Next generation access networks: the post-investment conundrum

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1. EXECUTIVE SUMMARY

Next Generation Access networks (NGA) entail significant investments but bring with it promises of a “brand new world” in telecommunications. In this paper, we provide an overview of some of its implications. In particular, we argue that it is not clear whether the “old” vertical integration model, where network operators provide end-to-end services, is likely to be maintained. But we also argue that, irrespective of that, network operators must look with increased interest at their wholesale revenue stream, i.e. at the possibility that, even if vertically integrated, profits can be reaped from providing access to (potentially rival) retail operators. Moreover, content providers will significantly increase their relevance in the future value chain. Therefore, we argue that revenue-sharing mechanisms between content, infrastructure and service providers are likely to (re)emerge.

2. INTRODUCTION

The purpose of this paper is to discuss alternative business models that can be envisioned in the telecommunications industry following the significant investments made in Next Generation Access networks (NGAs). Such business models will “shape” regulation and the future industry structure.

Until recently, largely due to historical and technological reasons, telecommunications services were provided by vertically integrated operators. The sector's liberalisation in Europe allowed new entrants to provide telecommunications services, but their business model was different from that of (vertically integrated) incumbents. With the deployment of NGAs, an important question which arises is whether the “old” vertical integration model is likely to be “revived”. This is still unclear. But we argue that even for operators who are, at present, vertically integrated, the provision of wholesale access to (potentially rival) retail operators is likely to be seen as an opportunity (generating wholesale revenues) rather than a threat (foregone retail profits). Therefore, irrespective of whether the vertical integration model is kept, the current business model is likely to be challenged, with a greater emphasis placed on the recoupment of investments made in NGAs through the provision of wholesale access to other operators.

In addition, a new and important player is likely to emerge: content providers. Therefore, firms along the value chain are likely to reposition themselves in order to accommodate for this. Again, rather than viewing this as a threat, infrastructure operators who have invested in NGAs may view this as an opportunity to recover the investments made. In particular, we conjecture that revenue-sharing mechanisms are likely to emerge between content, infrastructure and service providers. Such mechanisms are more likely to be successful at extracting value from differentiated and willing-to-pay subscribers. This is not a novel business strategy in the sector: the narrowband (dial-up) business model relied on such revenue-sharing mechanisms and, as we know, contributed significantly to the emergence of Internet service provision which radically shaped and changed the sector in the last decade.

This paper is structured in the following way: section 3 discusses two typical (but opposite) business strategies for NGAs; section 4 puts forward the possibility of an intermediate (revenue-sharing) business strategy; finally, section 5 concludes.
3. **TYPICAL BUSINESS STRATEGIES**

The definition of a NGA is, thus far, still an elusive concept. For instance, OFCOM (2006) defines next generation access as “broadband access services that are capable of delivering sustained bandwidths significantly in excess of those currently widely available using existing local access infrastructures or technologies” (p. 10). Whilst no explicit reference is made to the introduction of fibre-based technologies in the access network, these will, undoubtedly, allow a significant increase in bandwidth to final consumers and, thus, "qualify" for the next generation status.\(^1\) Typically, the deployment of fibre in the access network is either through Fibre to the Cabinet (FTTCab) or Fibre to the Home (FTTH).\(^2\) Under a FTTCab architecture, subscribers are connected through their copper loops, but fibre is deployed from the exchange to the street cabinet. By contrast, under a FTTH architecture, the copper loop is fully replaced by fibre.

The deployment of NGAs is currently evolving in most European countries, although at clearly different speeds and under different roll-out strategies. Although debatable, it is probably not far from the truth to say that NGA deployment is typically country-specific. Now imagine yourself as an operator who has made a significant investment in order to deploy a NGA. Such an operator is likely to differ across countries, insofar as (i) it may be the incumbent or an entrant who benefited from the sector’s liberalization, (ii) it may be a vertically integrated provider (who owns the network infrastructure and provides retail services) or it may merely own the network, (iii) it may face significant competition from other infrastructure-based operators (e.g. other NGA operators or cable-based operators), both at the retail and wholesale levels, or (iv) if vertically integrated, it may face retail competition for the provision of various services (television, Internet and voice), as well as bundles of services (double play and triple play). These possibilities are, naturally, not exhaustive and merely highlight that country specificities are the rule rather than the exception.

