

Open access networks, the Swedish experience

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ABSTRACT

In the open access network model, the roles of the service provider and the network owner are separated, and the service providers get access to network and the end customers on fair and non-discriminatory conditions. This should be compared to the traditional vertically integrated business model where the service provider and the network operator are the same. A large number of open access networks have been deployed in Sweden over the last 10 years. In this paper we give an overview of such networks, draw conclusions from the Swedish experiences with open access, and outline the perspectives for future deployments both within and outside of Sweden.

Keywords: broadband access, open networks, business models.

1. INTRODUCTION

By mid 2009, Sweden's Internet penetration passed 90% of the roughly 4.6 million households. 85% of households had broadband (here defined as "always-connected") Internet access, and around 30% had connection speeds of 10 Mb/s and above (mostly through FTTH, although DSL and cable also offer these speeds) [1]. When it comes to services, IPTV went from 1% of total TV subscriptions at the end of 2006 to 8% in mid 2009 [1]. This is accompanied by a strong political interest in fibre access networks, motivated by a persuasion that increased broadband penetration leads to social, environmental and economic benefits [2], [3]. Much of this interest has translated into direct or indirect government engagement – mostly at the local level – in the deployment of open access networks.

The basic idea behind the open access model is to promote the highest degree of competition in order to maximise the freedom of choice for the end users, and avoid monopoly [4]. An important underlying principle of open networks, however, is that of building an infrastructure for the society, not merely a revenue-driven system, and there is a strong political interest in open access networks – not only in Sweden, but across Europe. Another important driver has been the failure of traditional large operators to provide broadband access at sustainable prices in remote areas. This is a reason why many rural communities across Sweden have deployed open access networks. Today it is estimated that 95% of the 173 municipality networks and 42% of the housing companies with FTTx currently operate according to an open access model [5], [6].

In this paper we give an overview of the open access model in its various flavours (with openness at different levels). For each variant, we will review some major examples, highlight achievements and challenges from those experiences, and identify development trends.

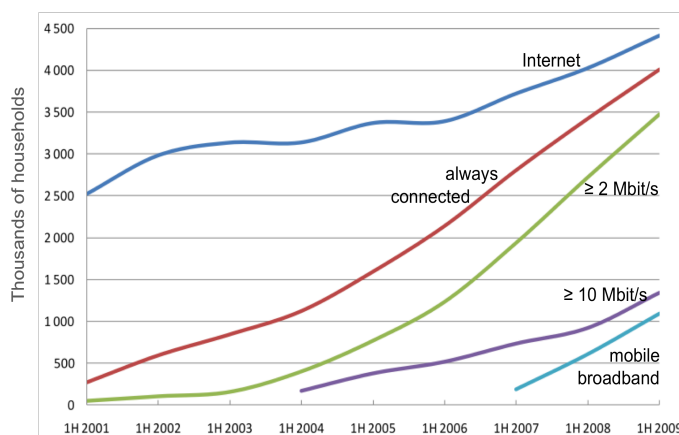


Figure 1 - Internet penetration in Sweden [1].

2. FROM VERTICAL INTEGRATION TO OPEN NETWORKS

The traditional telecom model is based on "vertical integration", in which one entity delivers the service, operates the network, and owns the network infrastructure. Originally, the available services were mainly limited to telephony, radio, and television. This justified dedicated infrastructures, each optimised to transmit information carried by a specific physical signal, and with inherently different traffic patterns.

Technology has evolved dramatically since. Today the amount of available services is booming: from well established ones such as telephony (mobile or fixed), web access, emailing, television (standard quality and HDTV) to rapidly growing ones such as video conferencing, video and music streaming and sharing, online gaming, e-health, to new and emerging ones such as 3D TV, grid computing, etc. For all these services information is stored and transmitted digitally, and it is increasingly delivered using the IP protocol. Moreover, the end user is no longer just a consumer of contents but has also become a producer of e.g., photos and video material using a variety of applications. A vertically integrated model with a dedicated network infrastructure for each service is therefore highly inefficient. Some degree of convergence has taken place during the past 15 years, but this has been a slow and incomplete process, hampered in great part by the resistance from the traditional vertical-integration business model. Ideally, there is no reason today, why telecommunication services should be

delivered by a network infrastructure that is optimised to the type of end-user termination (urban vs. rural dwelling, heavy-vs-light user, mobile-vs-fix, etc.) rather than the services being delivered.

