VERY HIGH SPEED BROADBAND DEPLOYMENT IN EUROPE: THE NETHERLANDS AND BULGARIA COMPARED

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ABSTRACT

Europe is trailing Japan, South-Korea and the USA in the deployment of very high speed broadband networks like FTTH and FTTB. Deployment and adoption over various European countries is however very uneven. The roll out of Next Generation Access networks in Bulgaria, a developing Eastern European nation, and the Netherlands, the current OECD Broadband penetration per capita leader, are compared at the national and sub-national level. The case studies are based on data from surveying users, expert interviews and collected statistics. Both countries show the fastest deployment of new infrastructure occurs in areas where citizens (organize to) wire up their neighborhoods lead by (local) entrepreneurs who bypassed incumbents.

Footdragging incumbents induced entry by industry outsiders deploying new high bandwidth technologies in both countries, but very different institutional contexts strongly affected the market outcome. The case studies show which factors contributed to the current high ranking in international bandwidth performance indices of both countries. The study explains why Bulgaria today has 670 high-bandwidth service providers, while in the Netherlands FTTH roll out rapidly consolidated into the business of a few construction firms, real estate owners and pension funds who shifted the market from broadband services to selling (unbundled) fibre as the benchmark product.

The study finds esthetical policies to avoid aerial wiring, as well as non-forward looking cost models for unbundled copper loops and tri-annual market regulation reviews strengthen incumbents by tilting the regulatory context towards short term equipment upgrade investment above new cable construction. This adds to the explanations why Europe trails other countries in new infrastructure roll out.

INTRODUCTION

The European Union's policy makers have a problem. Europe is trailing Japan, South-Korea and the USA in the deployment of very high speed broadband networks like Fibre-To-The-Home (FTTH) and Fibre-to-the-Building (FTTB). As the European Union's broadband adoption wasn't trailing the Asian and North-America OECD-countries, this is a matter of concern. It might imply that the way the EU's regulatory framework is implemented provides disincentives for investment and/or new entry. The ladder of investment[1], may not be climbed to the final and most expensive investment step: new entrants constructing new (optical) local loop access networks into the premises of endusers in direct competition with the owners or exploiters of older twisted pair copper and coaxial networks, the incumbents.

Such an observation, that market parties stopped on the ladder of investment in local exchange buildings at the Main Distribution Frame, would imply that todays infrastructure competition in access networks between operators using a copper network and others using a coaxial network is mainly an accident of history as digital subscriber line (DSL) technology and cablemodems enabled two idiosyncratic networks, one originally designed for voice telephony and the other for cabletelevision, to now convey similar digital services. Upgrading these networks

[1] The ladder of investment, a dynamic theory about market entry via easily replicated assets, was first described in Cave, M, S. Majumdar, H. Rood, T. Valetti & I. Vogelsang (2001), The relationship between Access Pricing Regulation and Infrastructure Competition, Report to OPTA and DG telecommunications and Post. A revised version of these papers can be found in Telecommunications Policy, Vol. 27, No 10-11 (2003)

to higher capacity would be a replacement decision at the discretion for their owners, without a serious threat of competitive entry. With a duopoly in areas were both types of fixed access networks co-exist, and a monopoly in the areas or even entire countries[2] where only one market party operates a local loop network, a low dynamic market structure results, with either a tit-for-tat duopoly or ongoing access regulation of old copper unbundled local loops with low incentives to upgrade them.

Deployment and adoption of FTTH/B over various European countries is however occurring, but very uneven. This can be easily seen from Figure 1.

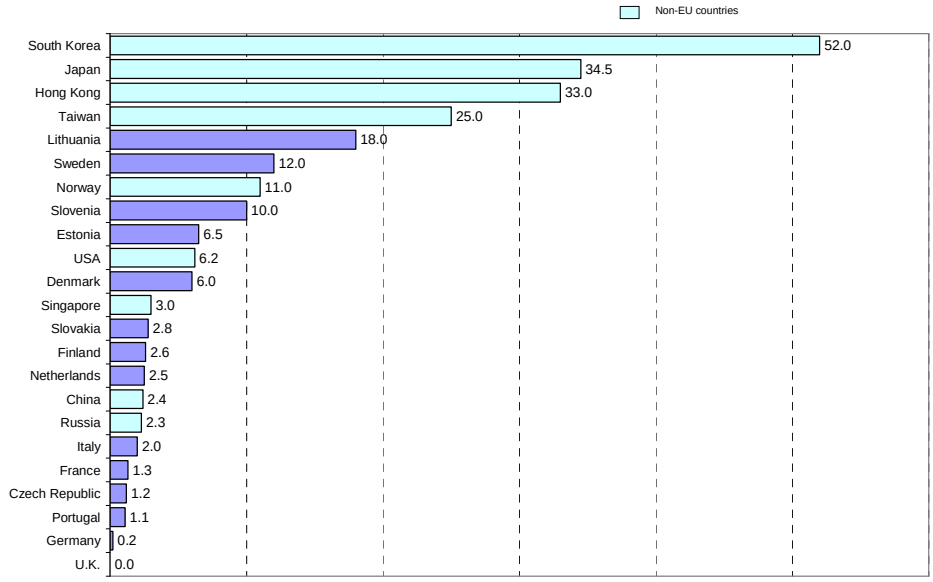

Figure 1 : Percentage of households subscribed to Fiber-to-the-Home/Building Services, February 2010[3]

The Global FTTH Council only tracks those countries where FTTH/B active subscriber penetration has risen above 1%, so McKinsey&Co added Germany and the UK, countries where fibre roll out and uptake has been minimal. The EU27 penetration is 1.1% of the households[4]. This is far behind the leading Asian countries and the USA, China and Russia. McKinsey&Co remarked:

The main hurdle in upgrading fixed access networks is financing. Achieving penetration levels in Europe that begins to rival those in Asia will cost in the ballpark of EUR 300 billion. This amount represents a significant stretch for the fixed-line industry. For instance, even if 100 percent of the industry free cash flow were to be invested in the fibre upgrade, it would still take 15 years to cover an investment of this scale.

Thus, without outside investors entering the market there isn't much acceleration to be expected to say a roll out pace where in a decade 80% or more of the EU27 households will be connected to a FTTH/B access network. Such a roll-out pace would be needed to upgrade the EU27's fixed network infrastructure to a level that rivals the leading Asian nations in penetration.

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[2] In Italy coaxial CATV-networks based cable services have not been implemented

[3] Source: Global FTTH Council February 2010; IDATE, ARCEP, Pyramid Research in McKinsey&Co Whitepaper, Creating a Fiber Future, 25 feb 2010, Exhibit 3 http://www.slideshare.net/ceobroadband/mc-kinsey-white-paper

[4] Authors calculation based on FTTH Council February 2010 study (by IDATE) and EU 2008 private household numbers from MAVISE database, http://mavise.obs.coe.int/

However as we already could observe from Figure 1 the country of Lithuania already has reached an active subscriber level of 18% of all households, not far behind the leading Asian countries. Also Slovenia and Estonia have reached active subscriber penetrations that are between the leading Nordic countries. This is intriguing as it suggests these countries might be leapfrogging in infrastructure roll-out. The picture of very high speed broadband development in Europe however becomes even more fascinating, when we turn to actual upload and download performance measurements, made by BitTorrent, Inc from their user base software clients. These are listed in Table 1. Suddenly we observe high rankings from ISPs from Bulgaria, Latvia, Romania and the Ukraine where a globally widely used application outperforms the measurements in the ISP-networks in leading OECD-countries.

Table 1 : BitTorrent, Inc ranking of countries by measured upload speed listing the fastest ISP network:[5]

Country	ISP	kbps up	kbps down
China	China Internet Network Information Center	51,202	65,535
Lithuania	LTD Elekta	37,304	69,851
Bulgaria	BBC Cable Ltd.	32,677	59,074
Latvia	Telenet Network	19,147	33,722
Romania	Cobalt IT s.r.l.	17,774	48,199
Russia	New Telesystems Ltd.	11,840	63,514
Sweden	Skycom Nordic AB	11,792	17,864
Ukraine	Kyiv Optic Networks ltd.	9,224	38,505
Norway	Altibox AS	7,963	11,160
Japan	U's Communications Corp.	6,692	31,430
Netherlands	Edutel BV	5,979	10,045
Czech Republic	STARNET-NET	5,846	9,042
Hong Kong	City Telecom (H.K.) Ltd.	4,533	25,675

USA	Optimum Online (Cablevision Systems)	2,104	8,227

For those who would object that only taking the best performing access network in a country, doesn't make much sense, BitTorrent CEO, Klinker had added a slide where he compared the upload speed of the 29 fastest ISPs with the ISPs in the USA. Those 29 contained 4 ISPs from China, 7 from Lithuania, 13 from Bulgaria, 4 from Latvia and 1 from Romania. With the slowest of these 29, Bulgarian ISP Interbild Ltd. With a measured average upload speed of 12,896 kbit/s and download speed of 24,714 kbit/s. This is a faster upload performance than the best performing Russian network, and a better up/down performance than the best performing network in Sweden, Skycom Nordic AB.

Already in the October 2009, second Broadband Quality Study, commissioned by Cisco[6] and executed by Saïd Business School (Oxford) and the University of Oviedo, it was found that:

Nine countries, South Korea, Japan, Sweden, Lithuania, Bulgaria, Latvia, The Netherlands, Denmark and Romania, have the broadband quality required for future web applications, such as high definition Internet TV viewing and high-quality video communications (such as home telepresence) that will become mainstream in the next 3 to 5 years. In 2008, only Japan exceeded this threshold.

[5] Sources: Eric Klinker, CEO Bit Torrent, Inc. The future of P2P. Presentation eComm America, San Francisco, USA, April 2010 http://blog.ecomm.ec/2010/08/bittorrent-future-of-p2p.html

[6] http://www.cisco.com/web/MT/news/09/news_021009a.html and report at http://www.sbs.ox.ac.uk/newsandevents/releases/Pages/GlobalBroadbandQuality.aspx

This study also listed the best 20 performing cities with their Broadband Quality Score metric which included major cities from Japan, Lithuania, South Korea, Sweden, China, Bulgaria, The Netherlands, Romania, Latvia, Denmark, Switzerland and Slovakia.

The superior performance in very high speed Internet Access in a number of Central and Eastern European countries that only recently joined the EU provokes a closer empirical look as it is quite unsuspected. One would not be surprised when high-income countries that lead the OECD-statistics on broadband showed up leading the pack of the best broadband quality performance rankings. Table 2 lists the FTTH/B subscriber penetration from Figure 1 and a number of usual suspected drivers. Household and population size, GDP per Capita and several so-called Information Society Indicators: the Digital Divide Index, ICT spending as % of GDP, current household and enterprise broadband penetration.

Table 2 : FTTH/B penetration and broadband Information Society Indicators in high subscriber countries:[7]

Country	% hh FTTH/B	hh ('000)	population	GDP per cap (PPS)	Digital Divide Index	ICT spend % of GDP	Household broadband	enterprise broadband
Lithuania	18.0	1,413	3,349,872	61.3%	0.56	1.8%	51%	56%
Sweden	12.0	4,200	9,256,347	121.4%	0.84	3.8%	84%	89%
Norway	11.0	2,171	4,799,252	190.0%	0.82	2.4%	84%	86%
Slovenia	10.0	774	2,032,362	89.8%	0.56	2.2%	59%	84%
Estonia	6.5	548	1,340,415	67.2%	0.71	2.9%	58%	88%
Denmark	6.0	2,564	5,511,451	118.3%	0.79	3.2%	82%	80%
Slovakia	2.8	1,714	5,412,254	71.9%	0.55	2.5%	58%	79%
Finland	2.6	2,453	5,326,314	115.0%	0.77	3.2%	72%	92%
Netherlands	2.5	7,207	16,486,587	134.9%	0.85	3.3%	86%	86%
Italy	2.0	24,258	60,053,442	100.5%	0.57	1.7%	47%	81%
France	1.3	26,982	64,351,000	107.3%	0.74	3.1%	62%	92%
Czech Republic	1.2	4,319	10,467,542	80.4%	0.60	3.2%	46%	79%
Portugal	1.1	3,892	10,627,250	75.3%	0.54	1.8%	46%	81%
Germany	0.2	39,722	82,002,356	115.8%	0.74	2.9%	75%	84%
U.K.	0.0	26,541	61,634,599	117.5%	0.70	3.5%	71%	87%
Bulgaria	?	2,882	7,606,551	40.1%	0.45	2.0%	25%	62%
Romania	?	7,384	21,498,616	45.8%	0.46	2.1%	30%	44%
EU27	1.1	195,593	499,695,154	100.0%	0.66	2.7%	60%	81%

Only cursory scrutiny of correlations reveals that there aren't any clear patterns, and econometric regression will not yield significant results. Even stronger, the last two countries that joined the EU, Bulgaria and Romania, weren't listed as having deployed much FTTH/B. Despite that, they have entered the top ranks in actual broadband quality measurements and metrics.

