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Emerging Market Models in Telecommunications – how fibre access is changing the landscape

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Abstract

Concerning end to end (real) broadband networks there is no alternative for fibre cable in the access. On the other hand the cooper access network is coming to its limit very fast. The public opinion in Europe seems to be that telecommunication network operators should handle the roll out of fibre but this is not happening. The reason can be found in the traditional vertically integrated business model. The proposed solution is to utilize a new business model where the areas are separated and the new access network is handled as infrastructure. Separating the parts and adopting the open access business model seems to be the most promising approach in solving the challenge of building new communication networks.

1. Introduction

Market opening in telecommunications was achieved by mandating incumbents to offer access to their networks via different wholesale products. These regulatory measures should only serve as an intermediate step towards self-sustaining competition. After ten years this goal still is far away. It is conceivable that the bottleneck character of the access network will remain in place – maybe indefinitely - and that infrastructure based competition will not be achieved. This situation is conceivable unfavourable for any future broadband network.

When comparing the current common definition of broadband with the current development in fixed and mobile networks, the impression could be that there are a lot of broadband connections in Europe. Unfortunately this impression is misleading because broadband in Europe is commonly defined by transmission speeds of 144 kbit/s. Also the FCC definition of broadband is 200 kbit/s in one direction, and for advanced broadband at least 200 kbit/s in both directions. The OECD has defined broadband as 256 kbit/s in at least one direction and this bit rate is the most common baseline that is marketed as "broadband" around the world. On the other hand, in Asia this kind of broadband would probably be called bonsai broadband. Japan and Korea are the leading nations in real broadband penetration whereby broadband means 100 Mbit/s and more. With the project “e-Japan” the Japanese government started their broadband program in 2001 by setting the goal of connecting over 10 million households with 100 Mbit/s till the end of 2005[1]. This goal was not achieved in

[1] http://www.heise.de/newsticker/NTT-legt-100-MBit-Leitungen-bis-ins-Wohnzimmer--/meldung/19789

2005 but two years later. Nevertheless, today in Japan there are over 12 million FTTH connections and since June 2008 the number of FTTH connections has surpassed the number of cooper access lines[2].

The European Union has not implemented a publicly financed program of supporting the roll out of fibre access networks, today resulting in 1 million fibre access lines compared to 229 million cooper lines[3]. The reason for this huge imbalance is not because cooper lines are seen by network operators as future proof but rather because of high financial burdens from investment for deploying fibre in the access. On the other hand there are numerous studies which emphasize the importance of broadband access networks[4]. The common statement is that a good infrastructure is the basis for a strong industrial location and national economic growth and the most recent ITU-T report quotes:

> "*In economic terms, access to a national broadband fibre network is as important a priority as building an effective national transportation network.*"[5]

According to the Federation of German Industry (BDI) only building these networks would result in 250.000 new jobs[6]. Incumbent network operators like Deutsche Telekom are aware of the fact that the existing cooper network will not be sufficient to cope with the rapidly growing data traffic but they are also pointing on very high costs for upgrading the access network with fibre. Rene Obermann, CEO of Deutsche Telekom, recently stated that this would be up to 50 billion Euros in the next 15 years for Germany only. Replacing the existing 229 million cooper lines would amount to investments around 300 billion Euros[7].

The European commission and the European governments have always counted on the free market forces for building new communication infrastructure. In the case of mobile networks it has proven to be right but in the case of fixed access networks, self-sustaining competition failed. The costs of upgrading the access networks with new cables seems to be very high and the financial incentives for traditional network operators are not existent. There are no new services that could only be provided by a 100 Mbit/s connection and for existing services

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[2] http://www.stat.go.jp/data/getujidb/zuhyou/o02.xls
[3] http://futurezone.orf.at/stories/308505/
[4] [Connected Nation, 2008], [Allen Consulting Group, 2003], [BMWi, 2006], [Gillett, 2006]
[5] [ITU-T, 2008]
[6] http://futurezone.orf.at/stories/1500270/
[7] http://www.euractiv.com/en/infosociety/eu-pushes-high-speed-internet/article-173662

like telephony, Internet and TV, customers are not ready to pay much more because of higher access speed.

On the other hand there is no alternative for fibre cable in the access. The cooper access network is coming to its limit very fast. On the one side the permanent higher customer request for higher Internet speed and on the other side new services like IPTV. IPTV is a very broadband "hungry" application, additionally disturbing existing services that are transmitted over the same cooper line especially on longer access lines (above 1.000 meters). For cable TV operators the current conditions are slightly better because of higher transmission speeds they can provide over longer distances by upgrading to DOCIS3.0 but neither cable operators will come around fibre.

Doc Searls description of fibre is very colourful[8]:

> "*One optical fibre is the width of a human hair. A typical fibre trunk fits an 864-fiber cable inside a 1,5-inch conduit and each fibre can carry 10 gigabits of data. The total comes to 1,6 terabits.*"

Additionally he says that:

> "*David Isenberg[9] puts that into perspective: If all 6,5 billion people on earth had a telephone, and if they were all off-hook, generating 64 kilobits a second, and all those conversations were routed to this cable, there would be 100 fibres still dark*."

