

Digital economy and regulatory issues. Introduction

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Abstract This special issue contributes to the topical field of Internet economics. The articles focus on multi-platform competition, the changing role of telecommunications regulation, issues of net neutrality, and open source software and innovation.

Keywords Telecommunications regulation · Internet economics · Net neutrality

1 Convergence of the telecommunications, media and information technology (IT) sectors

Convergence of the telecommunications, media and information technology sectors has accelerated in recent years with the emergence of the Internet and with the increasing capability of existing networks to carry both telecommunications and broadcasting services. Developments in digital technologies and software are creating large innovative technological potential for the production, distribution and consumption of information services. Convergence, characterised as the ability of different network platforms to carry essentially similar kinds of services, may have different faces: telecommunications operators may offer audio-visual programming over their network, broadcasters may provide data services over their networks, cable operators may provide a range of telecommunication services. Up to the present time the most relevant evolution and adaptation of such platform independence is that of the transmission control protocol/Internet protocol (TCP/IP).

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TCP/IP allows information packets to be transported across different networks, despite differences in bandwidth, delay, and error properties associated with different transport media (e.g. fibre, radio spectrum, satellite).

This special issue contributes to the topical field of Internet economics. The Internet as a driver of convergence is displacing traditional isolated computer networks, it is providing an alternative means of offering telecommunication services (e. g. Internet telephony), and, moreover, the Internet is also becoming a significant platform for broadcasting services. In addition, technological convergence makes possible innovative services that combine product characteristics from the traditionally distinct branches of telecommunications, IT and the media, thereby enlarging the scope of voice, data, multimedia and audio-visual services.

All contributions in this special issue centre on internet periphery and Internet service provision. The main elements of Internet service provision are an inherent part of the Internet and would not exist without the Internet. However, Internet service provision also requires several complementary elements, designated here as the Internet periphery, which are viable on their own, even in the absence of the Internet. Internet service providers (ISPs) offer their customers a wide spectrum of different services by combining both peripheral and main elements. Terminal equipment (e.g., PCs and cellular phones) can be used either with or without access to the Internet, although obviously the use of the Internet is not possible without any terminal equipment. Content (including broadband) may be provided via the Internet (e.g., video on demand, customized music and video libraries), but it is also available through other distribution channels, such as cinemas, traditional video libraries and traditional broadcasting. Internet service provision would be possible without any sort of content provision. For example, ISPs could specialize in interactive services such as e-mail. In order to provide Internet services, capacity of long-distance telecommunications networks (bandwidth) is required. Today, for the most part, investments in long-distance telecommunications infrastructure are increasingly motivated by Internet demand, despite the fact that telecommunication transmission capacity has many different purposes.

2 Multi-platform competition

Several access technologies exist: copper, fiber optics, two-way cable TV infrastructure (CATV network), powerline communication and radio in the loop. Broadband Internet access can be provided either by upgrading two-pair copper cables by means of xDSL (digital subscriber line) technologies, CATV based broadband Internet access, as well as broadband wireless technology (e. g. UMTS). Convergence and platform independence, however, does not mean that these broadband access technologies have identical cost-characteristics, and they also have different access quality attributes (e. g. mobility, reliability, start-up speed etc.). Nevertheless, effective facilities-based competition by means of high-speed access gains increasing relevance.

The challenge of interoperability may arise on different levels, such as, network infrastructure, terminal devices, content and communications services, and applica-

tions delivered across platforms. It can be expected, that the organisation of the telecommunications cluster and the organisation of the broadband cluster shall converge in the future.

3 The changing role of telecommunications regulation

The role of government interventions and regulations has strongly different traditions in the media, IT and telecommunication sectors. The media industry is traditionally attributed a function as the bearer of social, cultural and ethical values within our society. Whereas private communication has traditionally been unregulated, broadcast content has traditionally been regulated to some extent (public broadcast). The computer/IT industry developed in an unregulated manner, under the application of the general competition law. In contrast, the telecommunications sector had been organised for many years as a legal monopoly. Since 1998 in most countries of the world market entry has been allowed to all parts of the telecommunications networks, including both cable-based infrastructure and telephone services. Remaining sector specific regulations concern not only technical regulations (e.g. allocation of radio frequencies) or politically desired universal services objectives, but also the *ex ante* regulation of network specific market power. During the last decade a complex set of end user tariffs, interconnection and access charges in long distance as well as local networks could be observed.

In his article on “Changes in industry structure and technological convergence: implications for competition policy and regulation in telecommunications” Timothy Tardiff takes the recent consolidation of U.S. fixed network providers and the emergence of “triple play” of voice, video, and high speed data as starting points for an analysis of the new competitive environment that is no longer compatible with the way the Federal Communications Commission (FCC) had implemented the U.S. Telecommunications Act of 1996. Due to competing broadband infrastructure platforms the traditional regulatory concern, with network components that incumbent local exchange carriers need to provide to competitors at regulated rates substantially lost relevance. Tardiff traces deregulation tendencies for end-user charges by state public utility commissions and the FCC’s forbearance of certain unbundling obligations to these developments. In the U.S. unbundling regulation was reduced to the obligation for incumbent local exchange carriers to offer a narrow band channel for voice telephony to competitors. These developments have partially preceded and are partially running parallel to similar developments in Canada and in the EU, where the communications framework is currently under review. Within the current EU-telecommunications regulatory framework an intention to substantiate the phasing-out potentials of future regulations can be observed. This particularly holds for end-user price regulation, which will likely be reduced to the last mile. However, due to less current broadband infrastructure competition than in the U.S., in the EU the possibility of *ex ante* regulation of broadband access (including bitstream access and wholesale access provided by other infrastructures) has not yet been challenged. Tardiff concludes that technological and market forces drive regulatory developments, which change more slowly, though.