Methodology

The observations from the introduction have driven the interest to take a closer empirical look on what has actually occurred in Central and Eastern European countries where, while still at the low side in the total broadband penetration index, and assumed to be countries with many unserved and/or underserved areas by policy makers as

[7] Sources: FTTH/B subscriber penetration from Global FTTH Council February 2010; McKinsey&Co White paper
Households from EU MAVISE Database http://mavise.obs.coe.int/ , other data from 8th e-Government Benchmark Measurement, November 2009. EU DG Information Society and Media, prepared by Cap Gemini, RAND Europe, IDC, Sogeti and DTi / Eurostat data

well as the commissioners of part of the research for this study[8], actual broadband quality performance reaches levels that allows fixed Internet users in those countries to leapfrog into the global front seats.

As already described when commenting on Table 2, it didn't make sense to engage in a quantitative comparative econometrics study, as there were strong indications that aspects like institutional arrangements and regulatory context (or lack of regulation) influences the quite different outcomes we observe today. Therefore the paper will contrast two countries that are on the extreme of some of the metrics in Table 2 by in-depth case studies, focussing on (historic) market evolution and the interplay of economic actors with the regulatory environment.

The two countries are:

- **Bulgaria,** a country that only recently (2007) joined the EU and as can be seen from Table 2 has the lowest GDP per capita as well as lowest broadband household penetration and lowest score on the Digital Divide Index
- **The Netherlands**, an EU-founding country that has the highest GDP per capita from the EU-members in Table 2 as well as the highest broadband household penetration and score on the Digital Divide Index.

The study will track and compare the countries at the national and sub-national level. The case studies are based on data from surveying users, expert interviews and collected statistics on the evolution of the networks. For Bulgarian case this paper draws on material collected in a joint study commissioned by the FTTH Council Europe executed with the Yankee Group, Stratix Consulting and ISOC Bulgaria. For the Dutch case, the material is drawn from Stratix Consulting's field research as well as (public) statistical sources.

Both the Netherlands and Bulgaria are characterized by the construction of the new very high-speed networks by new entrants. This is according to IDATE still a very dominant pattern in Europe (including Russia)[9]. 74% of the homes passed with FTTH/B in December 2009 were serverd by Alternative Operators, 9.6% by municipalities or utilities they control, and 1.3% by housing corporations and others. Only 15.1% of the homes is passed by incumbents.

A theoretical angle

Our approach is also to assess whether a local FTTH/B access net could be consider as a kind of newly created shared / common pool resource in a community. In line with work by E. Ostrom[10] on institutional arrangements around Common Pool Resources, we take as overarching working hypothesis that even when we talk about public goods and services that the market cannot supply, or government provides but inefficiently, people can develop complex institutional arrangements in order to produce and distribute precisely those goods and services. Thus, that people can solve complex cooperation and coordination problems of governance without the state being involved in any way. As Aligica and Boettke[11] observed:

They [The Ostrom's] discovered for instance the possibility of conceiving a situation when the units of government were "collective consumption units" whose first order of business is to articulate and aggregate

[8] The Bulgarian field research for this study was part of a study the Fiber-to-the-Home Council Europe commissioned to the Yankeegroup of Boston, MA on the socio-economic effects of Broadband in a country with many unserved and underserved areas, with Stratix Consulting as research co-ordinator and ISOC Bulgaria as subcontractor.

[9] IDATE: FTTH Panorama for December 2009 on behalve of the FTTH Council Europe, presented 24 february 2010, annual FTTH CE conference, Lisbon slide 10: Breakdown of homes passed FTTH/B

[10] E. Ostrom, Governing the Commons: The Evolution of Institutions for Collective Action, Cambridge University Press (1990)

[11] P.D. Aligica and P. Boettke, The social philosophies of Ostroms' Institutionalism, Working Paper 10-19 April 2010, Mercatus Center, George Mason University

demands for those goods that are subject to joint consumption where exclusion is difficult to attain. In that specific situation relationships are coordinated among collective consumption and production units by contractual agreements, cooperative arrangements, competitive rivalry, and mechanisms of conflict resolution.

It is obvious that a local telecommunications network is an exclusionary good: one can connect to it, or not. However this characteristic is reduced due to the attractiveness of collecting in the value from positive network effects. A network rises in value when more people are connecting to it and this is also strengthened by economies of density. As it is a relatively low marginal cost (subadditive) to also connect the neighbours. Therefore, whenever the incumbent(s) or a combination of the incumbent and government creates a situation that amounts to a refusal of supply, people in the local areas that are confronted with such a decision, but have the idea that more of them are around, with similar demands can engage in attempts to articulate and aggregate local demands and try to solve the complex cooperation and coordination problems without the incumbent and/or the state or regulator involved.

In a standard model for empirical research in institutional economics on institutional change, economic organizations and households observe economic outcomes and when unsatisfied with what they observe, they approach political organizations who decide to implement institutional change and supplies them with new or different formal institutions[12]. For analyzing the typical lobbyist / regulatory affairs trajectories in telecommunications, such a model is a logical approach.

However the case differs for a group of people who articulate a demand to each-other and decide to circumvent either the incumbent or the regulator / polity or both, by creating a set of alternative cooperative and contractual arrangements to jointly create a new resource. As Noam discussed in Network Tipping, the rise and fall of the Public Network Monopoly[13] there is a need to overcome the critical mass point, but such a critical mass point can be surpassed by articulation and demand aggregation. Passage of a critical mass point by articulation and demand aggregation tends to be much easier when one operates in an environment of relatively high social homogeneity, as it is then easier to find likeminded peers. It should not be a surprise that in real cases the more entrepreneurial types might be able to gradually transform their joint project in an actual business.

When people succeed, due to the economies of densities and positive network effects the successful new institutional arrangements (contractual and cooperative arrangements, as well as rivalry and conflict resolution) can rapidly grow, and they tend to attract entrepreneurs or investors as counterparty. If these new arrangements can easily be replicated, then one can expect a so-called run for the market, with massive entry of “copycats” and a “take off” takes place. However if these arrangements are highly complex, and very idiosyncratic to a certain area, a group of people with specific demands, or dependent on the personality and social position of the proponents, who articulate and aggregating demand etc. such efforts could turn out to be successful only at a few locations.

When analyzing the two case studies on how idiosyncratic the specific circumstances are or whether there are lessons to learn for other countries to induce a dynamic evolution.

I. BULGARIA

In September 2009, the Fiber-to-the-Home Council Europe’s Market Intelligence Committee commissioned a study of the Bulgarian fiber market to evaluate the impact of the FTTB offerings in this country. The qualitative and quantitative study was undertaken by Yankee Group Research and Stratix Consulting and ISOC

[12] See, Figure 3, The dynamics of institutional change in Lee Alston, Thráinn Eggertson and Douglass C. North, Empirical Studies in Institutional Change

[13] Telecommunications in Europe, Chapter 3, in Network Tipping, the rise and fall of the Public Network Monopoly

Bulgaria between September and December 2009. This section draws on the expert interviews, a survey with 513 respondents and general findings of that study[14].

The key objectives of the study were to assess the extent and impact of FTTB broadband in Bulgaria and its socioeconomic benefits.

The main methodological approach was to compare the socioeconomic situations of Internet users in Bulgaria by making a distinction between users of FTTB and other types of connections.

Research methods have been primarily focused on data collection through the deployment of an online Web survey. In addition, a number of face-to-face interviews with key experts in Bulgaria were undertaken to form a better understanding of context and add qualitative elements to the picture. The main topics for the interviews were the change in socioeconomic condition as a result of the emergence of broadband infrastructure, as well as the way FTTB has developed in the country in contrast with the generic broadband competitive landscape.

As the soon for the generic public released study focuses more on the survey results, this paper will give more attention to the broadband competitive landscape.

The Bulgarian broadband market is a-typical in that some of the trends that have been emerging slowly in developed markets over recent decades seem to have played out much faster in Bulgaria. While the country still ranks last in broadband penetration in the EU, the growth in broadband penetration has been strikingly fast in the last few years and has been driven mostly by fiber connectivity. Fifty-five percent of Bulgarian broadband customers enjoy speeds in excess of 10 Mbps, and according to our survey results, approximately 30 percent have fiber to the building (FTTB).

This fast development of FTTB is due in part to the reluctance of incumbent Vivacom to allow any form of unbundling, as well as to the loose regulatory framework around physical network deployment. This has allowed a large number of small entrepreneurs to deploy fiber connectivity to buildings in their own neighborhoods extending LAN-links and provide end-users with high-quality connectivity.

1. The Bulgarian high-tech and telecoms market history[15]

Bulgaria was the leading computer and telecoms electronics producer of the COMECON[16] from the 1970s until 1990. Bulgarian computer and computer related exports amounted to 48% of the country's total export. In 1989 electronics and telecommunications accounted for 25% of the Bulgarian industrial production and a total of 130 thousand people were employed including 8,000 high-level engineers. Due to this manufacturing history Bulgaria had a relatively high fixed telephone line penetration.

This industry collapsed entirely after 1990. Leaving a lot of people with knowledge about electronics and software, but without a job as the technology changed dramatically. Since 1997 the economy stabilized, however already in 1995 some of the more entrepreneurial citizens had launched the first commercial internet Service Providers. With this new technology there was an obvious lack of skill, but also open terrain for new indigenous

[14] In the contract with the FTTH CE the detailed contents of the study *Socioeconomic Benefits of Bulgarian Fiber Broadband* will be reserved for their membership until September 2010, and then publicly released.

[15] Historic figures from Bulgaria: ICT infrastructure and E-Readiness assessment, ARC Fund 2002. p. 11-12 http://unpan1.un.org/intradoc/groups/public/documents/untc/unpan016719.pdf

[16] The Eastern European mirror-organisation to the Western European Economic Community

start-ups. The general public in Bulgaria quickly got used to the Internet and Personal Computers via Telecentres and Internet Café's. As of 2004, this resulted in a shift away from using public access points, with more and more households buying PCs and an Internet connection.

Historically, (since 1991) there have been relations between the Bulgarian incumbent BTC and operators KPN Telecom and OTE. However, in 2000 the Bulgarian government considered a take-over bid by their consortium too low. Soon after their rejection the Telecom-crash of 2001 occurred.

Attempts to sell off to foreign investors got delayed until BTC was sold in 2004 to Viva Ventures. It is now renamed to Vivacom and as of November 2007 AIG Investment[17] holds 94% of the shares. As a consequence of the protracted sale of BTC, ADSL was only launched in 2004. The inaccessibility of the copper and duct network after the market was liberalised in 2002, at which time BTC was not yet sold, strongly stimulated ISPs and CATV firms to find their own way and launch broadband with new self constructed networks.

Today the Bulgarian broadband market is characterised by two kinds of ISPs:

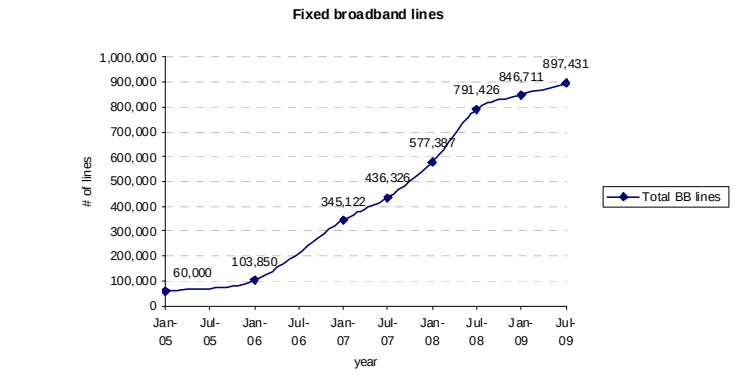
First-level ISPs, firms whose main business lies in providing broadband internet connectivity to end-users nation-wide and serve as primary internet suppliers to all second-level ISPs. First-level ISPs also supply large corporate customers and have developed international backbone to the largest European internet Exchanges.

