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ASSESSMENT OF A SUSTAINABLE INTERNET MODEL FOR THE NEAR FUTURE

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+ This report was commissioned by Deutsche Telekom. The opinions expressed herein are those of ESMT Competition Analysis (ESMT CA) and do not necessarily reflect the position of Deutsche Telekom. The conclusions are the results of the exercise of ESMT CA's best professional judgment.

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Extended summary

The increasing demand for bandwidth due to data-intense applications, the convergence of various digital communication technologies as well as the increasing commercial importance of the Internet has given rise to one of the most important questions in the coming years: whether and how the Internet economic model needs to evolve and what role regulation should play in this process. An extensive debate in the US – including contributions by distinguished scholars - has been looking at the pros and cons of net neutrality regulation in the US context. Also in Europe, the European Commission's consultation process in the second half of 2010, which resulted in over 300 responses, shows the vivid interest of policy makers and regulators, industry, and the general public on that matter. However, what is missing is a thorough analysis of the implications of net neutrality regulation on some possible Internet business models adapted to the different market conditions in Europe, foremost European access regulation.

In this context, ESMT Competition Analysis analyzes the interaction between different net neutrality regulations and Internet business models. Net neutrality regulation, if and when formally implemented in some shape or form, has the potential to reallocate resources among industry participants, affect optimal pricing strategies, and ultimately impact investment and innovation incentives. Through these effects, the regulatory framework is going to affect which business models will be at all feasible, which are going to thrive, and which will become obsolete. The report derives and analyzes some likely future business models with a view to sustainability in terms of the ability to accommodate increasing traffic volumes and social welfare implications. Based on these assessments, the regulatory implications are discussed for each business model.

The future ahead: Eight main features on the dynamics of the Internet

The starting point is the exploration of eight fundamental features and developments of the industry, features which will inevitably influence the future shape of the Internet.

Fact 1: Traffic is expected to increase significantly, in particular due to video-based applications. Actual traffic predictions predict that wired traffic will soar fourfold between 2009 and 2014. Video applications will contribute to this growth to a large extent as the share of Internet video alone will increase from about 30 percent of consumer Internet traffic to about 57 percent in 2014.[1]

Fact 2: Over the course of the day, traffic volumes fluctuate greatly and high levels of congestion might be reached. In Europe, traffic peaks are being observed between 4:30 p.m. and 9:00 p.m. in 2010. In off-peak periods bandwidth utilization falls dramatically and lingers around one-fifth of peak capacity utilization between 1:00 a.m. and 5:00 a.m.[2]

Fact 3: New applications such as 3DHD video, cloud gaming, and video conferencing require high-quality transmission standards. For example, streaming a YouTube video in HD quality requires 1.1 Mbit/s of transmission speed while streaming a 3D video in HD quality needs 50 Mbit/s. Increased needs for higher quality transmission are reflected by the increase in demand for quality of service enhancements provided by Content Delivery Networks such as Akamai and Limelight[3]: revenues of CDNs specializing in video content are predicted to increase from below 300 million US$ in 2007 to over 1.4 billion US$ in 2012 representing an annual growth rate of 36 percent.[4]

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1 See Cisco VNI forecast, http://www.cisco.com/en/US/netsol/ns827/networking_solutions_sub_solution.html#~forecast (accessed January 21, 2011).

2 See Sandvine (2010). Fall 2010 global Internet phenomena report. http://www.sandvine.com (accessed January 21, 2011).

3 Although, the data between a CDN and an end user is handled on a non-prioritized, "best effort" basis, the technology ultimately improves the end-user's experience.

4 See Buyya R., M. Pathan and A. Vakali (2008). *Content delivery networks*. Berlin: Springer.

4 See Buyya R., M. Pathan and A. Vakali (2008). *Content delivery networks*. Berlin: Springer.

5 See OECD (2009). OECD communications outlook 2009. http://www.oecd.org/document

Fact 4: End consumers are currently priced such that they experience little or no incentive to control the traffic they generate. The OECD recent Global Communications Outlook states that "broadband also remains largely a flat-rate subscription in most countries."[5] Flat rates imply that the end users' traffic consumption is largely unlimited and that heavy users are essentially subsidized by light users.[6]