If talking about real broadband (fibre) infrastructure in the access part, predominantly we will talk about one network. Obviously there will be areas that can sustain two FTTH cables, but there will be that many. Even future DOCSIS standards or eventually HFC can't economically compete with fibre because of the huge capacity advantages of fibre. There is no real incentive to build a second fibre infrastructure. It would be like building two motorway exits or duplicating electricity, gas or water infrastructure. Paris is currently one of the places where fibre infrastructure is partially duplicated by fibre roll outs of Orange (France Telecom), Neuf Cegetel, Free (Iliad) and Numericable but this is because all of them have started to build out

[8] http://publius.cc/2008/10/30/searlsforward-with-fiber/
[9] Author of „The rise of the stupid network“

at the same time and the regulatory framework for fibre deployment in the access isn't set yet.

Wireless broadband is a different infrastructure and will develop in parallel with FTTH but because it has a totally different business case it will not be "overbuilt" but either being a substitute for real broadband.

The paper is organized as follows: Section 2 looks at the vertical integrated telecommunication business model. Section 3 discusses new business models, whereby the open access model is discussed followed by two practical examples (NDIX and SSNf). Thereafter section 4 and 5 are analysing the existing and new business models respectively. Finally in section 6 we describe the new market model and conclude with section 7.

2. Telecommunication service provisioning

Traditional telecommunications providers are vertically integrated companies which offer telecommunications infrastructure (networks) and services. The public Internet on the other hand shows a clear distinction between infrastructure and services as well as from a technical point of view as in the business models. The future is sometimes painted as an "either / or" between the traditional telcos and the Internet.

The vertically integrated telecommunication business model is show in figure 1 and is based on the traditional value-chain business model like those that exist almost everywhere in our modern economy[10]. The main characteristic of this model is the one-stop approach where every part of the chain is controlled by the company.

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[10] http://en.wikipedia.org/wiki/Vertical_integration

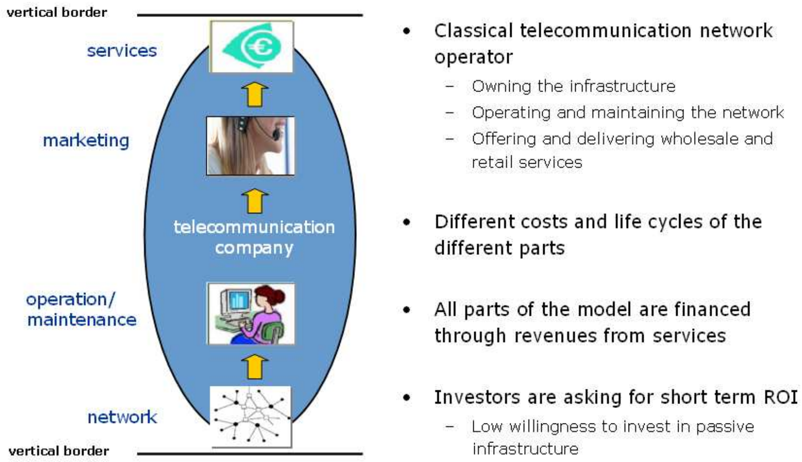

Figure 1: Vertically integrated networks

The network operator owns the network infrastructure and he is in charge of operating, maintaining and upgrading the network. Also the sales, distribution and marketing parts of services offered are in the hands of the network operator. Either the service or product itself is owned and controlled by vertically integrated companies. The advantage of this approach is a unique selling proposition and over the time telecommunication companies have developed their telephony service to perfection.

In the telecommunication business the model is subscriber-centric whereby the income is generated by monthly fees, voice calls (charged by time and distance) and the subscription to additional services like Internet access and IPTV. By collecting service revenues from services offered, telecommunication companies have been able to finance all parts of the chain and particularly the voice business was very successful over the last few decades. This is now changing rapidly.

The last 10 years have been characterized by a substitution of fixed by mobile telephony, resulting in a permanent decline in the number of fixed telephony subscribers thereby alleviating the income from the monthly fees. On the other hand, in the last years voice is under intense competition also because of Internet telephony, which is exerting downward pressure on revenue and profits by very low voice call charges. On the other hand, most broadband services, while certainly contributing much needed revenues, are in fact the dumb-pipe variety and will therefore commoditize rather quickly. It is the beginning of suffering the same revenue and margin squeeze as in the voice business.

Network operators are today trying to go against this trend by introducing new service platforms like IMS (IP Multimedia Subsystem) and cutting their operational expenses, but the main problem seems to be their existing business model. Because the business model is mainly dependent on revenues generated by service charges, fading service revenues also mean less money for financing parts of the chain. Thereby the most expensive part is the passive infrastructure in the access network which is nowadays starting to be the bottleneck for a real broadband network.