Clearly, a common concern is how best to take advantage of the investment made. Figure 1 contains a stylized representation of the several possibilities regarding that operator’s strategic choice along the vertical value chain. For the sake of simplicity, we concentrate on the two opposite poles of the spectrum: a structurally separated operator of the access network and a vertically integrated operator.

One possibility is for the operator to focus solely on the infrastructure in which it has invested and thus be a wholesale access provider. This business strategy entails some risks, namely of a regulatory

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\(^1\) Notice that in the definition of next generation access networks, it is implicitly assumed that there are no constraints in the core network which prevent such bandwidths from being obtained.

\(^2\) Intermediate variants exist which depend on “how close” to the subscriber is the fibre-based access network.
nature. Firstly, all indications point toward wholesale access in NGAs being susceptible to regulation (European Commission, 2010). Although it is acknowledged that any such (price) regulation must take into account capital investments and an adequate rate of return, it is clearly possible that an operator choosing such a business strategy will see its revenues (and profits) heavily dependent on the regulator’s decisions in the country where it operates.

Another possibility is for the operator to become a fully integrated provider, thus acquiring content (namely television content) upstream from content producers and selling it directly to subscribers. This business strategy entails the same regulatory risk mentioned above: insofar as wholesale access is regulated, the operators’ revenues are (partly) dependent on (regulated) wholesale price levels, which may vary considerably across countries. In addition, further risks exist associated with the operator’s presence in the retail market, thus “attracting” attention of competition authorities in potential abuse of dominant position complaints.

In any of the cases discussed, there is also an issue about who owns and manages the access network. In the past, due to historical and regulatory reasons, the incumbent provided network access while controlling the underlying physical assets. After liberalization, entrants were allowed and encouraged to invest in parts of the network infrastructure, but for economic reasons many chose to focus their investments and relied on the incumbents’ investments on the infrastructure segments they were uninterested in. At present, most local and national authorities in European countries are highly committed to developing and promoting the deployment of physical infrastructure networks. Because the deployment of NGAs is not highly specific from a technological point of view, non-telecommunications firms are not at a disadvantage (vis a vis telecommunications firms) when investing in the physical infrastructure. In any case, a possibility is that private or public provision of a structurally independent NGA might co-exist with telecommunications firms that operate across the whole vertical chain, at least in the more populated areas. However, because the discussion boils down to the issue about whether NGAs are better kept separated or integrated, we do not expand on it – it would have as an obvious implication an explicit comparison of the two (extreme) possibilities we mentioned earlier. Not that this point is not important, but just because we want to concentrate on pricing and revenue sharing mechanisms between access to the network and content providers.

In addition, we abstract from issues “higher up” in the vertical chain, for instance, those related to whether the NGA is vertically integrated upstream with a NGN core network. Again, this is an important issue which may affect the desirability of the two extreme business strategies mentioned above – e.g. because economies of scope may exist.