Second-level ISPs, who operate typically within a single town/city or several nearby towns. They usually provide internet connectivity and accompanying services to end users and small business.

The number of second-level ISPs has varied considerably in Bulgaria. It reached more than 150 in the year 1999, but after a series of mergers and acquisitions the number fell down to about 50-60 companies in 2001. However, with the construction of the new broadband networks to bypass Vivacom/BTC, the sole DSL-provider, their number has exploded to 670.

2. The Bulgarian Broadband Market

Compared to other countries in the EU, the information society in Bulgaria is still at a relatively early stage of development. In 2005, the broadband market in Bulgaria was nearly nonexistent, and broadband penetration stood at less than 1 percent of the population of 7.7 mln.



Source: CRC, Eurostat

Figure 2 : Growth of fixed retail broadband lines, Bulgaria (2005 – 2009)

[17] An Investment vehicle of American International Group, the failed insurer.

The steady growth of broadband subscriber lines and emergence of high-speed offerings can be mainly attributed to the efforts of local broadband LAN services providers. Their service answers the growing need among users for an affordable broadband product, with high speeds and quality of connections. In recent years, broadband LAN has developed into the dominant type of access technology in use.

Today, about 91 percent of all fixed subscriber broadband lines offer service over 2 Mbps, and nearly 55 percent exceed speeds of 10 Mbps, making Bulgaria the leading member state in the EU regarding local penetration of over 10 Mbps lines (see Figure 3).

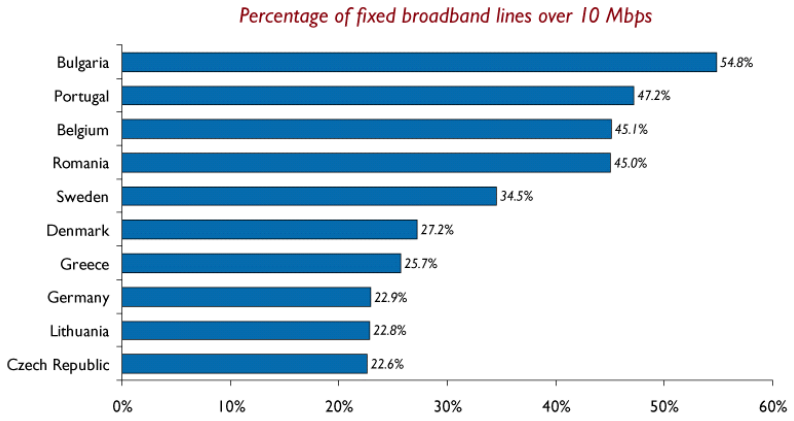


Figure 3 : Top 10 in EU: The majority of Bulgarian subscribers receive more then 10 Mbps (Source: EC, July '09)

One of the main causes for this market situation has been the dominant position of formerly state-owned incumbent BTC (now Vivacom), which stalled the deployment of xDSL up to 2005. For years, the fixed telecommunications market in Bulgaria has been characterized by limited competition and the clear dominance of the incumbent, even after the market was liberalized in 2002 and BTC was privatized in July 2004. Because access to the copper and duct networks was impossible, ISPs and CATV firms decided to find their own way to launch broadband with self-constructed small aerial cable networks.

At the start, these networks were built on an amateur basis and with minimal regulation by local or national government(s), resulting in a situation where LAN operators deployed their cables in the private domain by spanning overhead cables across the gaps of apartment blocks. In other cases, they have accessed the incumbent's ducts without any authorization or payment. Figure 4 illustrates what a typical LAN network in the city of Sofia looks like.

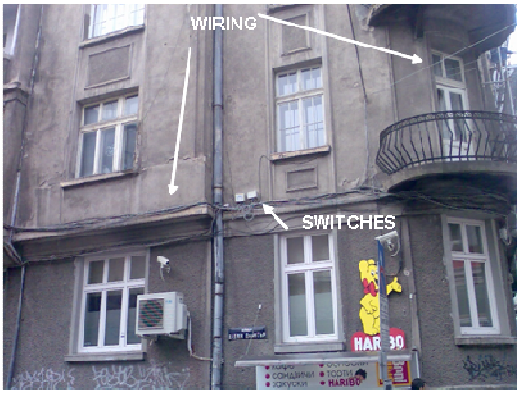


Figure 4 : Example of aerial cabling for broadband LAN networks

People were wiring up their neighborhood without regulation by the (local) government(s), keeping building costs and operational costs low. These low costs have been a key driver for the fast increase in both the number of LAN operators and their subscribers. A typical 10 Mbit/s symmetric Broadband LAN subscription costs 20 Bulgarian Lev (€10.22) per month, a 50 Mbit/s subscription around 45 BGN.

Today, there are nearly 670 official ISPs that provide broadband LAN Internet access throughout Bulgaria, but interviewed experts have indicated that the actual number is close to 2,000. These unregistered ISPs, however, mostly operate on a very local basis and usually do not serve more than a few dozen subscribers each.

In 2008 ISP Cluster performed a survey[18] among peer ISPs to assess the size of the area covered by an ISP and its subscribers.

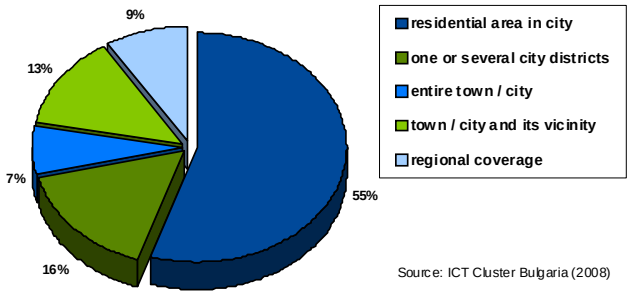


Figure 5 : Distribution of LAN providers by region of coverage, most are still neighbourhoodlevel

Figure 5 shows that 55% of the LAN providers in Bulgaria operate on a neighborhood level in a city, of which the biggest share can be found in the city of Sofia. A mere 9% of the operators provide their services in various regions of the country and none have deployed their networks throughout the whole of Bulgaria.

3. The Bulgarian Government tries to boost internet literacy as availability grows

Despite increasing availability and take-up of broadband, lack of computer and/or internet skills amongst Bulgarians remains high. Survey statistics from the National Statistics Institute of Bulgaria show that computer ownership in Bulgarian households in 2006 only amounted 21% compared to the EU average of 60%. The same survey found that 66% of the population has no internet skills, compared to the EU average of 40%. Especially in the rural areas of Bulgaria, the availability of computers and IT skills amongst the population remain low.

Realizing the need for better IT skills, the Bulgarian government together with other organizations started a series of skill-development projects. Examples of projects are:

- **The iCenters Project:** Set up in 2006, this collaboration between the Government of Bulgaria and UNDP, which provides IT related services to users in small or economically underdeveloped communities.
- **The home internet for teachers project:** In this project the Ministry of Education and Science provides teachers a monthly reimbursement for internet access at home

[18] Summary of the 2nd part of the survey on Survey of the Market of internet Services in Bulgaria via LAN Networks, available at http://www.ictalent.org/index.php/en_US/broadband

- **The SELF project**:, initiated by ISOC-Bulgaria amongst others, this project aims to provide a platform for the collaborative sharing and creation of free educational and training materials on free software and open standards.

4. Market consolidation and user maturity drives expansion.

The Bulgarian broadband market has started to consolidate, and this trend is expected to continue. In the past few years, several of the smaller networks have merged or have been taken over by larger operators. Cable operators have been the main drivers of consolidation, taking over companies providing broadband services via LAN networks in order to provide Internet services with speeds that, due to technical restrictions, could not be attained through their own networks.

These cable operators now deploy LAN networks and they as well as Tier-1 ISPs have built head-ends and are now delivering Video-on-Demand and IPTV at HDTV quality. Tier-2 ISPs often have to bring fiber backhaul closer to their networks edge or replace capacity on their switches to support these heavy applications. There is thus a gradual specialization appearing: Tier-2 ISPs focus on the distribution plant and Tier-1 ISPs on the more IT-intensive services platforms. Still most Tier-2 ISPs have more than one Tier-1 ISP for uplink to the Internet.

ISPs interviewed explained the standard arrangement between Tier-2 ISPs who serve towns and villages outside the major cities / backbone Points-of-Presence is that the fiber route is invested by the Tier-2 ISP, but the Tier-1 ISP then leases a fiber pair over this cable when they need to reach a business user in the town/village.

Another important driver for the current industry consolidation has been the new constraints laid down by regulator CRC, which forces LAN operators to lay their fiber-optic cables underground. Before 2009, no measures had been taken to overcome the unregulated situation, but new legal amendments have given the CRC the right to fine ISPs for cables that run through the air. Since the beginning of 2009, many ISPs have already been fined.

In addition, there are signs that some government IT stimuli programs are paying off. The home Internet for teachers project has been a success and has greatly boosted teachers' interest in using ICT. According to Orlin Kouzov, CEO of the ICT in Education Directorate at the Ministry of Education and Science, there were nearly 47,000 teachers participating in the project at the time of this writing. Instead off a large contract from the Ministry, with a single broadband provider, which would have forced them to purchase ADSL with incumbent Vivacom, they adapted to the highly fragmented broadband market.

The ministry created a database where all broadband ISPs in Bulgaria, willing to offer to teachers, could register their offerings and prices into this database, which resulted in 28,000 different prices / packages entries. Teachers could choose their own broadband ISPs and bitrate package as the ministry provided them a monthly reimbursement of BGN 15 (ca. €7.50).

The largest Bulgarian training program, developed and implemented by iCentres, has been successful and so far has educated about 45,000 civil servants in basic IT skills.

This training program was however a substantive divergence from the initial UNDP-initiative to create these iCentres. The Telecentres / Internet café's were obvious too late. Just as the facilities were deployed the Bulgarians stopped using them and brought Internet into their home.

Nevertheless, as the survey held in parallel to the interviews demonstrates[19], user maturity among Bulgarian Internet users remains limited—most people use their connections mainly for leisure and information searches. But

[19] Yankee Group Research, Inc. Socioeconomic Benefits of Bulgarian Fiber Broadband, January 2010, restricted availability to FTTH Council Europe members relieved from September 2010 onwards

the signs of a shift toward more experienced uses with people deploying it for work related and productivity purposes is also visible.

5. Indigenous entrepreneurs trump sold-off PSTN incumbent

The case of Bulgaria showed how, the group of entrepreneurs that deployed what was originally called "not-DSL" technologies, consistently outpaced incumbent Bulgaria Telecom (now Vivacom) with their ADSL-offering (see Figure 6).

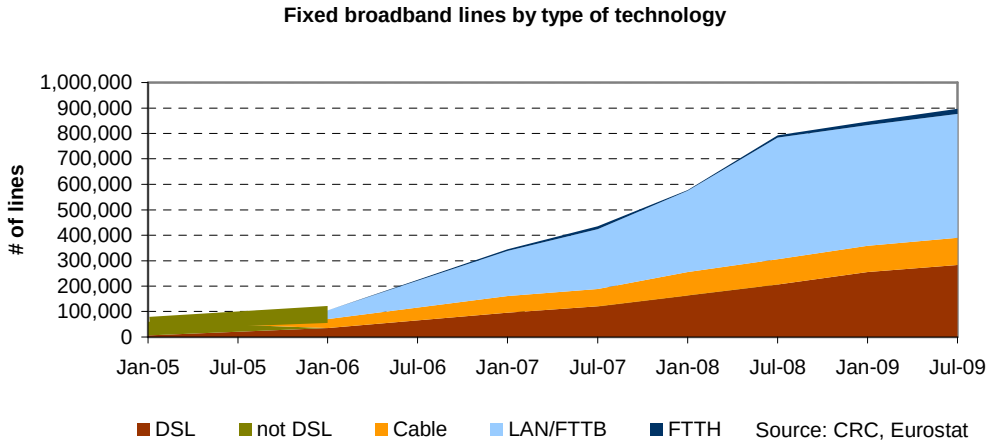


Figure 6 : The LAN/FTTB deploying ISPs outpaced DSL and Cable broadband in their run for the market

The very fact that the Bulgarian government kept the copper network closed for entrants until it had sold off incumbent BTC, has not only stimulated cable and Broadband LAN ISPs to work around by stringing aerial cables, but the ultimate result in Bulgaria is a market with 670 entrepreneurial entrants who jointly trump the sold-off incumbent by far in volume. Also the demand for access to unbundled local loops of the incumbent has vanished as DSL is inferior in stability of connection, price and capacity to cable and LAN based broadband offerings (see Figure 8, Figure 10) aspects of offerings end users value most.