Prof. Raul Katz concluded in his study[11] that incumbent operators are investing in fibre not because they make profit, but because of strategic reasons. If there is a strong competition between fixed network operators and cable companies, the incentives for fixed operators to invest in the roll-out of fibre is higher. The main parameters for profitability are ARPU and take-up rate, whereby the situation in Europe and America is slightly different because of higher ARPU in America. On the other hand there is a second very interesting remark of Prof. Katz – if incumbent operators are investing in acquisitions their incentive in additional investments in new fibre infrastructure is very low.

If traditional network operators are not in the position to finance the upgrade of the access network, the question is what alternative players or business models are able to achieve this very important issue. In the following chapter we are introducing some of the emerging new aspects.

3. Emerging new business models

Alternative business models are combining elements from the Internet model and from the traditional telecommunication business model. The basis for the different models is the open access model which we are presenting first followed by two practical examples.

3.1. Open access networks

Open access means non-discriminating access to a specific part of the network. We have seen that the openness of traditional telecommunication network is limited. If not forced by regulation they would not allow the usage of the passive and active parts of their network to alternative network or service provider. The reason is prevailing economical but the most

[11] [Raul Katz, 2008]

recent progress is showing that the vertically integrated business model is having serious problems in generating new revenues in the classical telecommunication business.

Talking about open access and communication networks, we have to differentiate between three main parts:

- passive network,
- active network, and
- services

The parts are shown in figure 2 whereby the vertical border has moved from the edge and is now in between the areas we are familiar with from the vertical integrated model. In the fist place it means that the network and the service will not came out of one hand but therefore the incentives for other players to join and invest are much higher.

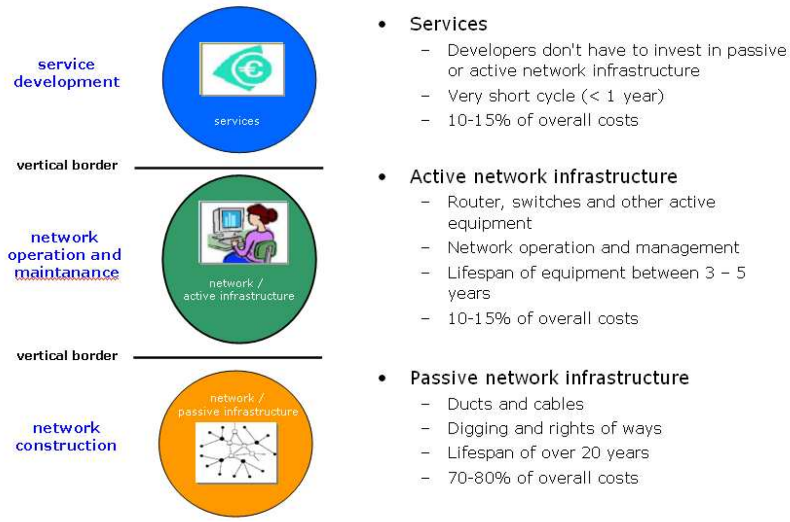

Figure 2: Parts of an open access network

The main characteristics of the passive network is a very long life-time of over 20 years. This is the fact for almost any infrastructure but on the other hand it is also common that the costs for building infrastructure are very high. For communication networks it is generally assumed that this investments are between 70 – 80% of the overall investments[12]. Passive network elements are ducts, trenches, cable channels and also fibre optics if they are not lightened.

Elements for controlling and maintaining the network are active parts, whereby the life-time of this part is much shorter then of the passive parts. Today we are assuming 3 – 5 years of life-time and investments between 10 – 15% of the overall investments.

The third part are services which can be provided to customers connected to the network. Estimating the investments for developing services in the same range as for active equipment (10 – 15%) the life-time of services is extremely short. Out of the “Internet-age” we are living in today, we generally assume that one year would be the average between rise and fall of common service deployment.

Concerning the interplay of these three parts, contrary to the vertically integrated model, the single parts of an open access model can be controlled by totally different companies. Assuming that a municipality is building the passive infrastructure, the possibility of lack of know-how in operating such a network is quite high. The operation and maintenance can be transferred to a professional company with experience in running such kind of networks. The company winning the tender will get a contract for running the network and their obligation is to provide the functional operation of the network for 24 hours a day. Beside this main responsibility there is no other task in providing any kind of end user service.

If the network owner or the network operator are providing any kind of retail service, the possibility of discriminating some service provider which is providing the same kind of service over the network using only the wholesale component is very high. This is one of the reasons for regulation in classical telecommunication networks especially with respect to discrimination and margin squeeze scenarios. A pure separation between network and service provisioning would also eliminate the need for a network neutrality debate. There is no need for network neutrality if the sole task of the network operator is running the perfect network and not additionally in protecting their sources of service revenues like in the vertically integrated business model. The British Telecom is going in this direction with OpenReach[13] but not without any critics coming from alternative network operators like Cable

[12] [ARCEP, 2007]
[13] http://www.openreach.co.uk/orpg/home/home.do

& Wireless. Critics maintain that the conflict between working with competitors while still being part of BT is too great[14].