The open network model, in which services are provided on a fair and non-discriminatory basis to the network users, is enabled by conceptually separating the roles of the **service provider (SP)** and the network and communication operator. Due to the different technical and economic nature of the different parts of the network, different roles and actors can be identified. A fibre access network broadly consists of a *passive infrastructure* (implying right-of-way acquisition, trenching, cable duct laying, local-office premises), and *active equipment* (transponders, routers and switches, control and management servers). The passive infrastructure is typically characterised by high CAPEX, low OPEX, low economies of scale, and is highly local, hard to duplicate and inherently subject to regulation. The active equipment is characterised by high OPEX, economies of scale, and is subject to limited regulation. These factors justify a further role separation between a **network owner (NO)**, which owns and maintains the passive infrastructure (typically real estate companies, municipalities, utilities); and the **communication operator (CO)** which operates (and typically owns) the active equipment (incumbent operators, new independent operators, broadband companies).

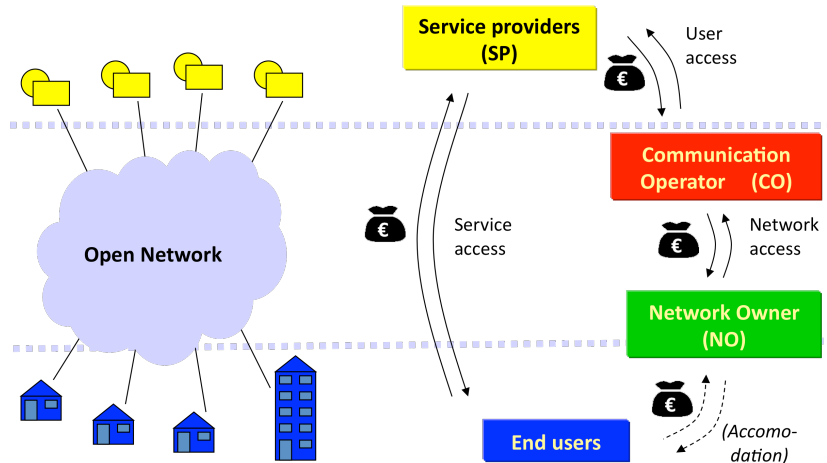


Figure 2 – The open network model and typical open access value chain

3. BUSINESS MODELS FOR OPEN NETWORKS

Depending on which roles different market actors take up, the network will be open at different levels and different business models will arise, as illustrated in Figure 3. A single actor may act as NO and CO (a), in which case the network is open at the service level. If the roles of CO and NO are separate (c, d), then openness at infrastructure level is achieved. Generally, one NO operates the infrastructure, while one or several CO can be allowed to operate the active infrastructure generally over a fixed period of time, at the end of which the contract may or may not be renewed (in which case a new CO is designated and active equipment may need to be replaced). Most often, economies of scale make it impractical to have a truly multi-CO network (although larger networks may assign the operation of different geographical parts of the network to different CO). Independently of the specific model, however, the CO should offer different service providers access to the network (and therefore the users) on non-discriminatory conditions. The end users typically purchase services directly from the service providers. The CO receives revenue from the SP and pays a connection fee to the NO for network access. This value chain is illustrated in Figure 2.