With this new indigenous broadband sector now consolidating and expanding coverage in a natural way, while the BTC owners AIG Investments are part of an effectively bankrupt American enterprise, there is little reason for the Bulgarian government to place their policy bets on broadband development with the incumbent anymore.

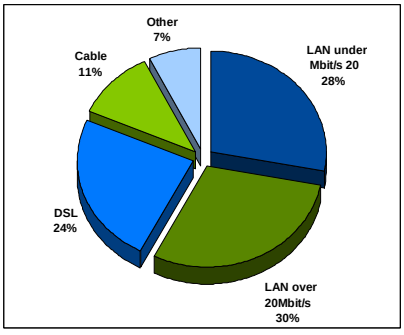


Figure 7 : Breakdown of internet access by technology for 514 valid survey responses

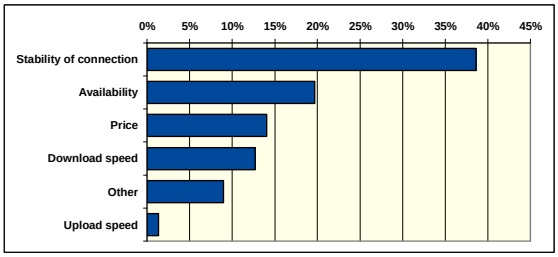


Figure 8 : The most important factor in selecting the current internet connection (survey)

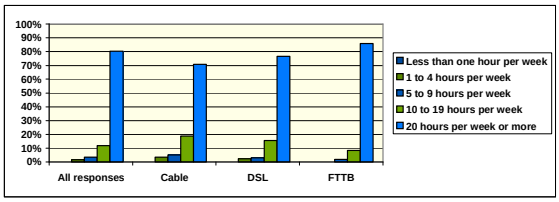


Figure 9 : Time spent on the internet for different types of internet access (survey results)

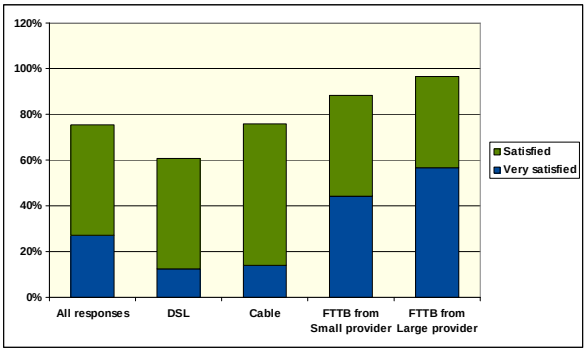


Figure 10 : Customer satisfaction for different types of internet access (survey)

During the interviews it was remarked that incumbent Vivacom (formerly BTC) seems to go around with a plan, supported by AlcatelLucent to bring fiber to 1 mln Bulgarian homes, which would cost up to € 900 mln. The idea seemed to be to draw some funding from the proposed € 1 bln stimulus package for broadband from the European Commission. Those who would only give a cursory look at Bulgarian statistics with low broadband penetration per household (30%) would easily depicting the country as one with many unserved and underserved areas that might be in need of a big fixed network upgrade stimulus.

Interviewees, including one of the responsible policy makers had a different view with respect to an eventual stimulus. They assessed the Vivacom/AlcatelLucent plan as a flight forward from a lagging incumbent. Also, while the Tier-2 ISP thought a subsidy would enable him and other Tier-2 ISPs to do more trenching of fiber optic backhaul cable to remote villages and towns. The policy maker thought it wiser to at most enable the locals in some still unserved villages to mount their local network and expected market parties to invest in the backhaul. He also expected only a very limited budget of 15 – 20 mln BGN (€ 7.6-10.2 mln).

Two interviewees pointed at the fact that actual statistical figures were understating broadband penetration levels, as many small ISPs with networks have not yet registered. One estimated that 50% penetration in 2009 might be closer to reality. In particular in the more rural areas people also used fixed microwave links constructed with unlicensed WiFi to implement backhaul links and some end users connect with their own WiFi directional antenna into those antenna towers. Indeed, in our survey several respondents indicated to connect via WiFi to the Internet, which together with FTTH and those using 3G broadband are categorized as “other” in Figure 7.

One interviewee indicated, that many in Bulgaria have left the rural areas to live in the larger cities, but keep the home as their family holiday residences. Therefore connecting the remote villages as a rural development effort may mainly improve broadband availability at homes that are occupied in the holiday season or at weekends. Mobile broadband coverage might be a better idea in those areas, as holiday and weekend Internet demand is more “nice-to-have”, maybe with a few in need of a fixed link in such a location wiring themselves to the base station.

The ISP interviewees also indicated that in Bulgaria mayors have considerable power and the support or obstruction of the local mayor vis-à-vis broadband LAN / FTTH-roll out is a highly relevant determinant on their roll out pace. So educating mayors of the advantages of local inhabitants and entrepreneurs articulating and aggregating demand and rolling out networks might be a rather cheap stimulus policy.

The impression cannot be lost that the foreign investors acquiring BTC/Vivacom have severely underestimated the limited barrier to competitive entry in fixed broadband network roll out, when a country allows the people in neighbourhoods stringing their own cables, and constructing networks. They might also have

underestimated the political sway of a market full with small indigenous entrants and an informed polity[20], while they are now the foreign owners of a former monopoly with an aging copper access network that was easier replicated than expected.

In general, the case of Bulgaria demonstrates that without a barrier to entry as expensive upfront cost for trenching, local initiatives at neighbourhood level and start-up entrepreneurs can create a very dynamic and competitive market, resulting in a high-paced roll out of high-speed broadband.

II. THE NETHERLANDS

The case of the Netherlands is one where one can also observe acts from local entrepreneurs, municipalities, housing owners and community activists and construction industry that cooperated too create FTTH, but it often clashed with vested interest and an (intern)national political, regulatory and business establishment with different agendas. This clash in a context were the polity had created in the 1990s one of the most liberal and free entry oriented political climates, but seemed not to have foreseen that this also allowed entry from different sectors of society.

1. The Dutch institutional and business context

The Dutch case has some significance outside the relatively tiny Netherlands. Part of the political maneuvers around FTTH resulted in a key State Aid decision by the European Commission on local government investment. Also the Dutch cable industry has a leading position in fiber optics manufacturing in the world, while the construction industry became a major European player in the 1998-2001 long distance fiber boom in Europe, leveraging know-how in constructing European natural gas networks since the 1960s. They benefit from developing institutional arrangements that could easily be exported to other EU countries.

The Dutch financial sector is also involved as actor in this case study. After two centuries dominating global finance in 17th and 18th century, it today consists of a highly global connected sector. Dominated by firms like bank-insurer ING Group[21], cooperative Rabobank[22], life insurer Aegon, pensionfund ABP and its executive arm APG[23], it is characterized by very large pension funds and life insurance firms, who are looking for robust long run investments. After they created a second involvement of Anglo-Saxon firms and financiers in a relatively liberal regulatory setting makes it interesting to observe whether new business models and institutional arrangements can be copied easily to other countries with a free market oriented regime to new infrastructure construction.

The development of FTTH in the Netherlands occurs in a geographical area where towns and cities are dense, but multiple dwelling units are not extremely common. About 80% is single family homes and the rural areas are dominated by a highly automated and export oriented agricultural sector equally spread over the landscape.

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[20] Internet Society Bulgaria, a non-profit with near 700 members but also subcontractor in this research, has many members from ISPs but also Members of Parliament, government Ministers and the current President of Bulgaria.

[21] ING Group with 2009 revenues of US$ 163.2 bln replaced AXA in 2006 as the highest ranked financial institution on the Fortune Global500 list, a position retaken by AXA in 2010.

[22] Rabobank is the highest ranking, non-government owned or government guaranteed bank on Global Finance magazine's World's safest banks list for more than a decade and has a 2009 balance total of € 620 bln and triple-A ratings since 1981.

[23] According to their Annual review 2009, APG (100% ABP subsidiary) manages € 240 bln for 19 pension funds for people mainly working in Education, Public, Construction and the (physical) Security sector. ABP is the largest pension fund in Europe and ranks 2nd behind the Japanese government employee fund and before CALPERS.

Although aerial wiring is legally allowed, telecommunications cables are subterranean since the late 1920s, CATV-cables were trenched from the start in the 1960s and after power utilities also removed aerial cables in rural areas in the 1970s all utility poles have been removed except the masts for the high-voltage power grid.

There is a silent assumption among permitting local governments that new FTTH-outside plant will be trenched. This has a substantive dynamic economic consequence on required capital expenses for an entrant, as installing aerial fiber optic cables cost ca. € 5 per meter, while subterranean construction results in € 30-40 per meter with trenching and local re-pavement of sidewalks and streets the dominant cost drivers.

70% of Dutch GDP stems from exports and trade. Businesses with considerable international communications demands can be found even in the tiniest villages. This international trade orientation is often ascribed to the situation of the Netherlands in the mouths of 3 major waterways: Rhine, Meuse and Scheldt. After the Carolingian Renaissance, the country emerged from feudal anarchy[24], with a weak aristocracy governing over militarily difficult to control swamp areas. This caused a shift of power to nascent cities lead by the Third Estate: merchants and crafts guilds.

The shift resulted in highly decentralized decision making and since the medieval Hansa-era, the Netherlands is best characterized as a country with strong economic competition between many municipalities, cities and provinces, in particular in fostering and attracting businesses to their own area. From ca. 1500 the Low Countries became the first pre-dominantly urbanized area in the world were more than 50% of the inhabitants lived in cities. That period of the Flemish and Dutch Renaissance and the consecutive Dutch Revolt brought rapid economic advances, which transformed the Netherlands already in the 17th century into a high-wage, high-income country with large private savings, trade surpluses and capital exports and due to religious tolerance and free speech a leading role in the information (publishing) industry, a set of characteristics that continues up to today.

Left to their own devices, power struggles between the Staten-Generaal in The Hague and local (municipal and provincial) authorities on *subsidiarity*[25] are a recurring feature of Dutch politics. Legal and administrative centralization in the Netherlands has mainly taken place during the Napoleonic period[26], while the welfare state in Bismarck-style was introduced during the German occupation of 1940-1945.

The Dutch business and financial community however has an *"Anglo-Saxon"* orientation, despite most trade occurs with Germany (Rhineland). This is partially a result of an invasion in the United Kingdom in 1688 (Glorious Revolution), financed by the Dutch merchants with an objective to open London as second base and resulting in exporting financial institutional arrangements to the United Kingdom as well as drawing substantive Dutch savings into funding the 18th century Industrial Revolution. Furthermore the Dutch business community has close political and business ties to the United States dating back to the founding of New Amsterdam.

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[24] De Long, J Bradford & Shleifer, Andrei, 1993. *"Princes and Merchants: European City Growth before the Industrial Revolution,"* Journal of Law & Economics, University of Chicago Press, vol. 36(2), pages 671-702, October

[25] Subsidiarity is an organizing principle that matters ought to be handled by the smallest, lowest or least centralized competent authority. The principle was established in the 1992 Treaty of Maastricht as formal EU law.