It is quite interesting that beside the newest deployments in fibre optic access networks, there are already existing variants of (partly) open access networks. One of this examples is NTT DoCoMo i-mode Platform, which is running in Japan since 1999. i-mode stays for interactive or Internet mode and is a mobile Internet service that is very successful with over 48 million subscribers[15]. The main characteristics are the possibility for third party service providers being able to offer their services to NTT DoCoMo customers. NTT DoCoMo has provided a technical platform for service providers and a very attractive revenue sharing model. On the other hand the voice service provisioning is exempted from third party offerings. It is also the decision of NTT DoCoMo which services can run on the platform and which not. The positive aspect of this deployment is the diversity of new services for customers of NTT DoCoMo.

Another example would be the Internet. There is no network owner in the classical sense because the Internet is a network of networks. Because of this service developers don't have to ask for permission to run any service over the network. Beside many other drivers this is the main one in the development of the diversity of Internet services we see today.

At last also Apples iPhone could be taken as an example of the success of (partly) open access. The phone has become a highly generative platform for countless purposes and one of the main characteristics is the apple store from where third party applications can be downloaded. In just three months, the number of applications has grown from a handful to more than five thousand[16].

Generally there is a number of positive and negative aspects of open access networks. As advantages one would see the service competition on the service layer, which is pushing innovation but also lowering the price for the same sort of service (TV, telephony and Internet access). Both properties are highly appreciated by users. For the customer it also means a much broader service offer and if the network is build and owned by the municipality they also act as a neutral partner for the house owner. Service providers don't have to invest in

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[14] http://www.guardian.co.uk/media/2007/may/29/internet.digitalmedia
[15] http://www.nttdocomo.com/services/imode/index.html
[16] http://publius.cc/2008/10/30/searlsforward-with-fiber/

infrastructure, lowering their costs an rising the incentives of providing their services to any open access network subscriber. The market entry is much easier as in the vertically integrated model or even some of the presented partly open access networks.

If the municipality or some of the existing utility companies are building the network, it would be seen as one of many infrastructure projects. There is plenty of experience for this because it is everyday business and also the costs would be reduced because existing infrastructure would be used (ducts, channels, buildings, house connections points). In small communities where people are more socially connected also the establishment of volunteer “building troops” is feasible, additionally reducing the cost of civil engineering. By this house owners are participating by self supply and after constructing their municipality fibre network, also participating in operational costs of the network by paying access charges like for water, gas or telephony. The main force for the community is to build the network by funding and connection charge (CAPEX) and cover operational costs (OPEX) by monthly access charges.

The advantage of location for the municipality or region would also be large, because companies will see the municipality as much more attractive for settlement. This will also attract new inhabitants because the living environment is appealing.

On the other hand, building the passive infrastructure is also a sort of challenge for the municipality in the sense of financing, finding partners (financing partners, other municipalities), tendering the operation of the network, organizational aspects for managing the whole project (responsible person), securing funding, marketing and balance with existing network operators. Some of the practical experience from Sweden and the Netherlands shows that from idea to market it takes about 5 years. The main force to win customers nowadays is offering cheap, fast and unlimited Internet connection and it looks like this could be the “killer application” for FTTH.

3.2. Examples of building and connect fibre networks

One of the possible ways in financing the open access networks could be that home owners are contribute to the cost of infrastructure like in the project of Malarenergie in Västeras in Sweden, but there are also other ways. By the next two practical examples we will show how fibre networks can be build and connected.

3.2.1. NDIX

NDIX[17] (Nederlands-Duitse Internet Exchange B.V., Enschede) is a non-profit organisation established in the year 2000 and is based in the Netherlands. It has several functions:

- Digital marketplace
- Internet exchange
- Platform for broadband interconnections
- Platform for knowledge transfer

The mission of NDIX is to accomplish cost reduction of broadband services through supporting fair competition between service providers by means of separation of services and infrastructure. NDIX comprises various interlinked locations in the Netherlands and Germany. These serve as a single marketplace. It therefore does not matter where an organisation is connected, it has access to the whole of the network.

All participators of NDIX are coming from the public sector – the power utility from the city of Münster, Participatiemaatschappij Oost Nederland (Oost NV) and holding technopolis Twente (University Twente).

In the context of the previously presented open access network, NDIX is primary taking the role of the network builder. They are investing in passive network infrastructure by laying new fibre or renting existing one. The fibre is additionally lit and every customer is provided with an 1 Gbit/s access, but the functionality is given only up to Layer 2 by using Ethernet switches. NDIX is not providing any Layer 3 routing and therefore they don’t have to deal with IP address ranges, routers and other necessary monitoring equipment. Routing and providing IP address ranges is left to professional network operators. The contract between NDIX and the network operator is a regular contract commonly used for running any other kind of communication infrastructure, whereby the payment is based on the amount of Ethernet ports that have to be managed. The network operator is not allowed to run any retail service on top of the network.

