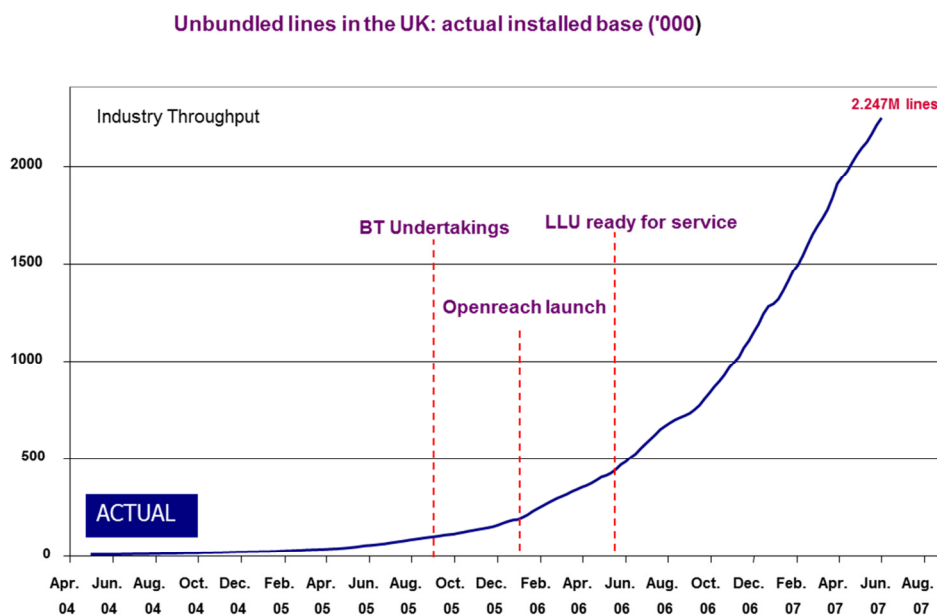
⁸³ Ofcom, Valuing BT's copper access network: final statement
(<http://stakeholders.ofcom.org.uk/consultations/copper/value2/statement/>)

In addition, Ofcom established the Office of the Telecommunications Adjudicator (OTA)⁸⁴, a body staffed by operational experts with experience from the telecommunications industry, which was tasked with assessing and resolving issues affecting the roll-out and performance of products provided by Openreach. Amongst other tasks, the OTA regularly publishes Key Performance Indicators (KPIs) which provide metrics on provisioning and repair times by Openreach in providing services to competitors as compared with its own downstream business units. The OTA also assists operators in reaching agreement on product functionality, process specifications, change management and implementation of products, and can issue non-binding recommendations if needed, on these subjects. It thus operates as a kind of arbitration body.

Effects of functional separation in the UK

As can be seen in Figure 20, take-up of LLU increased rapidly in the period following the introduction of functional separation. Although take-up has slowed in more recent years, the OTA reports that there were 9.3 mio. LLU lines at the end of June 2014⁸⁵, around 40% of all broadband lines in the UK⁸⁶.

Figure 20: Installed base LLU in the UK



Source: Office of the Telecommunications Adjudicator, WIK

⁸⁴ Office of the Telecommunications Adjudicator (<http://www.offta.org.uk/index.htm>)

⁸⁵ OTA KPIs June 2014

⁸⁶ Ofcom quarterly update Q4 2013/14 reports that there were 22.6m broadband lines as of end March 2014.

As a consequence of the success of LLU and the pre-existing competition from cable in the UK, Ofcom was also able to further deregulate the downstream wholesale broadband access market, withdrawing regulation from 90% of this market in its June 2014 decision on this market⁸⁷, a deregulatory measure which should have reduced the cost burden of regulation. The practical effects thus appear to have been significant and positive.

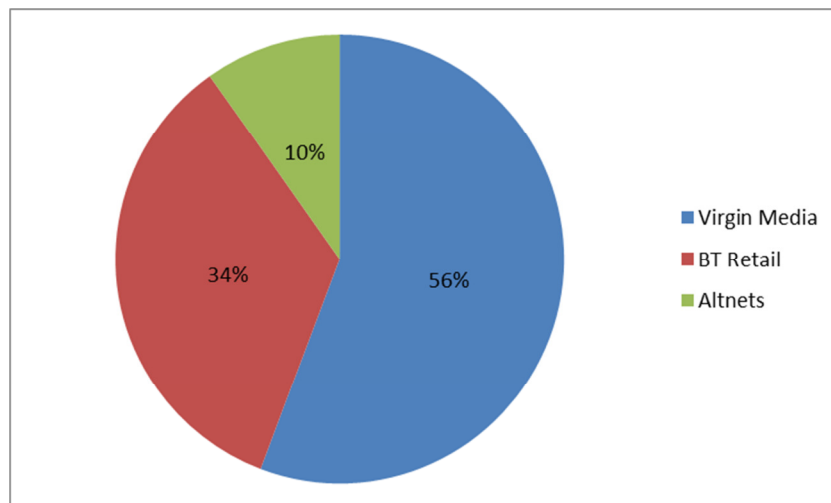
However, because functional separation was introduced in tandem with two other important measures affecting LLU - price reductions in LLU and the establishment of the OTA - it is difficult to determine where responsibility lies for the improved outcomes for LLU and the relative effect of addressing price vs non-price issues. Moreover, it is even harder to assess the role that the organisational separation (and consequent changed incentives) played in delivering positive outcomes as compared with the application of Equivalence of Input, which could have been introduced separately from functional separation.