[26] Schama, Simon, 1977, *"Patriots and Liberators: Revolution in the Netherlands, 1780-1813"*

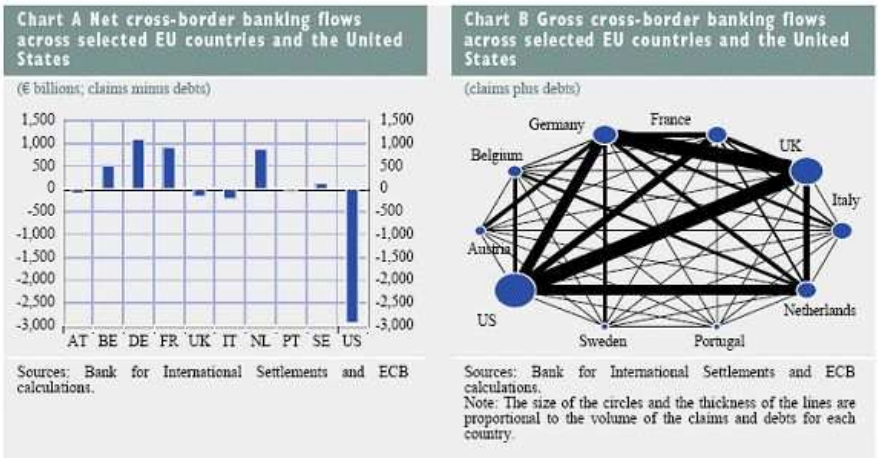

Figure 11 : The Netherlands prominent role in cross border banking flows between the EU and USA

This orientation is even very visible today when observing statistics of cross-border banking flows between the USA and Europe, similar graphs appear when analyzing Foreign Direct Investment flows[27], as well as the capacity of global information networks in London and Amsterdam, who are the prime destinations in capacity of international circuits from the USA[28]. As a result a Dutch ISP can access the global Internet backbone at very low price levels.

2. Cooperative arrangements

The arrangement of a cooperative is very common in The Netherlands since roughly the year 1000 when land (re)claiming from swamps, then lakes and seas started with homesteading developments accompanied by the creation of cooperative water districts to defend against flooding, with voting rights and taxation divided along land(value) possession. The cooperative has since been retried and rearranged in various forms since: f.i. the worlds first joint-stock company (VOC, 1602) and the Amsterdam Stock Exchange, retirement funds and life-insurance, agricultural cooperatives and auctions owned by farmers, banks, housing corporations. As a result, there is a large stock of institutions in the Netherlands, including legal forms and expertise for those who wants to design the next concept of a cooperative arrangements that is neither the government, nor the market.

During the development of the Internet in Europe, cooperative arrangements have developed spontaneously. Amsterdam was the first site in continental Europe from where, what later became commercial ISPs rolled out networks over Europe (EUnet, 1982)[29], after spun out of academic and research institutes. The desire to coordinate commercial Internet traffic with traffic on the National and European Research and Education Networks lead to the creation in 1989 of TERENA (academic) and RIPE[30]. An attempt by the European Commission to force the NRENs on the X.25 standard and block them from using the American TCP/IP-protocols induced the Dutch

[27] See Marilyn Ibarra-Caton, BEA, July 2010, *Direct Investment Positions for 2009, Country and Industry Detail* By http://www.bea.gov/scb/pdf/2010/07%20July/0710_dip.pdf

[28] See FCC: Section 43.82 Circuit Status Data http://www.fcc.gov/ib/pd/pf/csmanual.html

[29] See: Rick Adams, *Transatlantic Computer Networking BW (Before Web)* http://www.godfatherof.nl/media/rick-presnt.pdf

[30] Reseaux IP Europeènne, a non-incorporated tri-annual convention of European ISPs to discuss Internet coordination issues on IP addresses and routing of traffic. The RIPE Network Coordination Centre, created in 1992 is a membership association directing this business for daily operations.

NREN SURFnet to team up with Nordic NRENs and together created Ebone an Internet Protocol backbone to circumvent EU-policy.

In 1994 the Amsterdam Internet Exchange was created at (operator) neutral facilities as an association with memberships, which has developed into one of the world's largest public Internet Exchanges and the largest international mobile data traffic peering point. It consists of a membership association owning a limited corporation responsible for operations of the exchange[31]. Comparable non-profit control arrangements with a subsidiary daily business operations have been created in the Netherlands and a number of countries for coordinating a.o. Domain Names on the Internet[32]. K. Neggers and B. Nederkoorn, joint managing directors of SURFnet, were instrumental in creating several of these arrangements and chaired them.

A considerable group of people, often with still strong ties to the academic networking community was involved in all these efforts in creating coordinated networking with different institutional arrangements to govern them. It would thus not come as a surprise that in 2000 – 2001, when confronted with the Dotcom crash and subsequent Telecom sector collapse on the stock-market, resulting in a withdrawal of loans toward telecom and cable incumbents, several people would propose different, cooperative arrangements to fund and create Fiber-to-the-Home, outside the market-driven, risk taking business model that had halted rolling out.

3. Housing corporations enter the market as local loop owners

While the first trial by incumbent KPN in the Netherlands to connect homes / households via fiber dates back to 1990, the first operational deployments were done by universities connecting student dormitories, apartments and visiting professors housing from so-called housing corporations across town. Investment bills were split between the housing corporations and the university IT-departments.

In the second half of the 1999s some of the owners of large high riser student dormitories discovered that the deployment of 100 Mbit/s Internet access to all dorms, connected to the university backbone, but provided for a surcharge of € 5 - € 10 to the monthly rent transformed these often least wanted dorm rooms into their prime Real Estate. The typical vacancy periods of 2 – 3 months after a student left a room or apartment[33], altered into a waiting list and the velocity of students moving reduced. Where the surcharge income for 100 Mbit/s Internet Access was expected, this was unsuspected revenue and the additional income it generated due to the reduced room / apartment vacancies effectively caused a return on investment of 3 instead of the expected 10 years[34]. Students in the Netherlands rent dorms or private rooms for €200 - €300 pro month. The reduced vacancy time between consecutive renters attracted the interest of a number of other housing corporations[35]. One of the more entrepreneurial student

[31] For a detailed explanation of the institutional arrangements see: http://www.ams-ix.net/about/

[32] The Dutch Domain Name registry's history site: https://www.sidn.nl/en/about-sidn/

[33] In the Netherlands dormitories compete with private room providers, typically 30% of students moves in a year

[34] Authors calculation from consulting assignment for Delft University of Technology and student housing corporations Duwo (a Delft based company but also active in The Hague, Leiden and Amsterdam in dorms)

[35] Housing corporations in the Netherlands are non-profit private organisations, often with a background in charities or unions, that built and rent out homes and apartments. From student dormitories to family homes to elderly homes. In an across the board privatisation all subsidy laws and monetary flows between housing corporations and the government have been scrapped in 1995, which resulted for them in seeking new revenue streams and more (up-market) project-development. Due to their role in the after war reconstruction period they own roughly 40% of the Dutch homes. In the City of Amsterdam even ca. 80%. The commercial for-profit housing controls ca. 8% of homes, the remainder of Dutch homes is privately owned.

housing corporations, Duwo, turned it into a concept building temporary student dorms outfitted with very high-speed Internet access in other towns[36] together with a specialist firm, Lijbrandt Telecom, who also operated facilities with telephony, CATV, high-speed Internet, intercom and alarm lines in elderly home complexes and care centers.

As in 2000 Bredband Benelux, a subsidiary of the Swedish FTTB-provider entered the Dutch market, they negotiated contracts with the 5 largest Dutch housing corporations to bring fiber to several hundred thousand apartments and homes. Bredband's withdrawal from the Benelux market in October 2001, halted that effort. But it did not stopped the two largest housing corporations Vestia (75,000 homes) and Portaal (58,000 homes) to then open negotiations with resp. Lijbrandt Telecom and construction company VolkerWessels on deploying FTTH (in)to their assets[37].

The entry to the FTTH-market as (co-) investor by housing corporations is a Dutch phenomenon, albeit according to IDATE[38] it is also observed at less scale in Denmark and Sweden. In the 1960s and 1970s housing corporations had engaged in building Community Antenna TV, but most of them disposed these networks to municipal owned cable systems. Most CATV-networks were privatized by municipalities during the 1990s and Dutch utilities, US cable entrepreneurs from Denver, Colorado (the Schneider family and J. Malone) as well as France Telecom had just acquired them. Veteran cable industry executives, who recalled the origins of their industry got alarmed as they grasped this implied re-entry of organizations with considerable financial means.

In 1998 Gabel and Mueller posited household financing of the first 100 feet with a question mark[39]. They ended with doubts. What both overlooked is that the property owner receives a different kind of surplus from financing FTTH-loops than tenants. Also its incentives are longer term, in particular when financing or co-investing enables them to write contracts with the constructing company on open access. Choice between competing networks and service providers over open loops enhances the value of this fixed investment for their tenants and drives up penetration levels. This approach with home owners investing in local loops as property and demanding open access has recently been restated as *Homes with Tails*, by Wu and Slater[40].

[36] Dutch colleges and universities do not select except for a few studies (mainly performing arts and medicine). Student numbers in cities can be highly volatile. Since the economic crisis numbers are up and demand grows.

[37] Author tracks FTTH and FTTB deployments in databases since 1999 and consults in this area.

[38] IDATE tracks this category in their studies for the FTTH Council

[39] David Gabel and Milton Mueller, "Household Financing of the First 100 Feet?" in D. Hurley and J. Keller (Eds.) The First 100 Feet: Options for Internet and Broadband Access, Cambridge, MA: MIT Press (1999) 11-23

[40] Tim Wu and Derek Slater, (2008), *Homes with Tails, What if you could own your Internet Connection?* New America Foundation, Working Paper #23. http://www.newamerica.net/files/HomesWithTails_wu_slater.pdf

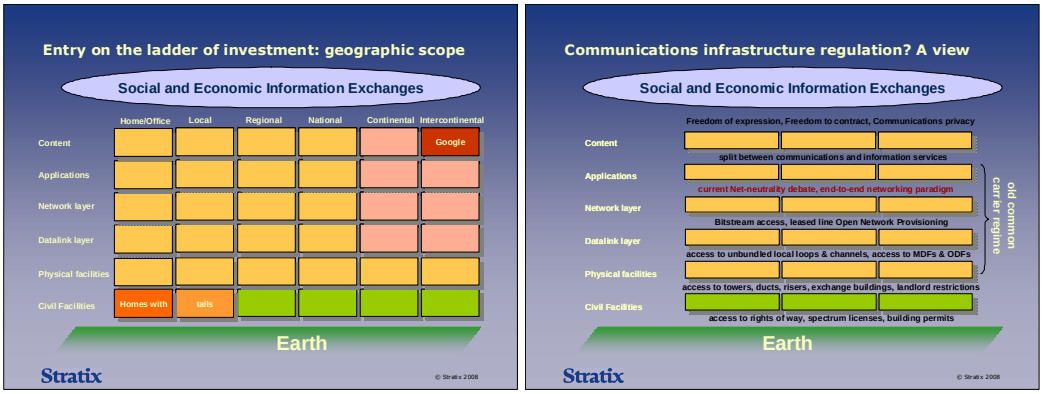

Figure 12 : Home owners investing in fibre enter the ladder of investment from a different side

The economic reason is best explained by the empirical models used for the research that led to the *Ladder of Investment*[41]. In that study also the networks in homes and offices were included, while these are often overlooked in analysis, which leads to "surprises" like user generated content, as well as entry by home owners into local loop construction to connect their objects to a collective (Optical) Distribution Frame in an Exchange building, where tenants like operators can install their equipment . For the home owner *the tail* is a complementary asset to his home, which has value even when not used by themselves, but the home later on sold.

4. Legal reclassification of local loops

The large scale sale of CATV networks has prompted another actor, the Dutch Tax Authorities, in 1995 to an attempt to collect the 6% Real Estate Transfer Tax from CATV buyers. This ended up in a legal jurisprudence procedure and in 2003 the Supreme Court decided that a cable network, including ducts, conduits, street cabinets and antenna masts must be classified as Real Estate and registered in the Kadaster, the official registry.

This legal decision had a lot of ramifications. First it enabled financers to write mortgage style contracts directly on the assets, as the Real Estate classification made it possible to vest a "Ius in Rem" on them instead of a "Ius in Personam" to a company operating these facilities. It also allowed for dividing up a fiber optic cable in a condominium like split, where "Ius in Rem" could be vested in single fiber pairs[42]. This decision however also raised the interest of *patient capital* investors like Pension funds in owning local loop cable networks as a long run Real Estate investment, with a potential moderate but stable return on investment.

The second major legal decision was made in the 1998 Telecommunications Act, where it was decided that all Dutch subterranean cable networks for telecommunications purposes that were offered to the general public were made local tax exempt. Even an "allowance obligation" was required on local authorities, they have to permit in 12 weeks. A period reserved for public works coordination and arranging for joint-trenching and cost sharing. If they fail to respond in that period the permit to trench and construct for the requested routes is automatically granted.

