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Net neutrality

November 17, 2011

Innovation and differentiation are not polar opposites

Communications infrastructure becoming increasingly important in the competition to attract business. Expanding the communications infrastructure is therefore climbing up the political agenda to become one of the top priorities in a number of countries. The value of investments in broadband expansion in the European Union alone will undoubtedly exceed the EUR 200 bn mark by 2020.

Capacity bottlenecks in the communication networks are not a distant figment of the imagination. The issues of how network operators can guarantee sufficient quality of data transmission and combine this with the commercially profitable execution of the necessary infrastructure expansion are thus inevitably gaining increasing urgency. It has been shown that the commercial success of the expansion and operation of a high-quality communications infrastructure is closely linked with the issue of the adequate level of investment protection and thus also of net neutrality. What is required is a sustainable compromise between investment protection and the promotion of competition and innovation. This compromise should prevent the internet from being able to develop into a “multi-level society” in which the small (and possibly particularly innovative) company is structurally disadvantaged compared with the large, financially strong firm.

Differentiation can accelerate infrastructure expansion and innovation. Price differentiation enables infrastructure investments to generate a profit faster; innovations would thus tend to be implemented earlier or even made available to users at all in some cases. This means that the argument often made that differentiation would inevitably threaten innovation does not hold water.

Sustainable business models require a reliable, consistent legal framework. In order not to preclude future innovations in currently still inconceivable areas of the internet, however, regulations must not be drawn up all too strictly. Accordingly, it is thus a challenging task for lawmakers to lay down concrete rules on net neutrality. The European Union has made a good start with its market-friendly decisions on promoting investment, innovation and competition (e.g. its directives on market transparency and extraordinary termination rights) – both in terms of economic efficiency and the protection of civil liberties.

Regulations concerning net neutrality must be tailored to country-specific conditions. Experience gathered in other countries does help, but there should definitely be no wholesale adoption of practices from other economic areas. This will probably lead to a segmentation of legislation worldwide. Bilateral agreements between the different economic areas are thus absolutely imperative.

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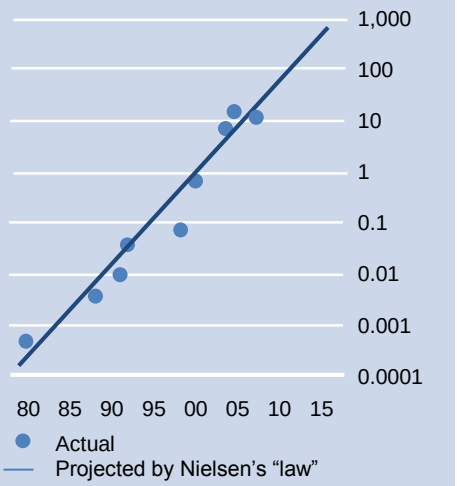
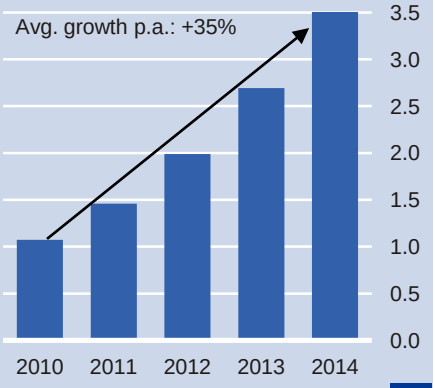
Nielsen's "law" fulfilled to date: +50% p.a.
Internet access speed, UK (Mbit per second)



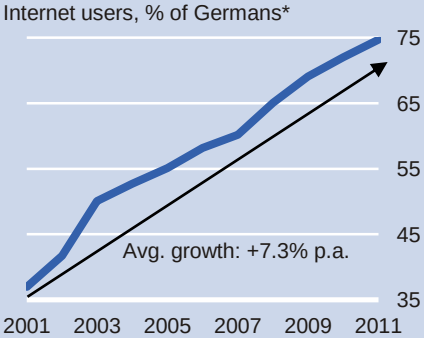
Source: FttH Council Europe, 2008 **1**

No foreseeable limit to growth
Monthly IP data volume, Germany, (exabytes, 10^{18} bytes)