When examining the effects of functional separation on competition in NGA roll-out and competition in the UK, the results are not clear-cut. BT has rolled out FTTx (primarily FTTC) to around two-thirds of the UK population – ahead of schedule⁸⁸. This suggests that functional separation was not a deterrent to investment. The UK was also one of the first countries to introduce VULA. This may have resulted from the structural set-up of BT, whereby BT's retail arm could not market superfast broadband without an equivalent wholesale product being made available to all operators. However, compared with standard LLU-based broadband, BT retail arm has maintained a higher market share for superfast broadband than its competitors on the Openreach VULA platform. As of March 2014, out of a total of 6.1 m. superfast broadband connections, BT retail maintained 34% vs entrants' 10% share of the total high speed broadband connections, and 78% share of FTTx connections (see Figure 21).

⁸⁷ Ofcom, 26 June 2014 Statement on the wholesale broadband access market (<http://stakeholders.ofcom.org.uk/binaries/consultations/review-wba-markets/statement/WBA-Statement.pdf>)

⁸⁸ See BT investor news release Q4 2013/2014.

Figure 21: UK market shares in superfast broadband (>25Mbit/s) March 2014



Source: BT and Virgin Media investor statements

The reasons for this are unclear, and may not be entirely due to regulatory factors. However, it is possible that the sole reliance on functional separation to support competition may have been insufficient. In June 2014, Ofcom issued a consultation in which it proposes to introduce ex ante margin squeeze testing on fiber-based broadband⁸⁹. Ofcom's plans to apply checks on pricing suggest that pricing may play a significant role as regards competition in NGA services and that pricing safeguards may be needed in addition to functional separation. This is consistent with the 2013 European Commission Recommendation on cost methodologies and non-discrimination⁹⁰, which calls for measures to preserve economic replicability alongside those to ensure technical replicability and avoid non-price discrimination.

Costs of functional separation

It is difficult to quantify the precise costs to the incumbent of establishing functional separation, largely because some of the costs incurred may have been incurred through normal business procedures in the absence of functional separation. For example:

- Establishing a new business division is likely to have incurred costs. However, such costs may have been incurred during normal business reorganisation processes.

⁸⁹ June 2014 Ofcom consultation on Fixed access market reviews: approach to the VULA margin (<http://stakeholders.ofcom.org.uk/consultations/VULA-margin/>)

⁹⁰ Commission Recommendation of September 2013 on consistent non-discrimination and costing methodologies (http://ec.europa.eu/smart-regulation/impact/ia_carried_out/docs/ia_2013/c_2013_5761_en.pdf)

- Establishing ordering systems to comply with a requirement for 'Equivalence of Input' would normally incur costs. However, system costs would also be incurred in the normal course of introducing new products, such as was the case for the introduction of VULA products based on FTTx.
- The establishment and maintenance of the 'Equivalence of Access Board' would entail both start-up and ongoing costs. However, it is likely that costs associated with the function of enforcing regulatory obligations for non-discrimination would have been incurred regardless of the existence of the EAB and functional separation. In the absence of the EAB, such costs would have been borne largely by the regulator and recovered from industry.

In conclusion, although there were undoubtedly direct costs associated with the establishment of functional separation in the UK, it is not possible to quantify these with any accuracy. In a 2009 study prepared for BT Global Services (one of BT's retail divisions) by SPC Network⁹¹, these direct costs were not viewed to be disproportionate.

It is also possible that changes to the incentives of the regulated access business could reduce the need for and costs of ongoing enforcement, although again the effects are difficult to quantify.

Effects of functional separation on infrastructure-based competition in the UK

Data on roll-out of FTTx suggests that functional separation has not impacted incentives by BT to invest in the technology. However, it is notable that to date alternative operators (besides the cable operator) have played a less extensive role in deploying their own access infrastructure in the UK than in many other countries – notably France, Spain, Portugal and Italy.

There could be many reasons for this. The presence of cable as an independent competitor reduces the business case to install a third access infrastructure. Conversely to the UK, regulatory approaches in France, Spain and Portugal, which have focused on deep passive access for NGA instead of downstream active access, may have compelled increased investments by alternative operators.