Typically, in the “old” Public Switched Telephone Networks (PSTN) days, regulation (e.g. wholesale price regulation) had as one of its main rationales the possible adverse effects to potentially competitive segments in the telecommunications sector arising because of vertical integration, namely of incumbent operators. This is known, in economic theory, as the foreclosure doctrine. Following Rey and Tirole (2007), imagine an upstream monopolist that sells an essential input to downstream (competing) retailers. This is a typical economic bottleneck situation, with clear parallels in the telecommunications sector. Under the foreclosure doctrine, the upstream firm has incentives to distort competition in the downstream segment, e.g. by favouring a retail firm (for instance, its own subsidiary) and thus “forcing” its competitors out of the market. In practice, in doing so, the upstream firm “extends” its market power to the downstream (potentially competitive) segment.
Foreclosure may be complete or incomplete (Rey and Tirole, 2007). An example of complete foreclosure occurs when the upstream firm refuses to supply the input to one (or several) downstream firms, thus preventing them from operating. Alternatively, the “refusal to supply” may be (slightly) more subtle, e.g. through the setting of a (prohibitively) high price. Partial foreclosure, whereby the upstream firm favours some firms in the downstream segment, can be achieved in various ways: through vertical integration, when economies of scope exist, through exclusive vertical arrangements or through price discrimination (Rey and Tirole, 2007). In the telecommunications sector, the often heard of DDD (Deny, Delay, Degrade) strategy of incumbents towards new entrants is a clear foreclosure example.

The view that foreclosure constitutes a serious and significant threat to competition is not, however, consensual. In stark contrast to this view, the Chicago School critique posits that this argument has shady foundations, insofar as only one retail market exists, and therefore only one “monopoly profit” can be reaped. A vertically integrated firm would thus capture this monopoly profit by exerting market power in the upstream segment, e.g. by charging a monopoly price for the essential input it sells (to all downstream firms).³ In other words, a fully integrated firm could not have higher profits than those obtained by the upstream monopolist, provided there is competition in the downstream retail segment.

NGAs clearly bring along a different paradigm. The work of several authors highlights that the vertical integration model of PSTN-based service provision is no longer expected. In particular, it is quite possible that even vertically integrated operators will realise the potential gains (at the wholesale level) from providing access to (possible) retail competitors at competitive price levels. In addition, a new player will gain increased importance in the value chain: content providers. Media and entertainment services (e.g. TV) will play a significant role in the new industry structure. Subscribers are willing to pay for content which best serves their interests. In catering for such differentiated subscribers, an intricate relationship between content, infrastructure and service providers is likely to emerge.

For instance, Ganuza and Viecens (2010) analyse possible market outcomes when NGAs are structurally separated from retail service provision.⁴ In this context, retail service operators need two inputs: content and network access. The key question addressed in the paper is whether the NGA benefits from downstream retail competition in the presence of vertical differentiation, i.e. when only one retailer has access to premium content. It is shown that if vertical differentiation is not too high (i.e. if the premium content is not too “exclusive” or valuable), then the NGA can increase its profits through retail competition (by lowering its wholesale access prices) and the latter benefits consumers. Interestingly, note that access price regulation would be redundant in this scenario, as the NGA’s (wholesale) pricing incentives are aligned with retail competition and consumer surplus. If premium content providers can reach consumers directly (i.e. by purchasing access from a NGA and bypassing retailers), it is expected that non-exclusivity of content provision will occur, i.e. content providers prefer to sell their premium content to other retailers rather than to market it exclusively. Weeds (2009) also reaches this type of conclusion: at the retail level, if one operator possesses some exclusive or premium content, it will typically prefer to make it available to its competitor and charge a (wholesale) fee, i.e. non-exclusivity is preferred.

Brito et al. (2008) focus on the incentives of a network operator to invest, and possibly give access to its retail competitors. The underlying market structure is that of a vertically integrated

³ Notice that this, obviously, is an argument in favour of (wholesale) price regulation, but not retail price regulation.
⁴ They argue that this is not an implausible assumption, either because NGAs were financed by public funds or because access regulation is unlikely to disappear.
incumbent operator, which owns the network and provides retail services, competing with a downstream retail operator (entrant), which requires access from the incumbent. More importantly, it is assumed that access to the old PSTN network is regulated, but access to the NGA is not.\(^5\) The interaction between operators takes place in a context excluding content-related issues. Nevertheless, it is clear that the incumbent faces two opposite incentives in its decision to grant access to the NGA. On the one hand, granting access allows the downstream retail operator to capture a share of its profits – a negative (retail) effect. On the other hand, granting access leads to higher wholesale profits, because the NGA will allow the provision of a higher quality service (compared to the old PSTN) and thus attract a higher wholesale price – a positive wholesale effect. If the old network’s (regulated) access price is low and provided the NGA leads to a non-drastic increase in quality\(^6\), the incumbent prefers to grant access to the NGA. In other words, retail competition is preferred even if the incumbent also competes in the retail market, because the wholesale effect outweighs the retail effect.