Source: Cisco, 2011 **2**

Continuing growth
Internet users, % of Germans*



*Residents over the age of 14

Source: (N)onliner-Atlas, 2011 **3**

Advanced broadband communications infrastructure is a central factor in the competition to attract investment. Interest is thus growing worldwide in online business models, modern forms of communication, smart grids[1], cloud computing, social networks, online gaming and internet TV. All these "hyper-connectivity" services stimulate the thirst for data, continually increasing the utilisation of the existing communications infrastructure and driving the demand for ever more powerful infrastructure referred to in Nielsen's "law"[2] (see chart 1). Estimates suggest that global IP data volume will probably quintuple between 2008 and 2013 and reach 700 exabytes p.a. (1 Exabyte = 10^{18} bytes = 1 billion gigabytes); this is equivalent to the storage capacity of 200 billion DVDs. For Germany alone the hardware maker Cisco expects IP data volume to grow by an average of 35% p.a. between 2010 and 2014 (see chart 2). This gigantic growth will be driven on the one hand by the increasing number of internet users (see chart 3) and on the other to a large extent also by video services. Experience suggests that it will be boosted even further in a second-round effect via improvements to the service offering (for example, by expanding the fibre-optic network to the end-consumer – Fibre to the home (FTTH)). Accordingly, individual major content providers are even constructing their own communications infrastructures in order to guarantee that their subscribers' exacting quality demands can also be met when there are capacity bottlenecks.

Capacity bottlenecks in the data network are not a distant figment of the imagination, but a reality. All the same, the network utilisation varies considerably depending on the time of day, the day of the week and the user groups. Deutsche Telekom reports, for instance, that 65% of its data traffic is generated by just 10% of subscribers. In addition, peak loads usually occur between 6 pm and 10 pm – though this can be heavily influenced by unplanned day-to-day occurrences.[3]

Excursus: Trends driving debate

On the technical side the debate on the necessity of defining net neutrality is being heavily stimulated by the three following drivers:

— *Data volumes are rising rapidly:* the growth in the volume of data to be transferred will continue to expand with the increasing range of bandwidth-intensive offerings (e.g. moving images, cloud computing). If capacity is not expanded, depletion in quality and data transfer congestion will become increasingly common.

— *Convergence is changing the competition situation:* the areas of fixed telephony, mobile, cable TV and also electricity are all banking on data transmission over internet protocol (IP). Competition is thus hotting up between what were originally discrete areas of the net.

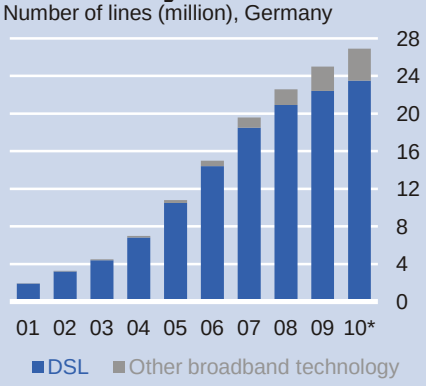
— *Network architecture is no longer application blind:* for a long time network operators were unable to differentiate in real time between the packets of data transmitted as to whether they were applications, services or content. Thanks to technological progress it is now generally possible to distinguish between the different types of packet data (e.g. internet telephony, e-mails, web search) and on this basis to implement priorisation rules for real-time access.

1 See Auer, Josef and Stefan Heng (2011). Smart Grids: Energy rethink requires intelligent electricity networks. Deutsche Bank Research. E-conomics 84. Frankfurt am Main.

2 According to Nielsen's "law" formulated in 1998 by Jakob Nielsen the speed of a user's internet connection will continue to rise by an average of 50% p.a. in future.

3 See Curran, Thomas Aidan (18.10.2010). Stellungnahme der Deutsche Telekom AG zum Fragenkatalog der Enquete-Kommission Internet und digitale Gesellschaft Thema: „Netzneutralität" - Kapazitätsengpässe, Differenzierung, Netzwerkmanagement. Bonn.