However, it is also possible that functional separation may have created the perception in the UK that regulated access would be provided on an ongoing basis, which is less certain in countries without such a regime. This may have the positive effect of providing increased certainty for access-based entrants to invest in their own core network infrastructure. However, it may also have had the effect of making the case for infrastructure competition in the access network relatively less compelling or urgent for UK-based competitors. This could have negative effects in the medium term if there is indeed a business case for infrastructure-based access investment or network.

⁹¹ SPC network report on functional separation for BT Global Services (http://spcnetwork.eu/uploads/20090226_EFS_Report.pdf)

6.4.3.2 Sweden

Another case of separation that is sometimes cited is that of TeliaSonera in Sweden. The background is that in 2007, in the light of complaints to the Competition Authority and perceived problems with discrimination in the regulation of markets relevant for the provision of broadband services, Swedish NRA PTS was tasked by the Government to conduct an assessment of the electronic communications sector to improve transparency and equal treatment. Following PTS' investigation and the publication of its report in June 2007⁹², the Government adopted legislation in July 2008 that gave the power to PTS to mandate functional separation. However, the legislation was limited in scope to copper access in the context of markets 4 (wholesale physical infrastructure access) and 5 (wholesale broadband access) of the 2007 EU Recommendation of Relevant markets.

Meanwhile prior to the adoption of the legislation, TeliaSonera made proposals for separation which included the creation of a separate legal entity for the management of physical infrastructure with the stated intention of selling copper and copper-related infrastructure on the same commercial terms to all operators on the Swedish market⁹³. Skanova was established on 1 January 2008. An Equality of Access Board was also established to monitor key performance indicators for the separated unit.

Although the separation in Sweden shares some characteristics with functional separation as defined in the EU Framework Directive as amended in 2009, it deviates in certain important respects. In particular, it did not entail Equivalence of Input in terms of the strict use of the same operational systems. In addition selection of the members of the Equality of Access Board is performed by TeliaSonera.

As the separation of TeliaSonera has not been formally acknowledged as functional separation within the meaning of EU legislation, it is difficult to assess what the practical effects of this voluntary regime have been over and beyond the effects of SMP regulation applied by PTS.

6.4.4 Relevance of option in Danish context

There is no experience within Europe of functional separation being introduced by means of mandatory obligations under the EU Framework for electronic communications. Rather, in all cases where the incumbent has executed organizational change (whether or not considered 'functional separation') in order to address perceptions of discrimination, this has occurred through voluntary measures, taken in

⁹² PTS report: Improved broadband competition through functional separation June 2007 (http://www.pts.se/upload/Documents/EN/Improved_broadband_competition_through_functional_separation_2007_18.pdf)

⁹³ TeliaSonera press release (<http://news.cision.com/teliasonera/r/skanova-access-meets-swedish-telecom-operators--infrastructure-needs-on-equal-terms.c322057>)

lieu of more stringent measures that might have been applied by the NRA and/or competition authority.

An important first observation is therefore that the relevance of voluntary functional separation in Denmark depends not only on whether functional separation would help to address structural competition issues in the Danish market (i.e. does it address the right problem? Is it the right solution?), but also on the strength of any case to take more stringent (mandatory) measures, the intentions of the regulatory authorities (is the threat credible?) and TDC's receptiveness to organizational change.

Would functional separation pass a cost benefit analysis?

When assessing the relevance of voluntary functional separation in a Danish context, it is useful to review the criteria set out in EU legislation for mandatory separation as these provide useful guidelines for the conduct of a 'cost benefit analysis'.

Under the terms of the EU Telecommunications Framework as amended in 2009⁹⁴, functional separation may be mandated in circumstances in which other remedies have been tried and been found insufficient to address competition problems, where there is little or no prospect of infrastructure-based competition and where functional separation would be the most efficient solution.

There are certain characteristics of the Danish telecommunications market which might support a case for functional separation.

- The integration of TDC, and its ownership of copper, coax, and in some areas fiber networks may mean that infrastructure-based competition in residential services is likely to remain limited and where present only consists of a choice of two infrastructures (TDC and fiber utility), which would fall short of a competitive market. This is confirmed by the analysis of coverage of relevant technologies in section 2.4.
- Data (see section 2.2) suggests that despite being mandated on non-discriminatory terms at a price which up to 2012 was close to the EU average, copper LLU has not been effective in Denmark to the same extent as in other countries. One possible reason (at least where there is a sufficiently long history to reach conclusions) could be that SMP remedies alone were insufficient to achieve effective competition in retail markets.
- There are some indications that TDC's choices as regards priorities for network upgrades between the cable and copper platform are based on the needs of its downstream retail broadband businesses rather than of the demands of the market as a whole. In theory if such decisions are taken primarily by the access unit on the basis of aggregate demand, it could render investment choices more

⁹⁴ Directive 2002/19/EC as amended by Directive 2009/140/EC

operator neutral. However, in practice the high retail market shares of TDC in comparison to alternative operators are likely to render this ineffectual.