The third party in the NDIX setup are service providers which are forming the digital marketplace. The digital marketplace is the most important part in the whole setup, because without services there is no reason for potential customers in purchasing an access

[17] http://www.ndix.net/de/

connection from NDIX. More service providers and services means higher incentives for customers to subscribe and a big customer base will attract even more service providers for joining the NDIX marketplace.

It's a clear win-win situation but the catch is still in reaching the sufficient number of service providers. At the beginning there were only 2 internet service providers. Today there are 48 providers, providing a multitude of services, ranging from classical services like Internet access, TV and VoIP, over PC- and Server-hosting or Backup till e-learning and specific bibliographic services. It is quite interesting that at the beginning of their activity, NDIX has charged service providers by different (higher) access charges. Very soon it became obvious that the usage of symmetrical fibre access, allows customers to provide services Hence libraries, which initially subscribed as retail customers, started to provide bibliographic services to schools for a certain charge. Therefore NDIX changed their policy and today there is no differentiation between customer and service provider in the sense of access charges.

The unique price is 300 Euros per month for a 1 Gbit/s connection. By paying the monthly charge customers are able to connect with any service provider on the digital marketplace. If they decide to subscribe to a 10 Mbit/s Internet service provided by a specific ISP from the marketplace, they have to conclude a contract with the chosen service provider and NDIX will direct the establishment of a dedicated virtual LAN connection between service provider and customer. After having dedicated 10 Mbit/s for the Internet service, the customer is still having 990 Mbit/s spare capacity for using other services from the marketplace. The payment relationship for the Internet service is realised between service provider and customer.

At the end of 2008 there will be approximately 600 companies and 15.000 buildings connected to the NDIX network. The described business model of NDIX is positive since 2007, whereby the operational costs of the company are quite low, e.g. by employing only 15 persons.

NDIX is also permanently expanding their network by adding new towns and districts. They are following a very successful strategy by cooperating with the major and the city council of the target area. The first step is explaining the benefits of an open access fibre infrastructure for the companies and citizens residing in the area. Because there is a well populated marketplace on the NDIX network it is quite easy to convince the responsible contact persons because there is a multitude of new services and prices for existing services are usually much lower. On the other hand NDIX is not asking for any financial participation in building the network but looking for a strong support in marketing and patronisation of the project. The next step is employing a certain number of persons responsible for concluding preliminary contracts with residing companies. The salespersons are acting on behalf of the town and the contract are not only letters of intent but obligatory. After collecting a certain number of contracts, NDIX starts with the construction work. The first phase is connecting companies and the second connecting residential customers. The time between the first and the second phase is now about one year.

3.2.2. SSNF

The Swedish Urban Network Association (Svenska Stadsnätsföreningen, SSNf) is a non-profit independent trade association for open access network owners and operators established in 1998. Members are local authorities and companies which own or operate open networks. The main idea of SSNf is the promotion of active involvement of the member parties in creating the future broadband infrastructure in Sweden.

SSnf regards itself as an extremely important function as creator of real competition:

> *"A competition-neutral and operator-independent infrastructure with extremely high capacity, "true broadband" creates freedom of choice, openness and variety. The purpose of the urban networks is to create conditions for operators and service providers both large and small to compete on equal terms for the benefit of health and other care institutions, schools, businesses and households. The aim is for urban networks to together form a future-proof independent infrastructure on a regional and national level too, for the benefit of the whole of Sweden: an infrastructure that is mainly constructed using fibre cable technology, but which can be supplemented with other technologies when its suitable. Urban networks also form an important part of the authorities' adjustment to always being accessible, as well as being a distributor of data communication of importance to society, digital television broadcasts, telephone and film."*[18]

[18] http://www.ssnf.org/

Because of very early governmental encouragement in IT usage and optical network deployment, more than 200 municipalities of the total 289 are having fibre networks today and the they account for 20 to 25 per cent of the fibre coverage in Sweden[19]. This networks are built by the municipality, by energy companies, cable-TV companies and others, but all of them are owned by the city's or city owned / public companies[20]. The mission of all of these networks is to give the city an open infrastructure for everyone and stimulating the market by offering new operator capacity at below self cost. Additionally the existence of an common infrastructure will also reduce the digging in the streets, which has been the same leading thought by setting up Stokab in Stokholm.

The Association was established in 1998 and today has 155 members. The complete fibre network of all municipality owned networks has 3,5 million kilometres of fibre and reaches 45% of the total population in Sweden. Thereby it is a real alternative to the network owned by Telia, the incumbent network operator. SSNf is providing a platform for all members where they can exchange experience in operating, maintaining and documentation of OAN networks. SSNf also intends to carry their know-how further than the borders of Sweden and the first cooperation should be with Stedenlink, the Dutch network of Broadband cities in the Netherlands[21].