Fact 5: Peer-to-peer applications might jeopardize the payment balance under traditional transit agreements. P2P technology partially circumvents transit via lower tier providers, thus reducing transit payments by content providers. At the same time, overall traffic is not reduced significantly. As P2P applications have gained importance in recent years, the amount content providers pay under transit agreements might no longer be a good approximation of the costs they produce on the entire network. To corroborate, in 2008 the peer-to-peer file sharing accounted for 32 percent of the total traffic on the Internet and for 22 percent of the global downstream traffic.[7]

Fact 6: Network management practices allow a more cost-effective way to satisfy demand than over-provisioning. The increasing quality of transmission requirements of new applications like medical telemetry, network gaming, and video streaming require additional investments from the side of ISP. Whether the same quality of service has to be provided to all applications has a huge impact on the scope of investment: economic research finds that, to provide the same level of quality to new and traditional applications, ISPs would need to invest 60 percent more into infrastructure capacity than they would if differentiation in quality of service is allowed.[8]

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5 See OECD (2009). OECD communications outlook 2009. http://www.oecd.org/document/44/0,3343,en_2649_34225_43435308_1_1_1_1,00.html (accessed January 21, 2011).

6 For example, Deutsche Telekom in its response to the EU public consultation states that 3% of their mobile customers generated 53% of the IP traffic in 2009 (see http://ec.europa.eu/information_society/policy/ecomm/doc/library/public_consult/net_neutrality/comments/01operators_isps/dtag.pdf).

7 See Sandvine (2010). Fall 2010 Global Internet phenomena report. http://www.sandvine.com (accessed January 21, 2011).

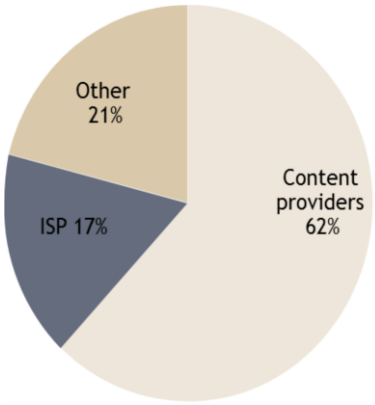
8 Houle, J.D., K.K. Ramakrishnan, R. Sadhvani, M. Yuksel, S. Kalyanaraman (2007). The evolving Internet: Traffic, engineering, and roles. http://www.cse.unr.edu/~yuksem/my-papers/2007-tprc.pdf (accessed January 21, 2011).

Fact 7: Content providers earn the largest share of the overall revenue in the Internet value chain. Content providers grab the largest share of the revenue earned on the Internet: in 2008, 62 percent of the total revenue[9] was earned by content and service providers, while Internet service providers cashed only 17 percent.[10]

Fact 8: The segment of content providers is becoming increasingly concentrated. The Internet is becoming a more and more concentrated economic system with a relatively small number of participants (hosting, cloud and content providers) accounting for the increasing share of the total traffic: "*Out of the 40,000 routed end sites in the Internet, 30 large companies - 'hyper giants' like Limelight, Facebook, Google, Microsoft and YouTube - now generate and consume a disproportionate 30 percent of all Internet traffic.*"[11] With an increasingly concentrated content provider side, it can be expected that the share of the jointly generated surplus that ISPs can appropriate is going to deteriorate.

These developments of the Internet indicate that the current business model might not be sustainable in the future and that changing to more tailored business models might open new opportunities for ISPs.

Distribution of total Internet revenue, 2008



Source: AT Kearney (2010).

[9] The total revenue includes money earned by content providers and Internet service providers as well as content owners (TimeWarner, EMI, BBC), providers of enabling technology and services (Akamai, PayPal and DoubleClick) and user interface providers (Firefox, Symantec, and Apple).

[10] See AT Kearney (2010). Internet value chain economics. http://www.atkearney.com/index.php/Publications/internet-value-chain-economics.html (accessed January 21, 2011).

[11] See Internet observatory 2009 annual report. http://www.nytimes.com/2010/03/02/science/02topo.html?_r=1 (accessed January 21, 2011).

About incentives: Four potentially profitable future Internet business models

On the basis of the identified developments and features of the industry, the report derives alternative Internet business models from the point of view of ISPs' profit maximization. Each one of the business models focuses on a different aspect.