- We understand that effective access regulation, the main goal of applying functional separation, is likely to remain relevant in the medium term to support competition in Denmark. Beyond the important investments made by fiber utilities and by operators focused on the business segment, it seems unlikely that other players would invest in parallel access infrastructure, and therefore will be reliant on access to serve fixed retail customers.

At the same time, there are characteristics which may militate against the use of functional separation at this time.

- The majority of operators relying on regulated access have cited price, (excessive charges and/or margin squeeze) rather than non-price factors as the main reasons for the low usage of access. Price issues, if these are responsible for competitive challenges in the Danish market, are unlikely to be addressed through functional separation, but rather through attention to the effectiveness of price setting methodologies and margin squeeze tests.
- There seem to be additional measures that could in theory be taken to enforce non-discrimination within the scope of SMP regulation, which fall short of functional separation. These are not policy options as such in the context of this paper, but could be introduced if considered by the DBA to be proportionate and necessary to address competition issues. Such measures could for example include:
 - Increased obligations around and scrutiny of internal and external KPI data for TDC as compared with competitors⁹⁵.
 - Establishment of a 'telecommunications adjudicator' with responsibility for monitoring KPIs, reporting on performance and addressing any perceived shortfalls.
 - Mandating equivalence of input for key products, where proportionate.

The British example shows how unbundling and VULA could be handled in a system of functional separation. However, a further complexity of introducing functional separation in the Danish context is the presence of cable. In theory cable assets could be included within a functionally separated unit if they were considered to represent an enduring bottleneck. However, there may be challenges in determining the nature and type of cable assets that could be 'functionally separated' given that cable access is via layer 3 bitstream, which is inherently a shared connection with connection points that may not be at the 'local' level.

⁹⁵ Existing KPIs are shown at https://wholesale.tdc.dk/wholesale/om/kpi/Sider/KPI_2014/Ra-kobber-og-Delt-ra-kobber-2014.aspx

There are examples of bitstream including cable bitstream being offered by a separated entity. Broadband in South Korea was initially deployed via cable technology by the state-owned companies Powercom and KT, under a regime of mandated structural separation⁹⁶. According to research conducted by WIK-Consult in May 2013, the structurally separated Australian NBN Co was providing layer 2 bitstream services at 121 handover points, which could be considered regional access, while the separated access provider across a large part of New Zealand – Chorus, was offering layer 2 local bitstream access, in both cases via FTTx (mainly GPON) technology.

Although theoretically possible, there may be questions over whether cable bitstream can be considered an enduring bottleneck. Moreover, the discussion flags another important issue – which is that vertical separation does not solve the root cause of a significant part of the competition problems in the Danish market, which stem from the integration of parallel infrastructures within a single company.

In turn, if functional separation were conducted purely on the copper and FTTx platform, this would not solve the problem of strategic decisions around the upgrade of specific technologies controlled by TDC (i.e. the possible preferential treatment of cable vs FTTx), and therefore would also fail to address some of the competition problems identified..

6.5 Divestiture of cable assets of TDC (option 5)

6.5.1 Description of option

TDC could divest its cable assets by selling it to another company and focus its activities on providing services over its copper/DSL and fiber networks.

An alternative to selling TDC's cable assets to another company would be an IPO (Initial Public Offering), where the shares of a newly created cable company would be offered on the stock market.

It should be noted that Denmark is the only remaining EU country where an incumbent still owns and operates the historical cable network. In other countries, incumbents have usually divested their cable assets following a government decision and at a time when governments were still major shareholders. There is, however, also a more recent case, where Portugal Telecom has divested its cable assets in what could be considered a voluntary commercial decision. Given that Denmark rests a unique case in

⁹⁶ For discussion see Ovum Consulting report for the World Bank "Broadband Policy Development in the Republic of Korea", October 2009.

the EU, we have assessed the option of separating cable from copper/fiber in the Danish context.

6.5.2 Pros and cons

Divestiture of cable assets could create the following advantages:

- The ownership separation of the copper/fiber and cable assets would improve infrastructure competition. It would create a new independent competitor in areas covered by cable. This would intensify competition in terms of network roll-out, network upgrade, and improvement of quality of service, and increased choice for customers. More specifically, the incumbent telecoms operator - in areas covered by cable - would put a higher priority on upgrading its copper network with VDSL2 vectoring and/or invest in FTTH roll-out.
- Ownership separation may allow deregulation of wholesale central access (wholesale broadband access as it is called today). This depends, among other factors, on at least three operators competing against each other. While this is not the case in rural areas, such an outcome could be relevant in urban areas. Here the separated cable company would compete with the incumbent telecoms operator (copper/fiber), access-based operators (i.e. based on wholesale central access/VULA) and/or an independent fiber operator. Three or more infrastructure based operators may be enough to deregulate wholesale central access. In two cases, the European Commission has not objected to regulators finding effective competition with three infrastructure-based operators.⁹⁷
- Ownership separation under certain conditions would also be conducive to access-based competition. As a result of the quicker upgrade of the copper network with VDSL2 vectoring in cable areas, access-based competitors will be able to rely to on more performant VULA products in these areas. This will remove or lesson their competitive disadvantage vis-à-vis cable. This effect would, however, not emerge if the increase of infrastructure-based competition led to the deregulation of all wholesale access markets, including the market for wholesale local access (and VULA products).