In 2007 SSNf has introduced the CESAR System in cooperation with the Swedish regulator PTS [22]. The “Centralt System För Accesser” (Central system for access lines) makes it possible for any service provider to offer their services in any OAN network countrywide by only one contract. Without CESAR the service providers based in the south of Sweden would be forced to make multiple contracts with transit network owners, if they would like to serve customers of an OAN network in the north. CESAR is a very important factor in the creation of an Swedish marketplace of service providers and thereby also the creation of diversity in services and lower prices for the customer. In the beginning of 2008 the incumbent operator Telia also has become a customer of CESAR.

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[19] [Alcatel, 2008]; [PTS, 2008]
[20] [SSNf, 2004]
[21] http://www.ssnf.org/templates/Base.aspx?id=65
[22] http://www.ssnf.org/templates/Base.aspx?id=2346

4. Analysing the existing business model

The vertically integrated business model is based on revenues generated by service charges. Not so long time ago the only service was the telephony retail service. Since regulatory changes were introduced this source of revenue have been decreaseing for the incumbent operators but on the other hand a second source of revenues, the wholesale business, has developed . By being the owner of the network, running the network and successfully providing the telephony service it has been a good business for a long time. Adding Internet access has been seen as an good additional income.

For fixed network operators the big change occurred with the emergence of two new technologies – voice over the Internet protocol (VoIP) and mobile communication networks. Both services have been directly competing with the main revenue generator of the telecommunication operator. How the technologies mature and become affordable, the challenge of customers cancelling their contracts has been larger. On the other hand the demand for faster Internet access keeps on going and the end is not jet predictable. Transit to mobile operators, VoIP and also the competition between fixed network operators are reducing the prices for telephony service which are dropping constantly, consequently reducing the profit. The answer to decreasing revenues is partially to be found in entering new markets (TV) but mainly in reducing operational costs. On the other hand to answer the demand for increased bandwidth for Internet access the only way is to invest in upgrading the network. The challenge is quite clear – if there is no money out of existing revenues, how to finance the upgrade?

The investment could be justified if there would be a “killer application”[23]. A new revenue source that is different from what is available from existing copper wires and only fibre having the ability to realise. But today there is now such application and the reason for this is obvious – if there is no fibre infrastructure, there is now way for new (fibre based) applications to evolve. It is a real chicken-egg kind of problem.

The challenge of finding the right business case for fibre investments is unfortunately not the only one. Incumbent network operators in Korea and Japan have been supported by the government for the last 10 years for rolling out fibre to the home. This effort has been

[23] Application so compelling that customers would buy the needed hard- or software

rewarded with the highest positions in the worldwide FTTH ranking but the statistics from this year also showing that fibre to the home is starting to “cannibalize” VDSL[24]. Therefore fibre to the home will undermine a providers’ ability to profit from its existing last-mile network!

Also the new source of revenues will get under pressure by fibre because Internet applications like WebTV will be more attractive and therefore compete directly with IPTV. Last but not least the unlimited capacity of fibre is undermining one of the basic economical principals. If there is no bandwidth scarcity, pricing a transportation system is extremely difficult. Like Roxanne Googin stated in her “Paradox of the Perfect Network”:

“*The best network is the hardest one to make money running*”.

5. Analyses of the new business models

Today it looks obvious that the classical vertically integrated business model of telecommunication operators is reaching a critical stage. This process is driven by the necessity of building fibre access networks witch are solely able to satisfy future demand on access transmission rates. Decisions on network investments are mainly based on expected service revenue and because today there is no fibre specific service for which the user would be willing to pay more, there is no business case for classical network operators for investing in a fibre roll-out. On the other hand – if there is no fibre infrastructure there is no possibility for new services and applications to evolve. Solving this chicken-egg problem requires new business models.

First of all it is important to realise who are the main beneficiaries of an optical access network. In our highly competitive business world of today, broadband infrastructure is becoming similarly important to the provision of electricity, gas, water and roads[25]. All of them are utilities which are self-evident and nobody is questioning their importance rather abstaining from not being “connected”. The ability of connecting to a broadband network is already one of the main decisive elements in the decision of a company to settle into a certain town or district. It is also starting to be a decisive element for not being forced to leave the existing premise. In only a short time from now it will be the same for citizens.

[24] http://www.stat.go.jp/data/getujidb/zuhyou/o02.xls
[25] [Connected Nation, 2008]; [Allen Consulting Group, 2003]; [BMWi, 2006]; [Gillett, 2006]

It is evident that the most advantages of a fibre infrastructure will be by cities and municipalities. Hence it is not a surprise that many municipalities and citizens groups are supporting or being actively involved in the construction of fibre networks in their jurisdiction. This has been shown by the presented cases of NDIX and SSNf but there are much more projects of this kind.