Foros (2004) reaches a similar conclusion. In a setup where a vertically integrated incumbent also competes with a downstream retailer, unless access prices are regulated, the incumbent will foreclose the rival in the retail market by choosing too high an access price. However, this does not occur when the rival retailer has a higher ability to make use of the increased quality of service that a better network allows, i.e. if it has the ability to add more value to the consumer than the incumbent. In that case, the incumbent prefers to face competition in the retail market, as its rival is in a better position to obtain (retail) profits and, through the wholesale access price, compensate the incumbent for its foregone downstream profits. This result is also similar to that of Spiegel and Yehezkel (2003). An upstream firm can market its products through two differentiated retailers, where only one of them provides a high quality service. If the cost differences between the retailers are relatively small, then the manufacturer prefers to engage in an exclusive relationship with the high quality retailer, thus not serving a substantial part of the market. This is profitable because exclusivity attracts a higher price, which thus compensates the lower sale volume. But it is also possible that the manufacturer prefers to engage in a non-exclusive relationship with the retailers, thus receiving a lower (wholesale) price, but reaching a larger market.

Hagiu and Lee (2008) observe that many sectors have this type of characteristics, whereby consumers must access a platform or network in order to “consume” a variety of services: e.g. IPTV or cable television or online music stores). In turn, competition between platforms or networks relies on product differentiation, which requires them to purchase premium or quality content. Provided the content producer does not relinquish pricing control, it prefers to make high quality content available to several networks. This is plausible, because exclusivity, whilst generating greater rents from the chosen network, prevents that content from reaching the rest of the market – in that context, the volume effect outweighs the price effect and the content producer prefers non-exclusivity. The analogy, in this upstream market, is clear: having the option to “vertically integrate” (through exclusivity) with one network, the content provider obtains higher profits through downstream competition (and non-exclusive content).

Dewenter and Haucap (2007), in a related context, analyse the incentives of mobile network operators to voluntarily grant access to virtual operators (MVNOs). They conclude that this decision depends on two factors: the mode of competition between operators and the degree of product

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\(^{5}\) The European Commission has already expressed its view that access to NGAs should also be regulated (European Commission, 2010).

\(^{6}\) A non-drastic improvement in quality is defined by the authors as a situation where the downstream entrant, using the old network, can compete with the incumbent using the new network.
differentiation. In particular, a higher degree of product differentiation makes voluntary access more likely, because, although MVNOs “cannibalize” the network operators’ retail profits, they also generate an increase in wholesale revenue – the aforementioned wholesale and retail effects – and the latter outweighs the former. In addition, the various models of competition analysed (Cournot, Bertrand and Stackelberg) all lead to the same conclusion: provided some product differentiation exists, network operators have incentives to voluntarily grant access to MVNOs.

Also in a related context, Crandall and Singer (2007) look at the incentives that a vertically integrated DSL provider has to distort competition at the retail level, e.g. by engaging in anti-competitive practices towards unaffiliated (rival) providers. Their conclusion is in accordance with the Chicago School: the vertically integrated provider has incentives to enter into an agreement with rival retail providers, especially if the latter have lower costs. Any attempt to distort competition at the retail level could be successful in inducing exit of rival (retail) providers, but would bring little future gain to the vertically integrated provider, because alternatives exist (e.g. through cable networks) which prevent it from raising its prices in the retail market and thus recouping its lost profits (associated with the distortion of competition through price squeezes or predation).