Also the Dutch Telecommunications Act of 1998 removed a licensing obligation for fixed infrastructure and fixed telecoms services, only a registration at regulator OPTA (which can be made after facilities construction) is required. Only Denmark has a roughly similar very lightweight non-licensed regime in Europe. The first chairman

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[41]. Hendrik Rood and R.A. te Velde, *Investment strategies in the Netherlands* Telecommunications Policy, Vol. 27, No 10-11 (2003), pp 701-715

[42] SURFnet, the Dutch Research and Education Network, has since acquired fibre pairs around the Netherlands and created jointly (customer) owned fibre rings in several midsize cities with condominium type contracts.

of OPTA at its creation in 1997, prof. J. Arnbak, is a Danish national and also a telecoms advisor to their government.

One of the first acts of Arnbak's OPTA, which came into existence in 1997, was a rebalancing of KPN's PSTN retail rates removing cross subsidies from voice traffic to loop rentals and then a decision (December 1997) to allow unbundling of the local loop (copper) requested by competitive entrant Enertel. Enertel itself was a telecom firm jointly owned by power utilities, who at that time also had acquired many CATV-networks from municipalities. The actual unbundling of local loops was however stalled until 1999, when the European Union required it in a directive. In its decision for Enertel OPTA projected a regulated price for a copper loop based on current cost, but added that it would gradually have to rise (!) to a forward looking long-run incremental cost. A rising price because capital expenditure for trenching new networks tend to be very labor intensive. Thus a fixed or capped price would result into a too low return to justify eventual replacement of worn out cables as construction salaries tend to rise too.

A final major act was the decision by Telecoms minister Jorritsma in 1996 to require the then just stock market listed incumbent KPN to dispose their shares in CATV-operator Casema (at that time ca. 1 mln subscribers), which was subsequently sold to France Telecom in 1997. As Casema was the heart of their technical know-how, it led KPN to decide not only to exit the Dutch cable industry but dismantle their entire Pan-European KPN Kabel division that they had created aside of KPN Telecom.

The result of the acts, jurisprudence, as well as political intervention at the end of the 1990s was:

- reclassification of telecommunication loops as real estate
- a very lightweight, right-of-way tax-exempt regime for new construction and entry
- a telecoms incumbent with universal coverage
- a competing CATV sector with near universal coverage (98% of homes passed, 97% connected and more than 90% subscribed)
- fixed long distance networks created by former railway and power utility networks, as well as new entrants constructing their own long-distance, dark fiber and business park networks.

5. Lobbyist actions and counteractions

The tax-exempt classification of local loop infrastructure was heavily lobbied against by the association of municipalities in 1997 together with the then minister of Home Affairs, deputy prime minister and Liberal Party leader H. Dijkstal. His opponents were Economic Affairs minister and later AkzoNobel CEO H. Weijers (Social Liberals) and Transport and Telecoms minister A. Jorritsma (Liberals) together with the joint CATV and telecoms operators. The final decision was made by Labour prime minister W. Kok, who showed the director of the association of municipalities the door of his office stating: *"I do not want your medieval taxes to weigh on the infrastructure of the 21st century"*[43].

As a result the municipal authorities experienced from 1998 on a large scale trenching effort by new entrants, which they hardly controlled anymore in direction of efforts. Those efforts by (international) market parties were mainly oriented on reaching the large City Business Districts and constructing long-distance networks over Europe. Public works servants in large cities were not pleased with the large scale installation of empty ducts in their soil. Rotterdam started a lobbying effort to regain tax powers. They also assessed that FTTH would imply even larger scale efforts and wanted to avoid multiple trenching and repeated opening of streets. While Rotterdam studied

[43] The source of this tale is the civil servant who had to rewrite the entire chapter on rights-of-way in the Telecommunications Act twice in one month due to political lobbying and ministerial maneuvers

duct construction for local loop as a public facility, for operators to blow in their fibers and cables, Amsterdam started to look at a way to deploy a fiber net that would lease out dark fibers to operators.

Municipalities ultimately received the right to tax when the Telecommunications Act was revised after the 2003 Supreme Court decision in 2007, but only for vacant ducts and after a 5 years waiting period. But the Dutch parliament also adapted in the same revision an article that prohibited municipalities to own telecommunications networks. This amendment was proposed by coalition representatives Aptroot (Liberals) and Hessels (Christian Democrats), supported by their junior coalition partner the Social Liberals and even opposition party Labour. It showed again, like in 1997, that the main political division was the one between the central The Hague parliament and government, and the municipalities and provincial authorities.

In 1997 Home Affairs minister Dijkstal teaming up with municipalities could thus be explained as functional, as his ministry has the closest ties to municipalities, but it was politically an a-typical act. From the 1960s onward the Liberals had close ties with the cable industry, as they promoted CATV and later (commercial) satellite TV vis-à-vis the Christian Democrats and Labour Party who acted as the stalwarts of the public broadcasting system.

From the 1970s till the 1990s a CATV-technology entrepreneur, Anthony Dake, was a Liberal Senator[44] and a champion of CATV-privatization and telecoms liberalization. He sold his cablemodem manufacturing firm Deltakabel to Lucent Technologies in 1999, when his firm had 25% global market share[45] in a nascent cablemodem market and retired.

When in 2003 France Telecom, after the telecom crash sold Casema to Providence Equity Partners and Carlyle Group, the Carlyle Group's telecom practice, lead by former FCC Chairman W. Kennard, recruited Dutch Liberal Party senator C. van Lede, a former AkzoNobel CEO and former chairman of the Dutch employers association as advisor.

Other notable champions for the cable industry and privatization from the Dutch Liberal Party are N. Kroes, (junior-) minister for Telecommunications in the 1970s and 1980s, European Commissioner for Competition and today for the Information Society (Digital Agenda) and B. Verwaayen, a former Alcatel, KPN Telecom, Lucent Technologies and BT (chief) executive and today CEO of AlcatelLucent, who authored the Liberal Party's 2007 election program. Both are today prominent actors in the international broadband / FTTH-debates.

The Liberal Party was chaired from 1999 – 2003 by B. Eenhoorn, who as mayor was chairman of the Cable Industry Association VECAI (now NLkabel) in the 1980s and 1990s, the period when the first privatizations of municipal CATV-networks occurred. In the Netherlands in many municipalities Liberal alderman handle the finance portfolio, as that party tends to attract more people with affinity to finance and business. From the 1990s many of them executed the sale of nearly all municipal CATV-networks. Eenhoorn terminated his mayoral function in 1996 to become an advisor for Ernst and Young mainly involved with CATV-network sales and Liberal party chairman.

Telecommunications policy in the Netherlands has been mainly the political responsibility of Liberal politicians. When Liberals were not part of the coalition, Social Liberals or Christian Democrats took the portfolio.

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[44] In the Netherlands, the Senate gathers 1 day per week and this is a part-time function representatives perform along their ordinary occupations.

[45] As estimated by IDC in dec 1999. It must be noted that cablemodem deployments at that point of time were in the tens of thousands for countries. See also: http://www.catv.org/bbb/1999/arch-1218.html#deltakabel

The result was a very liberal market regime oriented on easy entry, a privatized telecommunications incumbent, some politically well connected actors in the CATV-industry promoting infrastructure competition between cable and KPN Telecom and disgruntled municipalities who were blocked from re-entry.

The market however, did not only contain an incumbent KPN and a competing cable system, but also well funded, asset rich housing corporations weighing their desire for local loop construction, Pension funds and banks with interest in direct investment in relatively safe assets, instead of being exposed to management adventures of telecom and cable operators, and a group of local and national entrepreneurs in telecommunications that had set up business after market liberalization and climbed the ladder of investment from the core to the edge. In this cocktail one group is missing: the construction and cable manufacturing industry.

6. The Dutch cable construction industry puts networks on their balance sheets

When the European telecommunications market opened in the second half of the 1990s MCI Worldcom, Global Crossing, KPNQwest and Level3 launched and directed their continental European network expansion from the Netherlands. A substantial number of Dutch construction firms acted as suppliers and (sub)contractors for these pan-European networks. Due to the discovery of natural gas in 1959 in Groningen, an extensive pipeline construction industry had developed working all over Europe.

A few startups who aggressively grew in the 1998-2000 timeframe collapsed, but better funded large construction firms survived. The most notable is VolkerWessels who acquired the Network construction division from a distressed KPN Telecom in 2002 and made an FTTH-construction deal with housing corporation Portaal. The firm was delisted from the stock market in 2003 by the Wessels-family, who had sold off their shares in the IPO of ISP WorldOnline on March 18th, 2000 for a billion. As a non-public firm VolkerWessels advanced with FTTH.

The second major construction firm is stock market listed BAM NBM. They were the “house supplier” to KPN. After the Telecom crash of 2001, they created a firm TriLink together with VolkerWessels to built and finance greenfield areas and lease them to KPN. Effectively by this deal incumbent KPN exited investing in local loop construction in residential areas in 2002 and terminated planned network construction except for selected business parks.

Construction firms with deep financial pockets taking over the financing of local loops is an often overlooked form of *vendor finance*. Smaller construction firms, in the Netherlands, who laid cables for new entrants have also taken the optical fiber tails for links to businesses on their balance sheets. It turns a fixed capital expense for a competitive operator into a monthly or annual lease payment, comparable with leasing unbundled local loops. This reordering of the value chain, with construction firms advancing, is stimulated by business customers whose contracting departments requesting that they do not want to pay for the third or fourth time for a cable to their businesses facilities after they changed operators.

Cable manufacturing in the Netherlands is effectively the only telecommunications industry that remained after the 2001 crash. The key player on the manufacturing side is Draka, which is stock market listed, but a controlling minority of shares as well as supervisory board positions held by the Fentener van Vlissingen family, another billionaire family, whose capital goes back to Rotterdam harbour coal and the founding of Akzo chemicals. Draka has evolved former Philips Electronics activities and owns its optical fiber manufacturing patent portfolio and took over the Chinese joint-ventures for fiber optic cable Philips created in the 1980s, who produce with the Draka patent portfolio and are the largest suppliers of optical fiber and cable in China. Draka is 2nd to US-based Corning in optical fiber manufacturing, but with the production in their Chinese daughters they are the largest optical fiber manufacturing industry.

There are 4 other cable and duct manufacturers producing in the Netherlands as well as construction firms who specialized in telecommunications and duct construction. The stock market listed firms, all have large shareholders from the Dutch billionaire list listed in the notification registers. This is an interesting observation as

the largest CATV-operators are controlled by Liberty Media (UPC) and Warburg Pincus & Cinven (Ziggo), while incumbent KPN reports that 75% of their shares are hold by American and British institutional investors.

6. When the incumbents avoided fiber deployment the construction industry moved

In 1999 the Dutch government had launched an idea for a trial called "Kenniswijk" or "Knowledge Neighborhood" where they would provide the population with a budget of €800 per home to acquire an FTTH-connection and then a series of advanced applications would be trialed. It tendered for a municipality that would conduct the trial with 50.000 homes and induce applications development for this sizeable community. The idea was that by handing over money to the citizenry for this purpose, they would select one of the operators who would enter the area with FTTH.

The tender was won by a joint bid from the cities of Eindhoven and Helmond. But when the first few hundred homes were connected to an FTTH-connection by Bredband Benelux and 1000 homes were outfitted with fiber by incumbent KPN, the telecoms market crashed. UPC, who owned the CATV-network in Eindhoven and Helmond did not invest in FTTH. Bredband Benelux withdrew in October 2001 from the Dutch market and KPN did not expand. Without a very high-speed network most entrepreneurs who invested time in application development rapidly reworked their ideas for the then fast growing ADSL and Cablemodem based broadband access or terminated their efforts.

Nuenen was not included in the original Kenniswijk areas. It is an independent municipality between Eindhoven and Helmond. But it functions as a well-to-do Eindhoven suburb. It borders the Eindhoven University of Technology campus and is home to a lot of senior staff and middle management of Eindhoven's industry and university. The executive of the local housing corporation "Helpt Elkander" [Eng. aid each other] and a local entrepreneur K. Rovers, developed plans from 2001 onwards to develop FTTH in their town too, by founding a fiber network co-operative. They approached the local Rabobank, which due to its cooperative nature has its local boards and provide local management with ample decision freedom, before needing to coordinate with the central board. Rovers created an advocacy firm *Close-the-Gap* and referred in his first leaflets for *OnsNet* [Eng. Our Net] to cooperative initiatives taken in Grant County, Washington USA and Canada for customer owned network projects promoted by B. St. Arnaud, the director of the Canadian Research and Education Network Canarie, Inc.