3.1 Regulation of new markets?

The question arises whether new markets create network-specific market power. Since competition prevails in long-distance networks, the focus of regulation is on access networks. As these networks develop technologically and through parallel investments the extent of regulation requires renewed attention. Currently, a multiplicity of alternative upgrading strategies of telephone incumbents' infrastructures seems possible, together with competing infrastructure platforms. Competing infrastructure platforms would result in oligopolistic infrastructure competition. In this context the public debate centres round the following two questions. First, are upgrades innovative enough to warrant regulatory access holidays? And second, when will there be enough infrastructure competition for regulation to be abolished altogether?

3.2 Regulation of interconnection charges?

The regulation of access and interconnection charges has been an intensely discussed topic for many years. Should those charges be regulated and if so how? More recently, the discussion has intensified, spurred by the mobile termination issue and the emergence of Next Generation Networks (NGNs). Mobile termination charges are being regulated in more and more countries in spite of (or because of) the presence of competition in mobile retail markets. This development nurtures the outlook that interconnection regulation may stay around for a long time. The emergence of NGNs as a replacement for the old public switched telephone network (PSTN) has brought up issues of quality of service (QoS) across networks and the compatibility of the PSTN interconnection regimes with those currently governing all-IP networks.

In the context of these discussions a number of suggestions for access and interconnection pricing have been proposed besides the established per-minute charges of the PSTN, notably capacity-based interconnection charges (CBI) and Bill and Keep (B&K). Under CBI, parties wanting to interconnect with the (regulated) incumbent network operator would have to pay proactively for the incremental network capacity costs that they cause the incumbent's network. In addition, under two-way interconnection, the incumbent would also have to pay the new competitors for their capacity increments due to his interconnecting traffic. In contrast, under B&K each network would pay its own incremental capacity costs even if "caused" by the other network. In their article on "Efficient interconnection charges and capacity-based pricing", Kennet and Ralph eloquently bring out the arguments for CBI and against B&K as well as against per-minute charges. They make a convincing case for CBI over per-minute charges, as far as cost causality and end-user pricing flexibility are concerned. Thus, there would be good reasons for replacing per-minute charges with CBI. Given that first discussions about CBI began in the early 1990s, there must have been practical and/or political reasons working against CBI. We suspect both having to do with the necessity for interconnection seekers to commit in advance to "renting" capacity from incumbents.

In comparing CBI and B&K the authors use similar cost-based arguments in favour of CBI as they use against per-minute charges. In this sense they represent the traditional view on termination costs as being caused by the caller. Under this view,

B&K can only be justified for two-way interconnection and even there only in symmetric traffic situations or as a way of saving transaction costs. This may be contrasted with the new view of calls being “caused” by both calling and called party. While the caller takes the initiative, the called party is, under the new view, just as responsible as the caller for any continuation of the call beyond some trivial amount of time. Both parties would therefore share causality and should also share the interconnection costs. This would apply to both, the wholesale and the retail level so that the calling party pays principle would have to be replaced by hybrid pricing arrangements that make receiving parties pay for at least part of the calls. This view does not lead by necessity to B&K as the optimal interconnection regime, because that would only emerge if the ratio between origination and termination costs equalled the ratio between calling and receiving parties’ utilities. However, if one includes savings in transaction costs through simpler regulation and the like, B&K turns out to possess good efficiency properties. This holds in particular if regulated access and interconnection are restricted to access networks, while transit and other arrangements would be freely negotiated for the use of core networks.

As Kennet and Ralph note, negotiated interconnection charges are generally to be preferred over regulated charges even if they do not result in CBI. We would expect regulated interconnection charges to be restricted to call termination and possibly origination in access networks, while interconnection traffic in core networks will be subject to private negotiations only.

A salient feature of the telecommunications sector is the fact that economies of scope and scale play a significant role in the provision of services. As far as prices are competitively determined, they must therefore be allowed to freely find their level between stand-alone costs and short-term marginal costs, depending on demand. Under market power regulation a similar result can be achieved in combination with a price-capped tariff basket approach, as it has been practiced in the U.K. both for retail and access/interconnection regulation.

On the retail side a substantial price differentiation potential exists which should be exploited for the benefit of consumers. The development of innovative rate structures should therefore be an option open to all providers. Provided that access regulation is deemed successful, all market participants should have the opportunity of providing optional rates, multiple rates, non-linear price structures, etc. Any accusation of foreclosure of rivals by incumbents would then have to be dealt with ex post through the tools of competition policy.