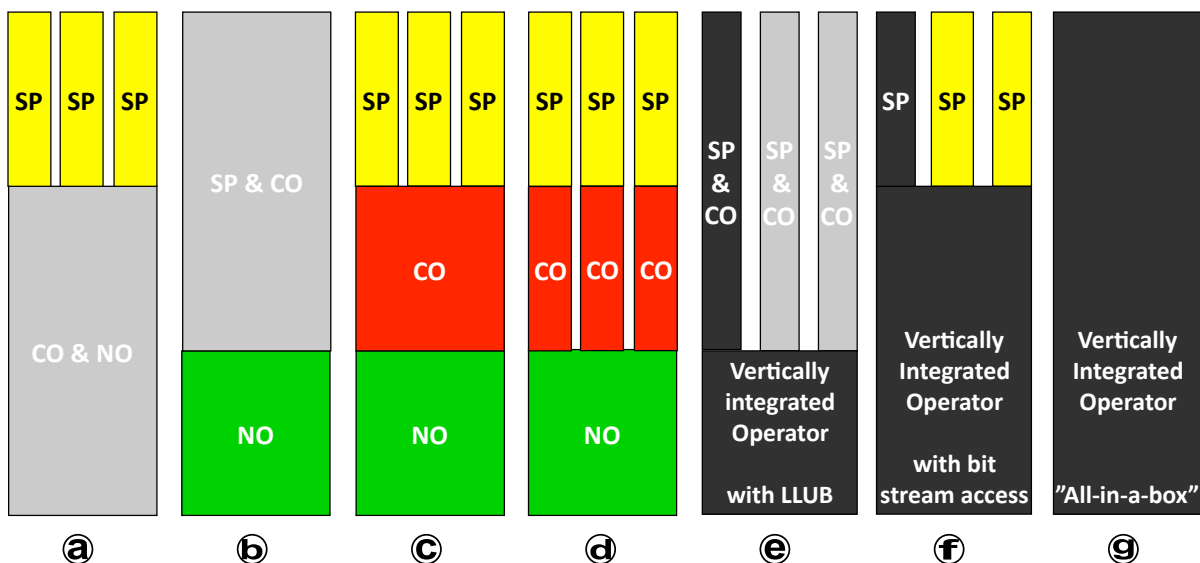


Figure 3 – Access network business models.

If the CO also acts as SP (b) the network cannot be described as being really open according to the definitions here, but it is still “more” open than the conventional vertically integrated model in (g) which most incumbents worldwide follow today. In case of local loop unbundling (LLUB), a vertically integrated operator is still present, but there can be multiple actors working as combined CO and SP. In case of bit stream access the vertically integrated operator assumes the role of CO, but there can be multiple SPs offering their services in the networks.

Observe that some of the roles in Figure 3 can be subdivided into more roles and that the limit between the different roles is not always as clear as in the figure. However, the figure should give a pretty good idea of which kinds of business models (in particular with respect to open access) are used in Sweden today. The definition of “open” may vary a lot depending on the type of actor and which level in the network is regarded. It may for instance be claimed that Figure 3b is also a truly open network. On the other hand, one could argue that if there is only one entity owning the fibre infrastructure the network is not open – despite the fact that all COs get access to the fibre on equal terms.

4. EXAMPLES OF OPEN NETWORKS IN SWEDEN

Many of the Swedish open networks have started as a locally driven effort to build an infrastructure for the society, and often further motivated by the lack interest of traditional large operators to provide broadband access at sustainable prices in remote areas.. However, even national operators are increasingly finding open access networks profitable and stepping up their business with such networks. In this section we give an overview of Swedish access networks operating different business models.

Stokab

In Stockholm the passive fibre network is owned and administered by Stokab [7], a company owned by the City of Stockholm. Stokab was founded 1994 and was one of the first companies worldwide who embraced the idea of an operator neutral ICT infrastructure in a larger scale. The historical reason for this has been twofold: to avoid uncoordinated trenching in the city and to create a foundation for the future IT society. It is today a huge dark fibre network comprising more than one million fibre kilometres. Stokab also owns fibre in parts of the Stockholm metropolitan area which include neighbour municipalities and the Stockholm archipelago.

The network supports both public and local administrations, enterprises, and operators. Stokab’s fibre network is operator neutral in the sense that all operators get access to the dark fibre, points of presence, and antenna sites on equal terms. The operators include both communication operators serving an open access network as well as vertically integrated operators. Apart from owning the dark fibre network Stokab also acts as a communication operator for the city administration and internal communication. Stokab would correspond to the role of the NO in Figure 3. All the models a, b, c, d coexist in Stokab’s network.