In conclusion, it is not at all obvious that a NGA that positions itself as a vertically integrated provider (one of the extreme business strategies mentioned earlier) will behave in a different way from another one which positions itself as a mere wholesale access provider: both will have to view (potentially rival) downstream retail operators as sources of (wholesale) revenue. In addition, content providers are likely to reshape the relationships along the value chain between themselves, infrastructure and service operators. This is so because subscribers are differentiated and have a willingness-to-pay for premium content. Thus, service providers will need to have access to valuable (premium) content in order to differentiate themselves from rivals; in turn, content providers will want to analyse how their content is “distributed” along the supply chain, e.g. exclusively or non-exclusively, as well as through conventional access networks or through NGAs.

4. THE “THIRD WAY”: REENGINEERING THE VALUE CHAIN

It is quite likely that technology and consumer demand for media and entertainment services will lead the industry into a new direction where infrastructure may or may not be separated from the services available to final consumers, but where the cost of investment and maintenance of the infrastructure is divided between consumers and content providers. The iPhone business model example puts the value chain into perspective, illustrating that there might be revenues and profits to be shared between various industry players: content providers, service and infrastructure operators. The iPhone allows the end user to benefit from a wider variety of services, using its mobile subscription, for which it typically has to pay (e.g. by purchasing applications or services compatible with the iPhone). This opens up the possibility that infrastructure operators demand a “share” of these additional revenues.

This type of revenue-sharing mechanism is not an entirely novel business strategy. Back in the early Internet days, (narrowband) dial-up access was provided by a multitude of Internet Service Providers (ISPs), which all required access to telephone networks in order to provide the service. Naturally, some ISPs were vertically integrated with network operators. Although some issues arose related to the market foreclosure potential, by and large retail competition was observed, thus confirming the Chicago School critique. As discussed earlier, it was the migration to broadband access that revived
the foreclosure doctrine, and thus fostered and supported the introduction of wholesale access regulation to prevent distortions of competition. Crandall and Singer (2007) argue that the dial-up access model cannot be replicated in this new context, because independent broadband ISPs do not add value to the service. They further argue that although different in nature, competition in the broadband era, without many independent ISPs, is nevertheless sufficient to spur growth.

It is worthwhile remembering the dial-up Internet business model. We highlight the UK case because of its pioneering role in the regulatory approach of Internet services. Oftel (1999a, 1999b) created a formula, in 1996, which determined how operators shared revenue for calls using specific numbers, which gave rise to local, national and premium call charges, or to no retail charges (free calls). The services benefiting from the formula were designated as Number Translation Services (NTS): a user who placed a call would not know that the number he dialled was “translated” to a geographic number, which could be near or far away from the user’s geographic location. More importantly, the user knew that the (per minute) price of the call did not depend on the distance. Whilst initially designed for innovative services such as radio/TV phone-ins and generally other call centre activity, the greatest beneficiary was (by far) dial-up Internet traffic, as ISPs made use of these non-geographic numbers to allow users to dial in to the Internet.

Without going into details, the formula “allocated” a portion of the call revenue to the ISP, namely the retail price of the call (e.g. the local rate) minus a wholesale call origination charge paid to BT (the incumbent). In particular, this wholesale call origination charge was “generous”, insofar as it more than covered the underlying costs. Depending on the time the call was made, BT kept between 32 and 59% of the call revenue (Oftel, 1999a). Whilst BT argued that the effective price it received from NTS services was lower than that obtained from geographic numbers and demanded a higher share of the revenue, Oftel (1999a) considered that price to be more than fair, as it was well above cost and because most traffic was carried in off-peak periods (when network usage is low). In doing so, it also acknowledged the contribution given by ISPs towards the value of Internet services. In addition, Oftel (1999b) made clear that originating operators other than BT (the incumbent) were free to negotiate with ISPs how they shared (retail) call revenue.