Analysing realised projects of open access networks worldwide it becomes clear that there are a few factors necessary to allow the successful realisation of such projects like

- High IT education and usage
- Governmental support
- Regulatory certainty
- Local initiatives
- Marketing

In both presented cases fibre-based access networks and sustainable competition have emerged through an interplay between public and private players and compared to the vertically integrated model there are more players occupying different parts of the value chain. The presented cases have shown how non-profit organisation such as NDIX and SSNf are approaching the deployment of optical fibre infrastructure but there are also other possibilities and parties being active.

We have seen that passive network infrastructure can be built by municipalities in the sense of being new public utility. The investments made are long-term investments with a long return of invest period

Services offered on the digital marketplace are different ISPs but also video, tele-learning, hosting, backup, security, e-learning and other service providers. NDIX is in many ways similar to SSNf, but they are also owning fibre based infrastructure. In this respect NDIX is a more integrated solution than SSNf. On the other hand, both offer a technical and competitively neutral interface to service providers and both are based on an interplay between private and public players.

The provided examples are presenting new players and new business models which are differing from the classical telecommunication model in separating the areas of competence. This approach could be seen as shifting the control of individual parts into areas where each of the new player is an expert but it also means splitting the possible revenues by a number of players.

5.1. Analysing the segmentation (technical point of view)

In this part we will give some possible answers on the question who will build the passive infrastructure part. Today the majority is expecting that carriers will take over this part, regardless if existing or new fibre service providers, such as telephony companies. For becoming a realistic possibility first of all the business model have to change because the vertically integrated approach will not generate sufficient revenues. If the carriers are going back to their roots and provide access only by only operating and maintaining a perfect fibre network, the operational costs would be much lower and the business model would change into a wholesale only business. Additionally a new source of revenues would be possible by allowing the homeowner to purchase the part between household and central office. By owning the access part the customers would co-finance the building of the fibre network and the carrier would be able to charge the homeowner a maintenance fee for managing the whole fibre network. It would be similar to condominium maintenance fee we have today. It would be a split between individual and collective ownership but it would also be a radical new approach for telephony companies.

Another entity for building the network would be the municipality. We have seen that many Swedish municipalities are already deploying fibre to the home but there are also more than 100 municipalities in the United States and the rest of Europe going the same direction[26]. In Europe the common approach is that municipality owned utility companies are leading the building of the network and also provide retail services. The utility company in Schwerte (Germany) is advertising their offer by “power play”, thereby pointing to the provisioning of water, electricity, gas and fibre access out of one hand[27]. It is quite obvious that adding fibre access in their portfolio is not causing a large increase of capital expenses, especially not if new housing areas have to be connected. The most expensive digging part has anyway to

[26] FTTH Council: Municipality Fibre to the Home Deployments, April 2008
[27] http://www.ruhrpower.de/paketuebersicht_start.html

be done for water, electricity and gas. Utility companies are experts on this and adding fibre access also doesn’t means they have to become a telecommunication company. There is a big number of companies on the markets who are experts on this field and utility companies can choose one of them. The best option would be for going to run an open access network, but on the other hand if the utility companies would first like to provide their customers very reliable services, the intermediate step would be a fixed-term contract with only one triple-play service provider.

We have also seen that the fibre infrastructure can be built by fibre construction firms like NDIX. NDIX is more than only a fibre construction firm but it is not the only one in the Netherlands. The company Reggefibre is very active in this area of business in the last decade. In the meantime Reggefibre has been so successful that also the incumbent company KPN was forced to cooperate with them. Regardless if carriers, municipalities, business or universities, they all can contract with this construction firms for building their fibre networks. The construction firms could also deploy fibre to the homes themselves and sell off strands independently, providing whatever limited maintenance might be necessary.

5.2. Analysing the segmentation (business point of view)

Telecommunications providers used to be vertically integrated companies. Although deregulation has required companies which enjoy significant market power to open up their networks and provide unbundled services to their competitors the general structure of the incumbent firms has not changed. Offering wholesale and retail services by the same company leads to conflicting goals within a company. The European Commission has recognised this issue and plans to include the remedy of separation in the future regulatory framework for telecommunications.

Europe's goal is towards competition in telecommunications. Infrastructure-based competition is regarded as the best form, although doubts are emerging if this scenario will provide sufficient incentives for market players to invest in state-of-the-art telecommunications networks. The access network might remain an economic bottleneck and become a technical bottleneck, not being able to fulfil the ever increasing demand in bandwidth.

The market model in the fixed network shows a decreasing part of incumbent players and an important role for carrier selection providers. Business models based on unbundled local loops and on deployment of alternative infrastructure have emerged. A nation-wide replication of the copper loop is not in sight although incumbent players start to introduce street cabinets and so shorten the copper loop, allowing higher bandwidth.

The value chain in the Internet is divided by the IP protocol. ISPs provide access to the public Internet and additionally offer services like hosting of web pages, e-mail and security. The Internet applications are dominated by IT firms, like Google, Microsoft, Yahoo etc. This separation is seen as the basis for innovation in the Internet applications. Applications in the Internet show various business models, often relying on advertising. The Internet is a multi sided market.