Disadvantages of divestiture of cable assets would include the following:

- Divestiture of TDC's cable assets would create substantial costs related to the separation of the divested assets; the reorganisation of the incumbent's

⁹⁷ In Portugal and the UK, the regulators deregulated the "urban" market for wholesale broadband access based on the incumbent competing with two infrastructure-based operators (e.g. a cable operator and an unbundler). See *Case PT/2008/0850: Wholesale (physical) network infrastructure access (including shared or fully unbundled access) at a fixed location*; *Case PT/2008/0851: Wholesale broadband access*; *Comments pursuant to Article 7(3) of Directive 2002/21/EC*. See also *Commission Decision concerning Case UK/2014/1606: Wholesale local access market* *Commission Decision concerning Case UK/2014/1608: Wholesale broadband access market*; *Comments pursuant to Article 7(3) of Directive 2002/21/EC*.

remaining business, and the sales process. Costs would be even higher in case of an IPO (Initial Public Offering) for a newly founded cable company.

- Divestiture is difficult to achieve for cable assets of telecom incumbents in which governments no longer have a majority share or other decisive influence. Private shareholders only consider divestiture if it increases shareholder value. A positive macroeconomic effect, i.e. more investment and competition, is not a private shareholder criterion. On the other hand, if divestiture would justify a substantial deregulation of wholesale access (perhaps wholesale central access and wholesale broadband access), then private shareholders should be inclined to consider more closely the merits of divestiture.

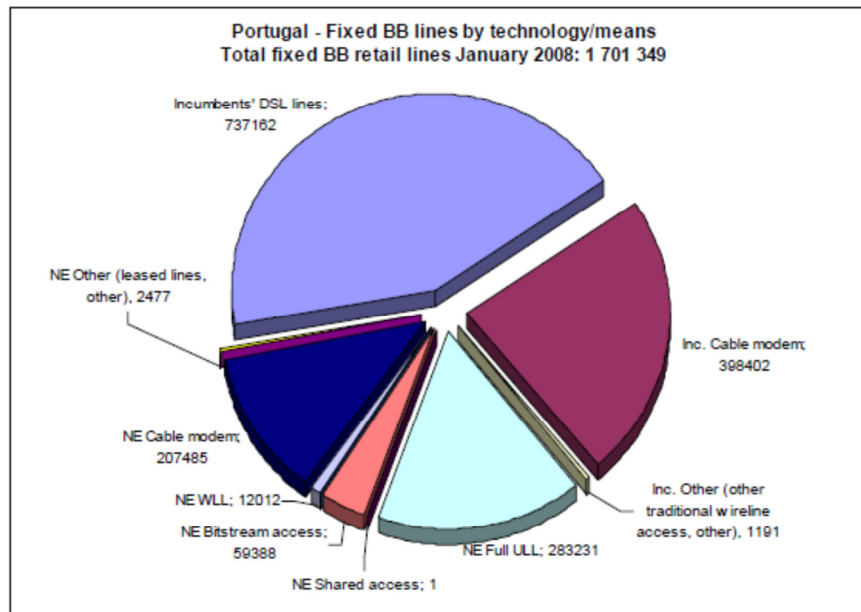
6.5.3 Selected countries experience - Portugal

Portugal provides an interesting case study of a country which saw the dynamics of competition (and consequently of regulation) change significantly following the divestiture of the cable operator (now ZON) from the incumbent Portugal Telecom.

The incumbent was initially granted a license to deploy cable networks in 1991. Due to the integration of the incumbent, relatively stringent SMP access obligations were imposed on the incumbent. A European Commission report from 2008 records⁹⁸ that, following the first round of market reviews after the introduction of the 2002 EU Framework for electronic communications, the NRA found the incumbent to have SMP in all but one of the markets it had analysed and imposed a full range of obligations, including a significant level of retail regulation. Prior to the spin-off of the cable operator, data from the European Commission suggests that Portugal Telecom had more than 70% share of the broadband market. New entrants relying on regulated access such as LLU and bitstream by comparison had less than 25% market share. The remainder was accounted for by an entrant cable operator. The overall structure of the market at this stage could therefore be said to be similar to that in Denmark.

⁹⁸ European Commission 13th Progress Report on implementation of the EU framework for electronic communications (COM (2008)153).

Figure 22: Portugal – broadband lines by technology January 2008



Source: European Commission 13th Implementation Report

In March 2007, a takeover bid launched by an alternative Portuguese operator (Optimus) for the incumbent and its cable subsidiary failed, because one of the conditions for the takeover bid was not approved by shareholders. However, the European Commission reports⁹⁹ that the incumbent had announced its intention to divest its 58.4% stake in the cable subsidiary should the takeover bid fail. This spin-off occurred on 7 November 2007.