Svenska Bostäder, Stockholm Hem, Familjebostäder

These three companies are 100% owned by City of Stockholm and is (if added together) with more than 90,000 homes Sweden’s largest housing company [8]. By the end of 2010 all apartments will have access to a fibre optic broadband connection. Svenska Bostäder (SB) has chosen an open access model with different service providers and different services to choose from for the end users. SB is connected to Stokab’s fibre network but owns the *passive* infrastructure within the multi dwelling units, MDU’s. This is typically single mode fibre between the communications room (serving one or several MDU’s) and the apartments. The *active* equipment in the access network, the communication rooms, and the gateway in the apartments is owned and operated by a communication operator, and the money flow is according to Figure 2 where the dashed line indicates that the tenants are paying rent to the housing company which is also the network owner. Competition at CO level is achieved by dividing Stockholm into three geographical zones, and each zone has its own CO. That is, only one CO operates in one zone. The CO has a contract for a limited number of years, which can be renegotiated by the end of the period.

Many other municipal housing companies across Sweden are using a similar model. However, only SB deploy more than one COs in their network. The business model of Svenska Bostäder corresponds to Figure 3d where Svenska Bostäder has the role of NO, and with multiple CO’s and SP’s being contracted. Generally a housing company would be the NO in Figure 3c.

Mälarenergi Stadsnät

Mälarenergi Stadsnät is a company owned by Mälarenergi [9], a local power utility owned by the City of Västerås. It is now a large municipality network and among the most successful in Sweden, with 40 000 homes connected. Mälarenergi Stadsnät owns the fibre infrastructure and acts as communication operator in the network, a role which covers being a service broker. Interestingly, ME Stadsnät has recently entered the municipality network of neighbouring Eskilstuna as CO [10]. Referring to the business models in Figure 3, Mälarenergi is the combined NO and CO in Figure 3a in their own network in Västerås, but they act as the CO in Figure 3c in Eskilstuna.

Säkom

Another example of a municipality network following model (c) is Säffle municipality (in Värmland County) with a population of 15,800, a significant part of which scattered over a large rural area. The municipality only owns the fibre infrastructure (through the wholly owned company Säkom [11] acting as NO), while a separate company acts as CO with a five-year contract. What makes Säkom interesting is that currently the incumbent TeliaSonera acts as CO. It is noteworthy that TeliaSonera, a former monopolistic telecom operator exclusively operates as CO without owning the network infrastructure, and without delivering its own services. TeliaSonera acts as a pure CO in a few other municipalities in Sweden.

TeliaSonera

TeliaSonera is Sweden's incumbent and originally operated as a typical vertically integrated operator only. However, TeliaSonera also embraces the open access model in different ways. The company functions as communication operator in some networks, as in the Säkom case and also in one of the three zones of Svenska Bostäder as described above. TeliaSonera also acts as a service provider in several municipality and housing company networks (e.g. Mälarenergi and in Svenska Bostäder's downtown part of its network), in competition with other service providers. That is, TeliaSonera is active in all the business models (b) to (g) in Figure 3.

5. EXPERIENCES AND TRENDS IN SWEDISH OPEN NETWORKS

The first optical access networks in Sweden were built around the turn of the century by Bredbandsbolaget, TeliaSonera and a number of municipality networks. While Bredbandsbolaget and TeliaSonera are vertically integrated operators, owning the whole value chain from fibre infrastructure to services, for the municipality networks the situation was different. In most cases a municipal company both owned and operated the network. However, although situations with only external ISPs existed, in many cases, they even acted as ISP, (albeit often in competition with other ISPs) in the network. This was due to it being difficult to attract external ISPs for several reasons: limited number of subscribers, connection procedures (both technical and administrative) varying from network to network, thereby hindering economies of scale for the ISPs, a limited number of ISPs (much smaller than today), lack of business actors taking the role of CO, to handle the contact to ISPs, etc.

The market place has matured considerably during the past ten years. The process of connecting ISPs is now much simpler, there are communication operators that take care of ISP handling, the number of ISP is now much higher, technology has improved, etc. Also, many municipalities have come to the conclusion that they should focus more on providing infrastructure for the citizens rather than competing with commercial companies.

The market is not yet fully mature but all in all municipality networks in general have moved downwards in the value chain – increasingly closer to just owning the fibre infrastructure – while network operation and service delivery is left to other players (other municipality networks or even telcos like TeliaSonera). Despite the clearer roles, many smaller municipality networks struggle economically, due to the reduced revenue share in a market place with many players. This has led to a consolidation process where municipality networks have been either acquired by competitors or have started to closely collaborate. This consolidation process is still ongoing.

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