OnsNet selected VolkerWessels, who in 2002 had acquired the network construction division of KPN, as their network contractor and then approached the Dutch government, stating that although they were outside the originally assigned area, their plan was to organize a local community drive to articulate and aggregate demand and this could save their "Kenniswijk-trial" from failure. One of their niftier ideas was to place a small front lawn marker (see Figure 13) for each household that signed up. Less to instruct the construction company where to dig cable as to signal to neighbors how many people registered for membership of the cooperative in their street.

In 2004 the installation of the network in Nuenen went on and after a first trial year the cooperative started asking for regular payments in January 2006 for their services in this town of near 8000 homes. They signed up 80% of the homes for fixed voice telephony, 73% for fast symmetric internet access (initially 10 Mbit/s later expanded to 100 Mbit/s) and 67% for the CATV-packages[46]. Services are provided by Edutel BV, a telephone company and ISP from the Eindhoven based Fontys Hogescholen (a college level education institute), which is found in Table 1. Special services for the local community were developed for the network, in particular televised church services from the local church led the priest recommend switching operators.

The co-operative launch did not go entirely without hick-ups. After a cost overrun the ownership

[46] Data on penetration levels has been collected by Stratix Consulting for an FTTH statistics database, which tracks local FTTH/B developments down to the neighbourhood levels http://www.stratix.com/ftth.php

arrangement was renegotiated to a 51% ownership of the network by the cooperative and a 49% share by an investment vehicle from the Wessels-family, with VolkerWessels then providing the managing director. OnsNet also expanded into the bordering blue collar Tongelre neighborhood in Eindhoven in January 2006 with a similar community drive approach, but offered besides a fast Internet access a slower 2 Mbit/s symmetric bitrate for a lower price. The line up at the first freezing saturday for signing up to the service is shown in Figure 14 . OnsNet Eindhoven reached 60% penetration of the homes in the Tongelre area.

Figure 13 : Front lawn marker for participants in cooperative network OnsNet

Figure 14 : Citizens in Eindhoven queuing to sign up to OnsNet Eindhoven, Jan 2006

A calculation based on retail prices of the offerings by OnsNet, UPC and KPN suggests that fixed revenue market shares in Nuenen from 2006 on were 80% OnsNet, 10% UPC (mainly single play CATV) and 10% for KPN (mainly voice telephony). The Eindhoven network had a bit lower penetration, but still resulted in an entry where the majority of revenue streams for communications services changed to the newly constructed FTTH platform.

The success in penetration with the OnsNet-projects lead VolkerWessels conclude they had encountered a functioning business model for FTTH-market entry and they created a new venture OnsBrabantNet to target other towns in the Eindhoven area, using community drives and local “ambassadors” aggregating demand from the citizenry. VolkerWessels set a minimum threshold of 40% of households pre-signing before construction would start.

VolkerWessels also contracted in 2003 with housing corporation Portaal, to wire up their 58,000 homes in the cities of Leiden, Utrecht, Amersfoort, Arnhem and Nijmegen. Nijmegen, was also the residence of B. Nederkoorn, managing director of SURFnet, was very familiar with Canarie, Inc and B. St. Arnaud as he was a prime collaboration partner of SURFnet in the Research and Education Networks community. Nederkoorn decided to try the community model in his own neighborhood with a local non-profit foundation Glazenkamp. The foundation negotiated a supply contract with Reggefiber, the investment vehicle the Wessels-family created for funding fiber ventures. Supply of a local fiber optic network was contracted for 20 years, with an extension option for another 20 years, with a CPI-indexed price for leasing fiber pairs per home. Reggefiber required a minimum pre-signing of 40% of households. CPI-indexation would be halved for penetration above 50% and reduced to a quarter above 60% penetration. At penetration above 70% Reggefiber promised to connect every home and not index the fiber pair lease price. When the passive networks usage would fall below 40% penetration for two consecutive years Reggefiber would receive pricing freedom, as the foundation assessed that in that case copper and CATV-coax were still in more demand.

The foundation made separate contracts with *active operators* a 2 year exclusivity for XMS a provider of triple-play services and an allowance for his foundation to retender for 1 Gbit/s capacity service after 5 year, with the freedom to then attract another operator to install equipment, when Reggefiber would decide not to supply. Glazenkamp reached 65% penetration among neighbors signing up for services.

The only project in the Netherlands were a local community financed and constructed an outdoor fiber optic network without outside investors was Lomboxnet, a neighbourhood in Utrecht. Other efforts for instance in a new development in Amersfoort-Vathorst resulted in a local community signing up 995 of 1001 new homes in their area, but like Glazenkamp, they contracted with VolkerWessels and XMS (Reggefiber). Fiber-to-the-Building has become a market for specialist firms installing networks and providing services to condominiums as well as housing corporations.

Reggefiber became in 2006 an 80% investor in Lijbrandt Telecom, a firm that had contracted for FTTB with several housing corporations, like Duwo for dormitories and Vestia in The Hague for apartments as well as elderly care centers. The owner of Lijbrandt decided to overbuilt his firm's home town Hillegom, center of the Dutch tulip field region, which resulted in 75% penetration in 2006. Also in this town televised local church services were added to the offerings. A subsequent attempt then to rewire neighboring town Lisse failed to reach sufficiently high pre-signing levels. CATV-operator Ziggo dispatched their own local marketing teams that waited on the street corners to observe the construction men going door-to-door selling their fiber services, after which the Ziggo team rang on the opened doors and provided their discounted counter offer.

Earlier efforts by cable operator UPC to provide heavily discounted triple-play offers by telemarketing teams of € 19.95 for a bundle in contrast to a typical € 50 - € 60 price over FTTH has proved a failure against the neighborhood ambassadors. After Ziggo's shown ability to reduce demand for FTTH by local on the street marketing, UPC changed course when projects in Dutch UPC cities like Amsterdam, Almere and Hilversum were announced and then organized counter information meetings for the citizenry, to match efforts and meetings organized by enterprises the Wessels family had invested in. UPC also launched 120 Mbit/s Docsis 3.0 cablemodem service, in the larger cities when FTTH-projects were announced.

A review of the penetration statistics for FTTH organized by demand aggregation in the Stratix database indicates that these efforts tend to be most successful when they are organized by either a visible local community leader and/or local entrepreneur as well as a not too large town or city c.q. city district. The typical target towns contain between 6 and 10 thousand homes and 15.000 to 25.000 inhabitants.

The largest successful effort has been in Deventer, an old Hansa-city with 97,904 inhabitants and 40,366 households. But Deventer had a cheerleading municipality, and also the temporary headquarters of Reggefiber and the first FTTH-projects were developed by a housing corporation that then sold it to Reggefiber. The total number of FTTH-projects, albeit growing, with various types of pre-signing efforts and community drives is alas still too small to allow for statistical meaningful regression analyses on the relation between these "local" factors and success in penetration rates.

7. Politics and finance enters the discussion

Where the activities of housing corporations, initiators of cooperative arrangements and VolkerWessels (later Reggefiber) in the Eindhoven area except for the Kenniswijk-trial stage were organized with local governments mainly in a cheerleading role, the Cities of Amsterdam, The Hague and Rotterdam had different ideas as had Almere, a new developed city in reclaimed land and Appingedam. A small town in an economically deprived region with high unemployment, but also with the largest Dutch fiber optic cable manufacturing plant from Draka on the other side of the canal in Farnsum.

Many municipalities who had originally also bid for the Kenniswijk-trial in 2000 decided to elaborate their own ideas. Most ended up in vain, but early 2002 the Dutch government thought it wise to ask for tenders for € 3 million in subsidies to municipalities to advance some of these projects. The key requirement was that the subsidies would not be invested in infrastructure, only in complementary activities / project management.

Among the 12 awarded municipalities Appingedam was listed nr. 1. They planned to construct a new fiber optic network in their town of 12,000 inhabitants. The tender for the network was won by Nacap, a subsidiary from

construction firm Koop, founded in nearby Tjuchem, and the cables would be produced at the Draka Farnsum facilities, while Cisco would deliver the network equipment.

When the Appingedam municipal council decided to approve their project Damsternet, on 27 may 2004, it got challenged in court by local cable operator Essent Kabelcom as they considered it State Aid. That must be notified to and approved by the European Commission first, before construction starts[47]. At that time only telecom incumbent KPN provided ADSL service in Appingedam, also Essent Kabelcom only announced it would install cablemodem service in the summer of 2005. The more peculiar side of this case was that Essent itself was a 100% government (several provinces and municipalities) owned utility, prohibiting one of its shareholders to bypass it. For the law an incorporated firm is a private entity, even with only public shareholders, but a municipality creating a new entity can create state aid. Appingedam lost this case, and was required to stall the project and ask for a State Aid review first in Brussels. Brussels considered it State-Aid in 2006.

Amsterdam and in its trails The Hague and Rotterdam took a different approach. In 2003 Amsterdam created a Committee lead by the then 75 year old former Minister of Economic Affairs J.E. Andriessen. Andriessen (Christian Democrat) was instrumental as minister in the 1960s in developing the natural gas distribution network. After an international career ending it as CEO of van Leer Packaging he became chairman of the Christian Employer Association, before returning in 1989 as Minister of Economic Affairs and briefly Transport and Telecoms minister. In his committee were former ING Group CEO A. Jacobs, an Amsterdam housing corporation executive and a professor in Competition Law and telecoms regulation who also worked as lawyer for the Amsterdam office of Allen & Overy. This committee advised the city to invest on in a newly created passive fiber optical network that would lease out fiber pairs on equal terms to private investors. The City elaborated it with a partner of another major law firm along the lines of the Market Economy Investment Principle. This is a legal principle in the EU that allows a public entity to invest in private firms as long as it behaves like a market investor. To prove it behaves in that way, it must not disadvantage itself e.g. by operating as a guarantor of last resort.

The City of Amsterdam invested € 6 mln, 5 Amsterdam housing corporations jointly invested € 6 mln and two private investors Reggefiber and ING Real Estate invested € 3 mln each and a bank provided a loan for € 12 mln to a joint-venture called GlasvezelNet Amsterdam (GNA). This would suffice for constructing fiber to the first 37,000 homes. GNA would deploy an unbundled local loop network between an optical distribution frame and the homes. It conducted an European tender for an wholesale operator willing to supply active equipment and provide wholesale services to ISPs and triple-play service providers. BBned, a wholesale DSL operator landed the contract. Part of the contract was that when BBned and the ISPs would not meet certain penetration rates of active users, GNA would be free to invite additional operators.

Amsterdam then wrote a notification to the European Commission, stating that according to their interpretation this setup was according to the MEIP and thus not State Aid, as the majority of investors were private and the city invested on equal terms. Would the Commission confirm that assessment? The cities of The Hague and Rotterdam each also had their committees lead by Andriessen, but did not dare to follow Amsterdam and decided to wait and see.

What occurred was that the EU DG Competition, freshly headed by mrs Neelie Kroes got aid in early 2005 by a dispatched civil servant from the Dutch Ministry of Finance, which was headed by Deputy prime minister G. Zalm of the Liberal party. The minister of Economic Affairs, who held the telecommunications portfolio, but was a Social Liberal, was not informed by this act. This civil servant before departing to Brussels wrote a piece dissuading

[47] Court decision in Dutch: http://www.rechtspraak.nl/ljn.asp?ljn=AQ8920

the proposals of the Andriessen committees titled Glasvezelkoorts (Fiber fever)[48] in the Dutch economists weekly ESB.

While mr. Passenier was able to aid the Commission with the rejection of the Appingedam plan as State Aid, the only rejection of an FTTH initiative up to today by DG Competition, the approach according to MEIP was not easily dismissed. This was an issue for DG Competition, as they had divided Europe in "white" and "black" areas. FTTH projects in the white areas (rural areas like North-Scotland, mountain areas etc.) they would approve after scrutiny, projects in black areas would be prohibited as distorting the market. City investment in FTTH by their own power utilities like Fastweb in Milan or NetCologne in Cologne, would however be allowed. However applying under the Market Economy Investor Principle the City of Amsterdam broke the EU advance approval scheme as it would allow municipal co-investment in obvious one of their "black areas".