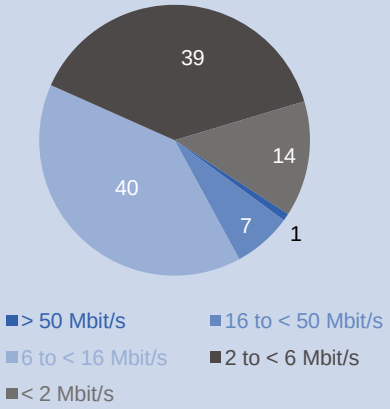
Germany predominantly a DSL country
Number of lines (million), Germany



* Estimate

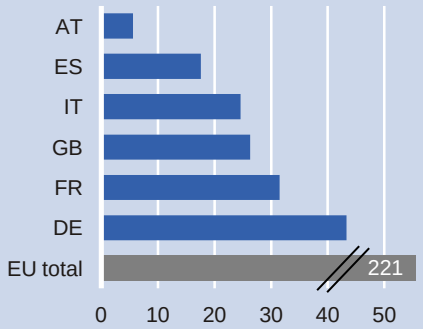
Sources: BNetzA, DB Research, 2010 **4**

Majority still without high speed
DSL lines by downstream bandwidth (%)



Sources: VATM, DIALOG CONSULT, 2010 **5**

Broadband expansion: A major project
Estimated investment required for broadband expansion (EUR bn)



Source: EIB, 2011 **6**

Policymakers concerned about broadband capacity

Realising the social and economic significance of sufficient broadband capacity, the European Commission has formulated ambitious objectives for expansion. By 2020 every EU citizen is to be able to go online at a minimum internet access speed of 30 Mbit/s; furthermore, at least 50% of them are to have access with a minimum speed of 100 Mbit/s. Germany, which like numerous other countries still largely relies on copper-based DSL cabling that achieves speeds that are much lower than 50 Mbit/s (see charts 4 and 5), is even raising the bar somewhat higher and is targeting an internet access speed of 50 Mbit/s by 2015 for 75% of Germany's 40 million households and by 2018 for every single household no less.

These ambitious broadband objectives entail huge infrastructure investments (see chart 6). In its relatively conservative estimates for the EU as a whole the European Investment Bank (EIB) projects that these costs will exceed EUR 220 bn; almost 60% of this total will be accounted for by Germany, France, the UK and Italy.

Despite the range of options for subsidising infrastructure expansion the private sector will ultimately cough up the lion's share of the investments.[4] Given the shrinking volume of the traditional telecommunications market (see chart 7), long amortisation periods and a deteriorating relationship between investment yield and expenditure it is currently still unclear how the expansion is ultimately to be implemented on a commercial basis. Hence, politicians and the private sector are working together feverishly to find sustainable business models within an appropriate legal framework. This must strike a balance between protecting investments and promoting competition and innovation – without being a major burden on the public purse.

In this quest for the right route to an adequate broadband network for the highly innovative globalised knowledge society net neutrality is proving to be an important criterion. There are already signs that the imminent decisions concerning network expansion and in particular net neutrality will have a lasting impact on social and economic developments.

Excursus: Internet not a traditional business area

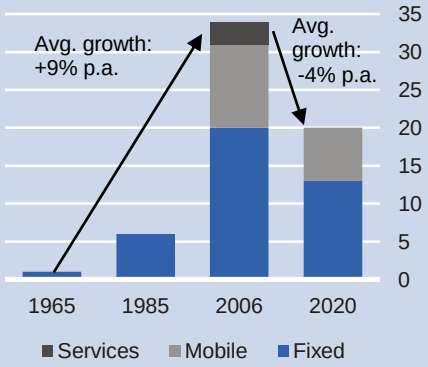
The internet differs from traditional business areas in several significant respects. The internet is based on a physical network infrastructure consisting of various sub-networks. These sub-networks are linked up by their various operators in order to transmit a variety of content and services – also between different jurisdictions. The competition between these sub-networks (for example, fixed telecommunications, mobile, cable TV, powerline, satellite) as access channels differs in intensity.

For the content and services to be transmitted in turn there are marked differences in the quality specifications concerning third-party access, for example.[5] The actual level of quality to be attained depends on both the quality provided by the network operator at every transfer point and the quality demanded by the user.