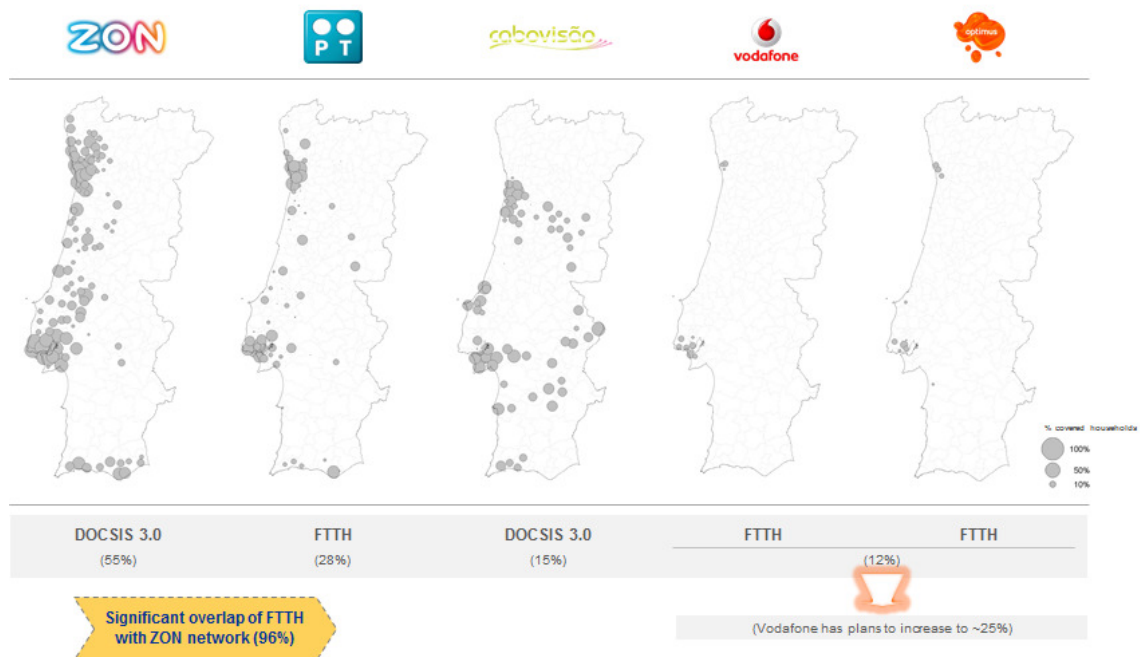
As a result, Portugal now benefited from cable competition to a significant portion of households. The stage was also set for infrastructure competition in the upgrade of networks towards NGA. By the end of 2012, data from the *Digital Agenda Scoreboard*, suggests that 84% of homes had access to networks capable of providing at least 30Mbit/s download speed (compared with an average of 62% across the EU). The share of subscribers taking connections of at least 30Mbit/s was 41% (double the EU average), while 100Mbit/s connections accounted for 19% of all subscriptions compared with 5% across the EU as a whole.

By 2013 the competitive situation and accompanying regulation were radically different compared with the years prior to divestment. Data supplied to the European Commission by Cocom suggests that by July 2013 regulated access for basic broadband of all types had fallen to 7% of broadband access lines, competitive cable lines represented 39% of broadband lines (roughly equivalent to the previous cable

⁹⁹ European Commission 13th Implementation Report

market shares, but now distinct from the incumbent), and 17% of end-to-end lines were provided by both the incumbent and alternative operators by means of 'other' technologies, understood to be mostly fiber. The geographic coverage of NGA networks achieved by the main operators as of the end of 2013 is shown in Figure 23.

Figure 23: Coverage of NGA networks in Portugal by operator, end 2013



Source: ANACOM presentation March 2013

It is clear from the picture that at this time, PT's coverage of NGA was behind that of ZON. The regulator ANACOM attributes some of the dynamics in NGA deployment to the catch-up that was needed by PT to match cable deployment.

Although alternative operators' FTTH is available only in limited areas (and Optimus has since merged with ZON¹⁰⁰), it is also clear that in the mostly densely populated regions, end-users may have access to 3 or 4 NGA infrastructures. The increased levels of infrastructure competition have resulted in a reduced focus on ex ante regulation for NGA in Portugal in comparison with the tight rules that were imposed on PT prior to the divestment of cable. As of March 2014, there was still no ex ante regulation of PT's

¹⁰⁰ One of the conditions of the merger proceeding was for Optimus to offer to divest its FTTH assets to the remaining significant fixed entrant Vodafone.

FTTH network. Vodafone has also declared its intention to increase FTTH deployment in Portugal, with plans to cover 1.5 mio. homes by mid-2015¹⁰¹.