In April 2006 Liberal representative Aptroot launched his amendment to prohibit municipalities from investing in networks and requiring those with existing investments to review and sell off in at most 5 years after enactment. That month GNA was officially created with a 45 – 0 vote in the Amsterdam City council. The two Alderman defending the investment were both members of the Liberal party. At the last moment Christian Democrat local council member O. Olmer, who also is Head of Regulatory Affairs at BT Global Services in the Netherlands, threatened to vote nay. Ultimately all council members went along.

In February 2007, a day after a new coalition of Christian Democrats, Labour and the Christian Union took over, the Minister of Finance and Labour party leader W. Bos, recalled mr Passenier from Brussels. A German EU civil servant took over all 10,000 pages were translated and in December 2007 mrs. Kroes declared Amsterdam's MEIP scheme as "not State Aid".

What occurred in this effort was that the national and european politicians in general, but in this case from the Liberal party in particular, opposed the attempts of the City of Amsterdam, led by liberal party Alderman and assisted by a select number of business leaders and legal experts. This provides reminiscences to history book descriptions of 17th century politics in the Dutch Republic, where the Amsterdam Magistrature and Merchants fought out long disputes with the Staten-Generaal. Plus ça change …

One of the peculiarities that surfaced is that in the bylaws of GNA the City of Amsterdam reserved some special rights and options in cases of sale of shares and major decisions. As a public authority it is not allowed to disadvantage yourself vis-à-vis private investors under MEIP, but it is allowed to receive preferential treatment. It looks like the City of Amsterdam, by early investing, has created a kind of "golden share" for itself, alongside an optical unbundled local loop network with open access.

As the Aptroot-Hessels amendment was adopted in june 2006 (and approved in the Senate in 2007) Amsterdam is allowed to proceed, while other Dutch cities are prohibited to follow its example. But other cities around Europe can follow its example. The entire political discussion in the three largest cities started in 2003 but only Amsterdam is now deploying FTTH. Rotterdam and The Hague have stalled any progress since that time.

8. The financial sector enters too, engaging in voluntary unbundling

While it shouldn't be a surprise that the cooperative Rabobank was in particular willing to look after financing "network co-operatives", the investment in GNA by ING Real Estate, provided a different signal: genuine entry of real estate investors.

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[48] J.J.D. Passenier, *Glasvezelkoorts* , Economisch Statistische Berichten, vol. 90, issue 4450, pp 12-13, 14-1-2005 also at http://www.minfin.nl/dsresource?objectid=3230&type=pdf

Real estate investors tend to invest in assets that do not deteriorate fast and have a characteristic to track consumer price inflation and/or wages in the long run. As is already described lease prices of fiber pairs in the Netherlands are CPI-indexed. The prime argument is that labor intensive trenching and construction[49] will probably be needed in the future in case of replacement or overbuilt. That makes it reasonable to raise the annual lease fee with either a wage index or CPI. It also explains why a vertically integrated network operator is not easily considered as Real Estate as the electronics, software and optics (lasers etc.) age too fast.

Rabo Bouwfonds created the Dutch Communications Infrastructure Fund in 2007, an investment vehicle of a few Pension funds, that acquired several of the remaining (municipal) CATV-networks and engages in **voluntary** unbundling. They do this by creating a passive "home run" fiber network with multiple fibers by constructing two Optical Distribution Frames one "green fiber" for the CATV-company and one "blue fiber" for a telecom company. A key element for them is to separate the investor in the passive plant from the regulated operator business and index the passive plant with the CPI. They fill the network by contracting with an *anchor tenant*, who does a cut-over from the existing CATV-plant to this network as first wholesale tenant. Whether this setup will succeed to also attract telecom operators on the second fiber remains to be seen, but chances are high.

Table 3 : Regulated local loop access tariffs differ for near equal construction costs per home

Access network		Wholesale access tariff per month	Avg construction cost per home connected
ULL - MDF access	(KPN)	€ 5.99	€ 1000
Coax - CATV resale	(Ziggo)	€ 8.45	€ 800
Coax - CATV resale	(UPC)	€ 8.83	€ 800
OLL – ODF access: actual	(Reggefiber)	€ 12.00 - € 15.00	€ 775 - € 1025
OLL – ODF access: ceiling	(OPTA tariff)	€ 14.50 - € 17.50	€ 775 - € 1025

Table 3 shows the tariff decrees the Dutch regulator published in 2009. Where originally only unbundled local loops (ULL – MDF access) was regulated, they now also started to regulate a wholesale line rental price for reselling analog CATV. Also, when in 2008 KPN announced to acquire a minority share in Reggefiber, OPTA decided to regulate the firm. The Reggefiber price is the actual one, the OPTA tariff is a ceiling that resembles remarkably a €2.50 surcharge on the Reggefiber business model which provides a different wholesale rate depending on the average Capex in an FTTH area.

As the Reggefiber business model was voluntary *structural separation* and community cooperatives like the Glazenkamp Foundation were able to contract with them, regulator OPTA had a tough time to defend their intervention. The only explanation seems to be that would the KPN (the incumbent) minority participation of 41% in Reggefiber in 2008, with future options to acquire majority control (51%, 60% for KPN on performance tresholds of 1 mln and 2mln homes), have remained under Competition Law conduct rules only – thus was it not regulated under Telecommunications Laws – the net result would have been that a large precedent was created that every incumbent in Europe could have "bought" itself a Regulatory Holiday by negotiating a similar styled 40%-60% ownership deal for a number of years with for instance a Pension fund like ABP.

The result of OPTA's decision to regulate Reggefiber within two years after its assembly from the various initiatives funded by (Volker)Wessels, by simply declaring all regulation designed for incumbent KPN valid for every participation (a kind of chain-clause) even in networks were Reggefiber itself held minority stakes, reveals three major flaws in EU telecoms regulation.

1. Regulation seems to presume unwilling incumbents, not voluntary unbundlers

[49] It is estimated by the Cable Industry Association that 50% of their network cost is labor cost, but this includes electronics. In FTTH projects 75%-80% might be closer to the truth.

2. Voluntary long term contracts like Reggefiber – Glazenkamp with a 20 year period, cannot be put in tariff regulation as the EU Framework requires a triennial Market Analysis and review. With a 3 year review cycle EU regulation is effectively biased to equipment investment and its innovation cycles and not the outside plant cycles.
3. The EU Regulatory Framework is not able to cope with many different local operators. Doing one market analysis with a major incumbent is executable but 10 different firms in various areas leads to a document flow of notifications that either overwhelms the national regulator or Brussels.

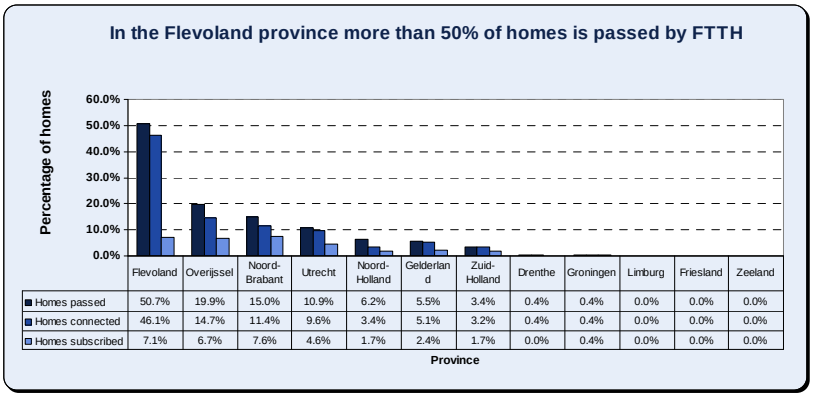
9. Discussion of the Netherlands case and future research

The experience in the Netherlands shows that the high level of capital expenditure required for subterranean construction of local loop networks effectively creates a market where it is difficult for cooperatives to succeed without an investing entrepreneur or property owner (housing corporation, real estate investor) as counterparty.

Also local demand articulation and aggregation has not been successful yet in large cities, the method to enter markets seems more adapted for relatively homogenous populations and dependent on a known local figurehead. It is thus replicable as a method, but highly sensitive on local context.

Also the case learns that in a highly developed economy there are far more potential entrants, and sources of finance available for local loop construction than the often restricted list of incumbents and competitive local exchange carriers. Entry by construction companies, retirement funds, housing corporations who meet aggregated demand is possible. It does not need to be the municipality or the province who has to enter the market.

Those who engage in high capital expenditure for FTTH-loops tend to have strong incentives to open the local loops and wholesale as such activities boost penetration levels.



	Flevoland	Overijssel	Noord-Brabant	Utrecht	Noord-Holland	Gelderland	Zuid-Holland	Drenthe	Groningen	Limburg	Friesland	Zeeland
Homes passed	50.7%	19.9%	15.0%	10.9%	6.2%	5.5%	3.4%	0.4%	0.4%	0.0%	0.0%	0.0%
Homes connected	46.1%	14.7%	11.4%	9.6%	3.4%	5.1%	3.2%	0.4%	0.4%	0.0%	0.0%	0.0%
Homes subscribed	7.1%	6.7%	7.6%	4.6%	1.7%	2.4%	1.7%	0.0%	0.4%	0.0%	0.0%	0.0%

Figure 15 : Overview of FTTH coverage per province in the Netherlands

In Figure 15 the current state of the market is organized by province. Not only are the 5 trailing provinces on the fringes of the country and the weakest in economic sense, they are also the least dense populated and have the lowest average home prices. The database we use for the Netherlands can link user data at the neighborhood level with socio-economic data like home prices, household composition and income in that area. Regressions must however be well defined as causality probably flows both ways. A statement that an FTTH-connection or a “home with a tail” improves the value of the home is easier determined in the rental sector, where cash flows improve with less vacancies, than from (average) home price developments in an area compared with a non-fibered area.

Today economics of density are such that the two large investors: Reggefiber and RBCIF develop entire towns / cities at once. Cherry-picking of neighborhoods seems not to occur. The most well-to-do towns and neighborhoods tend to require more capital expenditure as homes are separated by larger gardens. Thus picking high income towns / cities first might be the explanation but would require further research.

With unbundled local loops over copper, coax and fiber now all priced, there is a new question looming whether the regulator is not so much overpricing fiber loop costs as well as pricing ULL and coax wholesale too low.

The Netherlands is a-typical with two major outside entrants financing and constructing FTTH, although one is teaming up with the incumbent telecom operator, while the other is mainly active behind cable system operators.

III. SUMMARISED FINDINGS

The user survey in Bulgaria showed families with children in the school age lead adoption, followed by young professionals. Education applications of broadband turn out to be successful, while e-Health initiatives fail and the most used e-Government application is filing tax-forms. In this respect Bulgaria is following the standard patterns in usage that can be read from any end user survey and / or e-Government Benchmark Measurement on any EU country. The prime difference seems to be higher satisfaction with the quality and stability as well as longer usage per day of a high speed connection compared to cable modems and DSL.

Both countries show the fastest deployment of new infrastructure occurs in areas where citizens (organize to) wire up their neighborhoods lead by (local) entrepreneurs who bypassed incumbents. Foot-dragging incumbents induced entry by industry outsiders deploying new high bandwidth technologies in both countries, but very different institutional contexts strongly affected the market outcome. The case studies showed that entrepreneurs meeting neighborhood organizers articulating and aggregating demand are key factors contributing to the current high ranking in international bandwidth performance indices of both countries. The study explains that Bulgaria today has 670 high-bandwidth service providers, due to low entry barriers for stringing wires across streets and on poles, while in the Netherlands FTTH roll out due to high CAPEX in trenching rapidly consolidated into the business of a few construction firms, real estate owners and pension funds who shifted the market from broadband services to selling (unbundled) fiber as the benchmark product.

The study finds esthetical policies to avoid aerial wiring, as well as non-forward looking cost models for unbundled copper loops and tri-annual market regulation reviews strengthen incumbents by tilting the regulatory context towards exploiting old networks and short term equipment upgrade investment above new cable construction. This adds to the explanations and questions one should ask why Europe trails Asia and the USA in new infrastructure roll out.

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