[4] See Heng, Stefan (2010). Broadband infrastructure: The key factors are the regulatory framework, market transparency and risk-sharing partnerships. Deutsche Bank Research. E-conomics 77. Frankfurt am Main.

[5] The technical quality of a network is mostly described using the two metrics latency and jitter. Latency refers to the time delay for a data packet to travel from sender to recipient. Jitter, by contrast, is the variability in the latency of data packets that belong together. Too excessive jitter in multimedia applications can be particularly disruptive.

Sharp decline expected
Volume of German telecommunications market (EUR bn)



Source: McKinsey, 2008 7

Besides the factors that influence quality the high level of innovative dynamism is a special feature of internet offerings. Innovative dynamism is particularly associated with the following three factors:

— Low costs and rapid implementation: innovations can be realised at low cost and quickly be made available to a global market.

— Independence between innovator and infrastructure operator: innovators can deliver their new offerings regardless of the infrastructure operator.

— Independence between user and infrastructure operator: users choose offerings and quality of service for themselves.

Textbook of measures that tackle capacity bottlenecks with differing levels of efficiency

Data is usually transmitted via communication networks according to the best-effort principle. This principle initially covers only the assurance provided by the network operator to effect the data transmission as quickly as possible to the best of its ability with the resources at its disposal. Despite the best-effort principle demand-induced capacity bottlenecks will probably occur in the data network again and again.[6] Economics shows us that there are basically the following ways of dealing with this shortage of capacity:

1. *Gearing capacity expansion towards peak loads*: if capacity should be expanded to such a degree that congestion never occurs, then during the far more frequent off-peak periods there will be an unused oversupply of network capacity.

Time-of-day basis ignores special quality requirements

2. *Tariffs that vary depending on the time of day*: variable prices are supposed to reflect the scarcity of capacity depending on the time of day. Such prices can, however, only truly influence behaviour if demand is predictable over a sufficiently long period and thus users can incorporate the price signal into their calculations in a timely fashion. Another problem with load-dependent prices with regard to efficient management is that they are only geared towards load but not to the quality requirements for the respective service.

Network management susceptible to lobby-group intervention

3. *Rational differentiation*: the two distinct variants of this instrument are as follows:
   a. *Discretionary network management*: in this case the network provider decides which data is to be given priority treatment in order to achieve optimum utilisation of the network for users as a whole. This solution presupposes that the network operator is sufficiently informed at all times about the data and utilisation level in its network. In addition, the solution inevitably brings with it the risk of lobby-driven intervention.

Priority pricing takes preferences into account

   b. *Differentiation via market prices (priority pricing)*: in this case it is the willingness to pay of content providers and consumers that decides who may have priority access to the scarce network capacities during periods of excessive network load. This is intended to guarantee a certain level of transmission quality. In its purest form it can be executed as follows:
      i. In the *Quality Classes – Content Pays allocation model* it is the content provider who decides which quality class for sending its data that it would like to book and be charged for by the network operator. For receiving content the user pays the network operator only a flat fee that is irrespective

[6] Demand-induced congestion, by contrast, is not caused by natural disasters or terrorist attacks (for example if an earthquake ruptures an underwater cable).

of the quality of the delivery. In this "Quality Classes – Content Pays" model it is especially those providers that require high performance in terms of quality and speed of data transmission (for example IPTV providers) who will choose premium quality classes.

ii. In the *Quality Classes – User Pays allocation model* it is the content user who decides which quality class for receiving data it would like to book with the network operator and pay for. In this case the content provider merely pays the network operator a flat fee that is irrespective of the quality of the content sent. In this "Quality Classes – User Pays" model it is especially users who require high performance in terms of quality and speed of data transmission who will choose premium quality classes.