Although it is clear that competitive dynamics in Portugal changed significantly following the cable divestiture, and this may have influenced PT's behavior, it is important to note that this was not the only reason for the developments in infrastructure competition. Since the start of cable deployment, cable had shared ducts with PT's copper network, and this early limited duct access regime was widened to other operators with some success (see section 6.1.3.2 for details). It is likely that the effective SMP regulation of PT ducts contributed to the roll-out of FTTH by alternative operators in Portugal.

A further issue specific to Portugal is the Government ownership at the time of the cable spin-off of 500 golden shares in Portugal Telecom that provided extended voting rights over strategic decisions¹⁰². The Portuguese Government revoked its golden share in PT (along with similar shares in other utilities) in 2011¹⁰³ following a 2010 EU court ruling¹⁰⁴ that such shares were illegal. However, the Government held such shares at the time of the divestiture.

PT's decision to divest its cable assets may have been commercially driven. The divestiture allowed it to pay additional dividends to shareholders as a reward for blocking the takeover. In practice the divestiture was approved by the vast majority of shareholders.¹⁰⁵ The separation of cable from copper assets was also already under consideration as it had been cited in December 2006 by the Portuguese competition authority as a condition for the merger with Sonaecom to go ahead.¹⁰⁶ However, it cannot be excluded that the influence of the Government via its golden shares may directly or indirectly have influenced PT's decision regarding the spin-off of cable, as some media reports implied.¹⁰⁷

¹⁰¹ Vodafone news release (<http://www.vodafone.com/content/index/media/vodafone-group-releases/2014/award-fiber-rollout.html>)

¹⁰² See FT article (<http://www.ft.com/intl/cms/s/2/0a51e156-bd5e-11db-b5bd-0000779e2340.html#axzz3B2XP5wdz>)

¹⁰³ See Reuters report (<http://www.reuters.com/article/2011/07/05/portugal-goldenshares-idUSLDE76414L20110705>)

¹⁰⁴ <http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:62008CJ0171>

¹⁰⁵ Bloomberg claims 90% of shareholders backed the divestiture of cable (<http://www.businessweek.com/news/2007-04-27/portugal-telecom-shareholders-approve-pt-multimedia-spinoff>)

¹⁰⁶ See <http://www.concorrencia.pt/SiteCollectionDocuments/AdC/RelatorioPT2007.pdf>

¹⁰⁷ See for example <http://www.ft.com/intl/cms/s/2/0a51e156-bd5e-11db-b5bd-0000779e2340.html#axzz3B2XP5wdz>, <http://www.neurope.eu/article/sonaecom-may-have-sell-pt%E2%80%99s-copper-network>, <http://variety.com/2007/biz/news/takeover-bid-shakes-portugal-biz-1117960872/>

6.5.4 Relevance of option in Danish context

In the Danish contest, divestiture of cable assets could create the following advantages:

- Divestiture of TDC's cable assets would likely improve infrastructure competition. It would create a new independent competitor in an important part of Denmark (coverage of the TDC cable network is 50% of homes). While it would not raise the number of infrastructures, it would raise the number of *competing* infrastructures in many locations in Denmark. This would intensify competition in terms of network roll-out, network upgrade and product innovation and provide more choice to an important part of Danish customers. Notably, TDC would have an immediate incentive to upgrade its copper network with VDSL2 vectoring across the national territory (where viable) rather than focus primarily on areas where there is no cable. An independent cable operator may also create incentives for TDC to expand the geographical footprint of its fiber network in cable areas.
- Ownership separation could allow deregulation of wholesale central access (wholesale broadband access as it is called today) in Denmark. TDC may no longer have individual SMP if cable is separated and regional markets are defined to catch the higher degree of competition in these markets. The higher density markets would be characterized by three infrastructure-based competitors: Copper (TDC), cable (new operator separated from TDC, respectively SE/Stofa), fiber (TDC, and SE or Waoo!). Whether the additional infrastructure competition would also allow the deregulation of wholesale local access (including VULA) is difficult to predict.
- The consequences of ownership separation for access-based competition would depend on the amount of deregulation justified by the increased infrastructure competition. If regulated access of wholesale local access was maintained, notably VULA, there could be an improvement of access-based competition. As TDC would have improved incentives to implement quicker vectoring upgrades and/or fiber roll-out in cable areas, VULA-based competitors would be able to benefit from improved access products.