This leads us to put forward the idea of a “third way” for NGAs to position themselves along the value chain. In addition to making wholesale access available to downstream operators (who may compete with the NGA if it is vertically integrated), we wonder whether a revenue-sharing mechanism, such as that adopted for dial-up Internet services, may be an interesting business model.

The value consumers can extract from the network depends on the services it supports. The service and infrastructure provider, if vertically integrated, is supplying services to two different customers: on the one hand, the content provider, who is willing to sell the content to the final consumer at a high margin in order to maximise its profits, and, on the other hand, the final customer, who wants high quality service and might be willing to pay a premium for the access service. Furthermore, insofar as NGAs allow bilateral communication, the ability of the infrastructure to facilitate the link between content provider and final consumer is directly linked to the price charged, the level of the service and the stake of the infrastructure and service provider in the industry value chain. Given that wholesale access is likely to be regulated, by positioning itself as a wholesale access provider, the operator is subject to regulatory risk and downward pressure on its wholesale prices. On the other hand, if it

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7 In particular, 0800 or 0500 numbers were free, 0345, 0645 or 0845 numbers were charged at the local rate and 0870, 0990 or 0541 numbers were charged at the national rate.
vertically integrates, in addition to this regulatory risk, there is the possibility of competition problems and investigations by the competition authority. A revenue-sharing mechanism significantly reduces these two risks. Firstly, by tying its revenue to the retail prices charged by downstream operators, the NGA will not accept any revenue-sharing scheme which does not compensate it adequately for investments made. Secondly, some of the regulatory pressure is alleviated, as its revenues depend on the (competitive) retail prices. Finally, by not providing content services itself, the NGA virtually eliminates the risk of potential competition problems in the downstream market.

Looking into the future, from a strategic point of view, it is quite likely that the different firms in the value chain are willing to discuss a revenue sharing mechanism that allows an efficient use of the infrastructure and offers an adequate return on investment. Various models mentioned in the last section show that, under normal conditions, the content provider is not interested in exclusive contracts with the access provider, given that this restricts its potential market and the lack of competition might jeopardise the quality of service delivered to final consumers. On the other hand, the access provider is willing to maximize the traffic in the network so as to benefit from economies of scale and increase its wholesale revenues. Therefore, even if it is vertically integrated, it should be keen to open the network to retailers and other firms – such as content and billing aggregators – in order to maximize the return on investment.

The incentives to open the network are a necessary but not sufficient condition for the appearance of a revenue sharing scheme. That comes into play on a second round, as premium content and service providers may want to capture premium customers which can only be reached provided minimum technical infrastructure standards are met. In fact this might be in the interest of both consumers and content providers. The access network plays an interface role, because the “distribution channel” is central to the variety and quality of the services demanded and supplied.

The idea of differentiating consumers in the access market according to a price linked to the quality or capacity is not new. In fact, this is the current standard of the industry, as there are customers who pay different prices to access the infrastructure. The novelty here is the way through which this price differentiation may come about – through a revenue sharing mechanism –, as the content and other service providers might be interested in relinquishing part of their revenue to the access network operator in order to ensure standards of quality in the service.

Therefore, such revenue-sharing mechanisms may be better suited to reflect the relationships along the future value chain, where content providers play a new and important role, but where both infrastructure and service providers are also essential in order to provided valuable services to willing-to-pay customers.

5. CONCLUSION

In conclusion, the point we make in this paper is that NGAs allow a new perspective of the telecommunications value chain, which has implications for the industry structure. We highlight that NGAs allow for a whole new range of operators to use the access network that is made available by either structurally independent or vertically integrated access providers. This novel paradigm requires a new strategic thinking from content providers, which might be interested in sharing revenues with the access operator, therefore allowing for a new pricing mechanism to (re)emerge in the industry, driven by the strong upward trend in demand for media and entertainment services. Though this topic deserves
further investigation, the incentives suggest that the adequate contracts in this industry are those of revenue sharing mechanisms between access, content and service providers.

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