Prevent long-term, irreversible cementing of market clout

Generally, differentiation via market prices brings with it the risk of the network operator artificially reducing the generally available service quality in order to impose higher prices for premium services or also where it operates a vertically integrated business to shield its services from (potential) competition.[7] As a monopolist the network operator would thus – from a social point of view – invest too little in the network over the medium term.[8] If there is a danger that the network operator can permanently and irreversibly extend its dominant market position vis-à-vis users and (potential) competitors the advice of economists is for the regulator to make an urgent intervention.[9]

Heated debate

Divergent associations make rapid agreement difficult

The differentiation of data has long been an everyday feature of data transmission. Important control data has to be afforded priority status when being transmitted via the net simply on account of network management needs. Nevertheless, the particularly heated current debate about the need for an explicit legal anchoring of net neutrality pits two camps against each other. One camp consists largely of internet users who advocate equal treatment for all data on the net in order to safeguard innovation potential and civil liberties. The other camp mainly consists of network operators that are calling for the ability to differentiate between types of data so that network expansion by the private sector can actually become an attractive proposition. The irreconcilability of the conflict between these two camps is demonstrated particularly clearly by the issue of whether a network operator may prioritise or even block certain content and applications. This apparent irreconcilability, however, also stems to a large extent from the fact that the terms "net neutrality" and "differentiation" partly trigger emotive associations and are not precisely defined. This means that different groups use the terms to mean different things. Correspondingly, the German government's expert commission on research and innovation (Expertenkommission Forschung und Innovation – EFI) has pointed out that uncertainties in the data networks area can hamper innovative capacity in the dynamic internet.

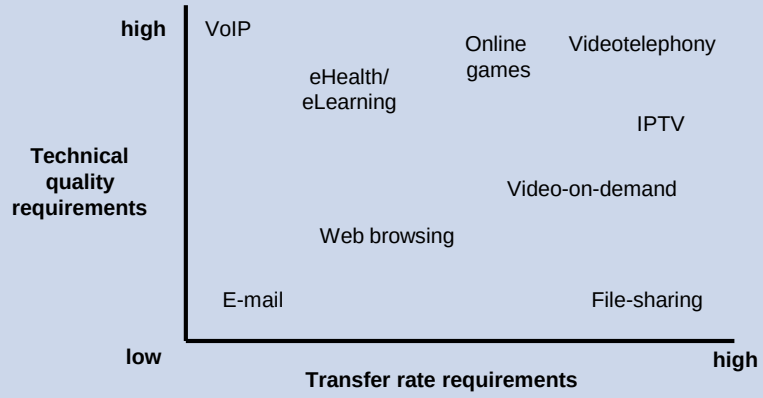
[7] See Kruse, Jörn (2011). Net Neutrality: Should internet neutrality be regulated? European Forum for Sustainable Development. Berlin.
[8] See Expertenkommission Forschung, Innovation (2011). Gutachten zu Forschung, Innovation und technologischer Leistungsfähigkeit 2011. Berlin. pp. 62.
[9] See Haucap, Justus (10.2.2011). Netzneutralität aus wettbewerbsökonomischer Sicht. Presentation at the 6th Bitkom-Forum 2011. Berlin.

Spectre of the threat to civil liberties and innovative capacity

Prior to debating net neutrality fundamental clarification is needed as to whether the objective is to achieve completely equal treatment of every single bit or whether quality of service (QoS[10]) differentiation would also be acceptable for data transmission. It should generally be noted that differentiating between data on the net is not necessarily to be equated with a restriction of civil liberties, the limiting of innovation potential or the cementing of market clout.

Different applications: Different requirements

Requirements for online applications concerning quality and speed on the net



Source: Based on Kruse, Jörn, 2011 8

Differentiation does not hold back innovation

Differentiation can be derived from the technical necessity that different internet offerings tolerate very different latencies, packet delay variations and packet losses. Web searches and e-mails are thus considerably more tolerant with regard to latency than internet telephony, internet TV, online gaming or even telemedicine services (see chart 8). If all data packets are treated the same and the network is overloaded this can most certainly result in it no longer being possible to guarantee the transmission quality required by particularly quality-sensitive services in future. This means that in the absence of differentiation there will be recurring instances of quality-sensitive packet data (e.g. from internet telephony) having to wait until non-sensitive data (for example e-mails) have been processed. Since the sensitive services lose a great deal of their appeal in such a situation without a resulting real advantage being gained by the non-sensitive ones, this is an economically very unsatisfactory situation because it is inefficient. This means it is entirely possible that specifically because of a ban on differentiation the actually desired innovations in quality-intensive areas would be prevented by latencies, variations in latency or packet losses.