The value of fibre access increases with every new connection, and every new application running on it. The costs of fibre, conduit and installation are coming down while quality goes up.

The change in the business model for network owners could also go into the direction of selling the access part to their customers in the same way service providers are selling services today. By this the customer would own the access part of the network - an idea brought by Bill St. Arnaud[28] who is actively promoting this model for over a decade and extensively described in the New America Foundation article “Homes with Tails”[29].

6. New market model

The cost of upgrading the existing cooper network with fibre are high but we have also seen that this is not the only reason for classical network operators to be sceptical for fibre investments. The regulator is motivated to change the regulatory policy but their view on the fibre challenge is sometime narrowed because their approach is the same as in the last decade - how to encourage infrastructure and/or service competition of network operators? Motivating the network operators to invest in the upgrade of existing networks is one possible way but there are also others. It could also be questionable if the vertically integrated business model is able to leverage the great possibility of fibre access.

One of the big steps forward is the fragmentation of the vertical model into three parts – the passive network, the active network and services. We have seen that the characteristics of

[28] http://www.canarie.ca/~bstarn/
[29] [Slater and Wu, 2008]

these three parts are different whereby the main differences are the live cycle and investment costs. Considering the financial part, the largest allotment has been for the passive infrastructure part. We have to find out ways of how to utilize the new passive network.

Supporting the development of municipality networks is one of the new ways. The government of Sweden has shown by practical example how this can be done. Governmental support in creating the right legislative environment and financial support allowed the evolving of 200 municipality owned networks out of overall 289. SSNf leverage the deployments by connecting and supporting the building and operation of this networks. On the other hand by adopting the CESAR system a further big step forward has been done. CESAR will build a true marketplace and boost service innovation.

It is neither the provision of voice services nor the renting of unbundled local loops or bitstream access from the incumbent nor a vertical integrated model. The market occupies a niche, which offers an open, competitive neutral interface to service providers. The business is providing infrastructure in a similar way as electricity and water.

On the other hand the business is also bringing together supply and demand side. NDIX invests in fibre-based access networks and gains a considerable subscriber base in the Netherlands and western Germany. This subscriber base attracts service providers, who want to offer services to NDIX subscribers. NDIX itself just serves as a hub for the connection of subscribers to services. NDIX is not involved in the pricing of services. The service contract is concluded between customer and service provider directly.

SSNf also acts as a hub for service providers, who need only to establish contact to SSNf to be able to reach the customers of all members of SSNf in Sweden.

The model involves in both cases public investors. It is also common understanding that involvement of public investment should be accompanied by an open access policy. It includes optimizing the design, its engineering, the marketing, and business case. A true partnership demands that only a limited number of nonnegotiable objectives are set and it also includes acceptable business cases for all parties involved. The optimal solution will be fine tuned in a dialog with the market and with technology partners. A large amount of details have to be investigated including trends, technological developments, designs, business models, marketing models, engineering issues, operational issues etc.

Truly open ubiquitous fibre access networks maximize the free choice of end-users in using the network and in the selection of services, service providers and content providers. They are also with the lowest possible threshold or barrier for end users whereby including the use of the network for basic communication and peer-to-peer communication. Being within economical, technological and practical limitations, open access networks should not set incentives but rather prevent the rise of vertical integration and this will limit openness and free choice.

7. Conclusion

One of the main issues in telecommunications policy is the balance between incentives to invest in state-of-the-art telecommunications networks and services and safeguarding competition. The models explored by NDIX and SSNf seem to be a promising way to combine both goals in an efficient way. Infrastructure based competition – being the preferred solution – is not always achievable since the economic replicability need not be the case. The examples of NDIX and SSNf show that a single infrastructure can be the basis for service based competition provided that this infrastructure is offered in an open, non-discriminatory way. The examples also show that a public private partnership model can be used to build this state-of-the-art next generation infrastructure.

Build an open access networks also means building a simple network. Simple for network operators to manage, simple for service developers to offer their services and simple for customer to connect and use. The main drivers in every technical revolution are falling costs of production, simplification in usage and high availability. Fibre to the home is sometime seen as the rise of an new era of living environment, characterized by a communication access network with unlimited capacity based on fibre and massive service deployment based on open networks. In the near future it could be that because of fibre in the access, communication networks will be a non-brainer and for the developed countries self-evident as water and electricity today. Comparing broadband access based on fibre with electricity is a very good one. The company delivering electricity is not in charge or control on how electricity is used in households or industry and the ways of using electricity are manifold. Today it would be inconceivable to live without electricity. This will also be the future of the new communication networks based on fibre optics coming with new market models for building, operating and service provisioning of this networks.

The awareness of information society potential and benefits should be increased by targeted measures set by the government. This also means to assist in e-skills development and educate the user for being able to use information technologies. It will also be an ongoing series of decisions about technology, business strategies, partnerships, financing, pricing and management. Deploying fibre networks is the 21st century equivalence to roads and railways build in the 20th century.

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