4 Regulation of network neutrality?

In the last few years telecommunications regulation has shown a trend towards consolidation and concentrated on a few issues, such as interconnection, unbundling and local end-user prices. Regulation appeared to be gradually on its way out. It now appears that new regulation may be emerging from an unexpected area, the Internet.

The Internet has been kept remarkably free of regulation so far. It is therefore fascinating to see that the so called “netheads”, who traditionally represent the Internet, are now calling for net neutrality regulation, while the “bellheads”, who represent the incumbent phone companies and had lived under regulation almost all

their lives, are fighting obligations for net neutrality. Proponents of ‘network neutrality’ require that customers should be able to access any web content they choose and use any applications they choose, without restrictions or limitations imposed by their internet service provider on content or application providers via e.g. innovative pricing schemes. They argue that such restrictions would stifle innovation by content and applications providers, who have driven the growth of the Internet. In contrast, the opponents of net neutrality obligations argue that such regulation would stifle network investment. With both positions being highly contentious, emotional and political a more careful and detached analysis is in order.

Such analysis is provided in the two articles on network neutrality by Kocsis/De Bijl and Hogendorn. Methodologically the two papers are based on different approaches. In their article on “Network neutrality and the nature of competition between network operators”, Kocsis and DeBijl use knowledge gained in Industrial Organization research in recent years and systematically apply this to a welfare analysis of network neutrality obligations versus their absence. In contrast, in “Broadband Internet: net neutrality versus open access”, Hogendorn builds his own game-theoretic model of the market relationship between content providers, intermediaries and network (conduit) providers. This allows him to extract the effects of access regulation and network neutrality regulation on market outcomes. Both papers provide a wealth of insights that should put the network neutrality debate on a more reasoned footing. In line with the fundamental contribution that economics makes to society it turns out that polar positions either leave out crucial ingredients of social interaction or hold true only for very special cases. Rather, real-world problems are predominantly characterized by tradeoffs.

From the perspective of static and dynamic efficiency, the tradeoffs are nicely worked out by Kocsis/De Bijl, who come to the conclusion that a clear policy recommendation can only be formulated against port blocking and deliberate quality degradation under lack of competition. In contrast, the net detrimental or net beneficial effects of access-tiering depend on the relationship between static inefficiency effects and dynamic efficiencies or inefficiencies. The static inefficiencies result from market power increases due to product differentiation and from impairment of competitors through vertical restrictions. In contrast, the potential dynamic efficiencies result from the higher profit opportunities from innovations in networks, while dynamic inefficiencies can come from reduced innovations in content. It is not clear that all these effects can be readily identified in practice. Thus, a per-se approach will be wrong, while a rule-of-reason approach may not be practical.

Hogendorn’s model differentiates between network neutrality and open access, where network neutrality refers to openness of network providers (like AT&T) and intermediaries (like AOL) to content and open access refers to openness of network providers to intermediaries. While in popular language both of these often fall under network neutrality, they are clearly quite different in their effects. Hogendorn shows that in a model with free entry of network providers, content providers and intermediaries an open access policy is not sufficient for guaranteeing network neutrality (in Hogendorn’s sense). His main results on market outcomes and implicitly on welfare depend on two main parameters. The first is the fixed cost of entry for intermediaries. These costs were low in the Internet dial-up world, where hundreds of ISPs were created. They have, however, increased tremendously in the

broadband world, where a few intermediaries dominate. The second parameter is the value of Internet services relative to other services for the network providers. This value has also increased substantially in recent years. As a result, open access leads much less to increased openness to content now than it did before in the dialup world. The reasons are that, due to increased fixed costs, fewer intermediaries are attracted by open access and that, due to increased importance of the Internet, network providers are more interested in restricting content. Hogendorn warns, however, that the welfare effects of these restrictions remain quite ambiguous.

Thus, both papers leave it to the empirical circumstances to decide if network neutrality regulation is going to be good or bad for economic welfare.

4.1 Open source and intellectual property rights

The controversial debate on Internet neutrality is strongly related to the protection of property rights of the different parties involved. Companies that supply high-speed Internet connections to customers argue that demanders of scarce network capacities (e.g. content providers) should not be allowed to use their property for free, otherwise incentives to invest into network bandwidth would be eroded. The development of computer software is of particular relevance in internet markets. At first glance property rights seem to be also necessary to provide incentives for innovative activities in the computer software market. The paper on “Open source software: Motivation and restrictive licensing” by Fershtman and Gandal challenges the traditional paradigm of patent protection dealing with the development of open source software. The development of software may be considered as a learning industry, because only by successive applications potentials for software improvement can be identified. In contrast to proprietary software, the source code of open source software is typically available for free. The question arises, what the motivations are to induce unpaid volunteers to invest effort in contributions to open source software projects.

Even though open software is distributed freely, the programs are distributed under licensing arrangements. The focus of the authors is on how the choice of license type affects incentives in open source development. Fershtman and Gandal show convincingly that the license that has fewer restrictions and allows the development of commercial products leads to a much higher output per contributor.