Net neutrality can put small companies at a disadvantage

It is also conceivable that specifically because of the statutory equal treatment of all data packets the result could be a multi-tiered society on the internet.[11] This observation is based on the network expansion being geared towards users with the lowest willingness to pay and quality-sensitive users (e.g. companies from the energy utilities, medical equipment and finance sectors) building up their

[10] Quality of service (QoS) refers to a guarantee that a certain service is delivered to a user with a defined quality (e.g. with regard to maximum tolerable latency, variation in latency, data loss rate).

[11] See: Die Medienanstalten, Kommission für Zulassung und Aufsicht (January 21, 2011). Press release: Keine inhaltsbezogene Priorisierung im offenen Internet. Berlin.

own infrastructure – insofar as they can afford it. In this case the enforced net neutrality results in the macroeconomically undesirable outcome that small (and possibly particularly innovative) companies would be structurally disadvantaged compared with large financially strong companies.

Boost efficiency via differentiation

By contrast, differentiation can boost efficiency via several mechanisms. Differentiation could enable heavy users to also contribute more to the (operating and expansion) costs of the network by paying higher charges. The potential additional revenues could enable infrastructure investments to turn a profit quicker – or make this a possibility at all in some cases. The enhanced appeal could lead to a more extensive and faster expansion of the infrastructure – even in areas that have long been regarded as uneconomic. With the more favourable infrastructure basis the innovation environment would also improve. This scenario presupposes that the price differentiation does not favour large vendors (via bulk discounts, for example) and furthermore that especially small dynamic firms without their own infrastructure can position their innovative products well in the market.

Accepting the challenge, trusting in the market's positive forces

Balance between protecting innovation and promoting competition

A reliable, consistent legal framework that guarantees an acceptable balance between investment protection and promotion of competition and innovation is the essential precondition for viable private-sector business models. Lawmakers in numerous countries are thus already faced with the daunting task of defining a binding and consistent position with respect to net neutrality within the existing general legal framework while at the same time not introducing regulations that are so stringent that they hamper desirable future developments in currently still unforeseeable areas of the internet.[12]

Dare to boost transparency

With these ambitious objectives the European Commission prefers – as do the relevant German institutions – a way in the competitively organised communications market that enables network operators to differentiate between data. Consequently, the European legal framework neither includes the explicit formal anchoring of net neutrality nor introduces binding minimum standards for network operators. Instead, the legal framework relies on the future-oriented application of legislation already in force that bans the abuse of power (in Germany, for example, the Act against Restraints of Competition (GWB) and the Telecommunications Act (TKG)) and expanded transparency regulations. The efficiency of the broadband telecommunications market is essentially to be boosted via the interplay between the following four instruments:

Transparency and efficient regulation are key factors

— Competition between the network operators is to be intensified in the areas of price and quality.

— Network operators are obliged to provide timely and regular information to their existing and potential clients about the actually attained quality of the services they offer and about the blocking of competing services.

[12] Concerning the legal side it should be pointed out that the anchoring of net neutrality in a strict form could certainly conflict with the constitutional claims of network operators; in Germany, for example, these would be in particular Article 14(1) (Protection of property) and Article 12(1) (Occupational freedom) of the Basic Law.

— Customers have a special right of termination if there is a significant decline in the quality of service and they can change provider quickly in such cases.

— A supervisory authority (in Germany, for example, the *Bundesnetzagentur (*Federal Network Agency)) can effectively monitor the market.

The road embarked upon thus bears witness to both the basic trust in the functionality of the market as well as the recognition of the risks that inevitably accompany government interventions in such a fast-moving area.

US is anti-discrimination – but has left the back door open

US searching for its course

Like the European Union, the responsible authority in the US – the regulator FCC (Federal Communications Commission) – also repeatedly stresses the economic importance of a fundamentally open internet. In December 2010 the following rules were laid down for network operators in the fixed and mobile sectors in the US:

— *Discrimination ban*: network operators must not discriminate unjustifiably against applications, services and content and must provide them with unrestricted access (as long as they are not illegal or differentiation cannot be justified for network operation reasons).