Disadvantages of divestiture of cable assets would include the following:

- Divestiture of TDC's cable assets would create substantial costs related to defining the scope of the divested business activities, reorganising TDC, and managing the sales process. Alternatively, the cable business could be transformed into a public limited company and shares offered at the stock market in form of an IPO (Initial Public Offering). The costs of an IPO are likely to be even higher.
- There does not seem to be a legal basis to make divestiture a policy option. Neither EU nor Danish law provides such basis. Divestiture could of course be a commitment imposed by Competition Authorities in a merger approval procedure. At this point in time, such merger is difficult to envisage.
- It is also uncertain whether there is an incentive for voluntary divestiture. TDC's shareholders would only consider divestiture if this enhances the value of their

shares. In fact, it is not excluded that divestiture may enhance shareholder value if substantial deregulation can be expected. It is quite likely that, following divestiture, at least in the urban areas, infrastructure-based competition could be considered strong enough to deregulate at least wholesale broadband access (in the future, wholesale central access). A less regulated environment would be factored in when assessing a company's value.

6.6 Comparison of options

Section 6 has outlined the advantages and disadvantages of options that could improve competition in the Danish broadband sector. Table 12 provides a comparative view of the options in terms of

- Whether implementation of the option can be mandated or depends on a voluntary (i.e. commercial) decision of the operator(s);
- Whether, and to what extent, it likely increases infrastructure-based competition (potentially allowing removal of SMP regulation);
- Whether, and to what extent, it likely increases access-based competition;
- Whether there are one-off implementation costs; and
- Whether there are recurring implementation costs.

Table 12: Comparative assessment of options to improve competition in the Danish broadband market

No.	Option	Mandated or voluntary?	Competition benefits		Implementation costs	
			Increase of infrastructure-based competition?	Increase of access-based competition?	One-off implementation costs?	Recurring implementation costs?
1	Greater role for municipalities in fostering digital infrastructure readiness	Mandated	√	-	↑	↑
2	Symmetric FTTH terminating segment network sharing	Mandated	√	-	↑↑	↑↑
3	Access to fiber networks of utilities	Voluntary	-	√ ⁽¹⁾	↑	↑
4	Functional separation of TDC	Voluntary	-	√√	↑↑	↑↑
5	Divestiture of cable assets of TDC	Voluntary	√√√	√ ⁽²⁾	↑↑↑	-

Notation:

Competition benefits: √: Low benefits, √√: Medium benefits; √√√: High benefits.

Implementation costs: ↑: Low costs; ↑↑: Medium costs; ↑↑↑: High costs.

⁽¹⁾ If demand for access to fiber utilities came predominantly from TDC, a positive effect on access-based competition would not materialize.

⁽²⁾ If the increase of infrastructure-based competition led to the deregulation of wholesale access markets, access-based competition would decrease. In these circumstances, access-based competition would, however, become less important for overall effectiveness of competition and market performance.

Source: WIK

The results of the table can be summarised as follows:

Mandated versus voluntary:

Only two options can be mandated and therefore be regarded as genuine policy options: The first option is giving a greater role to municipalities in fostering digital infrastructure readiness. The second option is imposing symmetric FTTH terminating segment network sharing.

The other options considered lack a legal foundation and therefore cannot be imposed on a mandatory basis. They become relevant if they make commercial sense to the relevant operators, respectively company shareholders. This applies in relation to

access to fiber networks, but also to functional separation (unless imposed through SMP regulation, which was not considered) and divestiture of cable assets of TDC.

Promotion of infrastructure-based competition:

Divestiture of TDC's cable assets clearly fares best, when it comes to promoting infrastructure-based competition and dealing with the origin of much of the current competition problems. FTTH terminating segment network sharing potentially could also have an impact on infrastructure-based competition, it seems however that demand for it may be limited to TDC. Giving municipalities a greater role has a relevant, though limited, impact on infrastructure-based competition.

The other options - access to fiber networks of utilities and functional separation of TDC - are unlikely to contribute to a relevant extent to infrastructure-based competition.

Promotion of access-based competition:

Functional separation fares best in terms of promoting access-based competition. Access to fiber networks of utilities could potentially also provide a stimulus, but it remains to be seen whether operators other than TDC would express an interest in it. Arrangements between fiber utilities and TDC could be prohibited by the Danish Competition Authority if they give rise to competition problems.

Divestiture of cable assets of TDC, however, may also have a positive impact on access-based competition as it may improve TDC's incentives to upgrade its copper network with vectoring or roll out FTTH in cable areas and thus improve access products for competitors. In turn, if the creation of an independent cable operator lead to a significant enough increase in infrastructure-based competition, access-based competition would become less important for overall effectiveness of competition and market performance. This would likely lead to deregulation of wholesale access markets.

The other options – greater role of municipalities and FTTH terminating segment network sharing – do not promote access-based competition. Their primary focus is on strengthening infrastructure-based competition.

One-off implementation costs:

All options create one-off implementation costs. Such costs are highest for divestiture of TDC's cable assets given the necessary reorganisation of TDC and the sales process or IPO (Initial Public Offering). The cost of implementing functional separation and FTTH terminating segment network sharing is also significant. Costs are lowest in case of a greater role of municipalities and access to utilities' fiber networks.

Recurring implementation costs:

Divestiture of cable assets of TDC, once completed, has no recurring costs. All other options create to a varying degree recurring implementation costs.