— *Transparency obligation*: Network operators must provide regular information about network management and the quality of service in their network.

FCC particularly concerned about achieving practicability

The FCC approach focuses particularly on practicability. That is why the authority qualifies its requirement for net neutrality simply by making explicit reference to “unjustified” discrimination. Equally, the explicit reference by the FCC to unjustified discrimination suggests that there certainly can be cases where a differentiation between services for online data transfer can be justified. The cases that particularly come into question are the especially capacity-intensive services that overload the network at peak times.

The US differs from Europe

The lines of argument pursued in the US are also of interest for the debates in Europe. All the same, with regard to the transferability of conclusions it is essential to be aware of the fact that there are fundamental differences between the competition and regulation situation in the US and that in Europe.[13] In the US, for instance, there is no obligation to unbundle connections, which in Europe, however, is a key factor for intensifying intramodal competition.[14] Furthermore, in the US new competitors have no right to network access for their content – this is another right that significantly livened up the European competition for services.

Different market conditions, different solutions

Correspondingly, both the intramodal and the intermodal competition[15] in the US fixed broadband segment is far less intense

[13] See Friederiszick, Hans W. et al. (2011). Assessment of a sustainable internet model for the near future. ESMT White Paper 11–01. Berlin.

[14] Unbundling refers to the various possible forms of separate provision (line-sharing, last mile, bitstream access) of individual services for end customers as well as the advance services of competing providers.

[15] Intramodal competition refers to competition between various providers within the telecommunications segment itself; intermodal competition, by contrast, is competition between a telecommunications provider and providers of substitute telecommunications technologies (for example cable TV, powerline, satellite).

and self-sustaining than in the European Union.[16] It is therefore consistent that the US with less competition in telecommunications as regards net neutrality and data differentiation trains its focus on equal treatment of data, whereas Europe – where there is more competition – can allow itself to rely more on the self-regulatory powers of the market and greater investment protection.

Conclusion: Do not condemn differentiation on the net as the enemy of progress

Disagreement about socially correct degree of investment protection

The expansion of communications infrastructure worldwide entails huge investments and in the European Union alone these will undoubtedly exceed EUR 200 bn by 2020. However, the commercial success of the politically desired expansion of high-performance broadband networks in a competitive market environment is closely linked with the issue of the socially correct degree of investment protection. This protection should, on the one hand, be as strong as necessary, so that the required network investments can be sufficiently profitable. On the other hand, however, the investment protection must not be too extensive, thereby enabling a network operator to systematically exclude (potential) competitors from the market and in turn also resulting in insufficient infrastructure investment from a social point of view.

Government intervention can easily fail to achieve desired impact

The question of the right form of investment protection leads in turn to the issue of defining net neutrality. Experience shows that government intervention in a very fast-moving market like the internet can easily fail to achieve the impact that was actually desired. Particular caution should thus be exercised in this respect. Government intervention, however, always makes sense when the behaviour of the market leader poses a lasting and irreversible threat to competition – namely a situation which would already be in conflict with the general competition and antitrust regulations. Discussion about guaranteeing the efficiency of data transmission should thus, however, be focused far less on new laws but rather on a forward-looking, effective application of existing regulations concerning the abuse of a dominant market position.

Global net has specific local features

Experience from other countries can help to sharpen up the arguments in favour of one's own geographical market. This experience from other economic areas should, however, definitely not be adopted wholesale. Different regulations are required in the US than in the European Union simply because the competitive situations and infrastructures are fundamentally different. This means that striking a balance between investment protection and the promotion of competition and innovation automatically requires a different focus in these economic areas.

Regulations for cross-border data transmission required

The foreseeable segmentation of legislation between the different economic areas can result in issues with integrated cross-border data traffic. This means that a key political task is the international coordination of the regulations in the various jurisdictions.

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[16] See Holznagel, Bernd and Christoph Nüßing (2011). Legal Framework of Network Neutrality: USA vs. Europe. In: Spiecker, Indra and Jan Krämer (ed.), Network Neutrality and Open Access. Baden-Baden. pp. 27.

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