The first business model, named "**Congestion-Based Mode**l," stresses the possibility to tackle congestion problems through congestion-based pricing, however, no quality differentiation is introduced. Specifically, in this business model ISPs are assumed to charge content providers higher prices for traffic in peak periods than in off-peak periods. For example, the cost for a provider of movie downloads of an end user downloading an HD movie during the peak evening period could be significantly higher than if the same movie was downloaded in the early morning hours or within a 24-hour period. End users in this business model can choose between flat rates with differentiated data caps.

The second model, named **"Best Effort Plus,"** considers a two-tiered Internet structure. It preserves the traditional best effort network for traditional (existing) services and assumes that content providers and end users are priced as in the status quo if they operate on the best effort level. However, these restrictions do not apply to innovative future services, for which pricing and guaranteed service requirements follow individual negotiations between the eyeball ISP and the content provider The Internet as we know it would keep operating under similar principles as it does today, but there would be more flexibility in the provision of novel services and the pricing thereof. For example, an ISP could charge a premium price from an innovative e-health service provider in return for guaranteeing a specified level of transmission quality (premium service). This model implies that there is a greater level of vertical cooperation between ISPs and content providers necessary to implement quality guarantees. Future innovative services would remain unregulated; however, policy makers and regulators would have to define what defines an innovative service and which type of service is thus exempted from net neutrality regulation.

The third model, labeled "**Quality Classes – Content Pays,**" stresses the perceived need of different applications for various degrees of quality of service and offers different quality classes open for different applications. Unlike in the previous business model, the quality classes encompass all services, including currently available traditional services. Depending on their requirements, content providers

could purchase the transit quality most appropriate for its type of content. For example, a content provider offering HD movie streaming or gaming services requiring low latency would purchase a more expensive premium quality class to ensure the quality of experience for end users. In contrast, for delivering an e-mail a cheaper, lower priority class could be chosen. It would become the ISPs responsibility to deliver the quality of service paid for by the content provider. In other words, content providers could choose to pay a premium price for a higher quality of transmission of their data. End users would still pay a uniform flat rate in this model and experience the quality as chosen by the content provider.

The last model, labeled **"Quality Classes – User Pays,"** however, puts the focus on consumer choice for higher quality levels and offers multiple quality classes for end users that are designed to match their different usage patterns. For example, end users who frequently use interactive applications might choose the quality class which is more suitable for dealing with such applications, that is, that offers a low level of delay and jitter. Other users, who focus on multimedia applications, might choose another quality offering characterized by low packet loss and high bandwidth, and so on.

An economist's toolkit: Seven robust economic principles

In the following section, we summarize and characterize seven general and robust results from the economic literature that are relevant for the assessment of the expected effects of new business models from the social welfare point of view.

Principle 1: Common-pool resources are characterized by congestion and suboptimal levels of investment. A number of fundamental design features allow treating the Internet as a common-pool resource and hence make the existence of problems typical for common-pool resources likely. Common-pool resources are characterized by difficulties developing physical or institutional means of excluding beneficiaries (so-called non-excludability). This leads to strong temptations to free ride and consequently to suboptimal investment in the resource. At the same time, common-pool resources share with private goods that one person's consumption subtracts from the quantity available to others (so-called rivalry). This implies that common-pool resources experience congestion problems unless use limits are devised and enforced.

Principle 2: Product differentiation increases total welfare. The introduction of product differentiation quite generally generates positive welfare effects. Broadly speaking, product differentiation increases welfare because it increases the number of available choices and allows heterogeneous consumers to choose the consumption bundles more closely suited to their individual preferences.

Principle 3: Price discrimination increases total welfare. Price discrimination describes a practice of charging different buyers different net prices for the same product. Although price discrimination may invoke negative reactions and connotations among the public, it is a practice that is widespread in a variety of market settings. A common understanding among the economic profession is that it is generally welfare-enhancing and price discrimination only occasionally raises competition concerns.

Principle 4: A price increase to content providers reduces the price to end users ("waterbed effect"). A well-established and quite general theoretical result in the literature on two-sided markets states that increasing prices for one side usually leads to lower prices for the other side. This effect has important implications for net neutrality regulation: in such a setting, the allocative effect of higher charges on content providers implies a (partial) transfer from content providers toward end users.

Principle 5: The difference in expected profitability with and without investment/innovation affects incentives to invest and innovate. Expected profitability depends to a large extent on the competitive environment. Uncontested monopolists have low incentives to invest and innovate in their core markets (so-called *fat-cat effect*). If industry participants expect competitive conditions in the future, they will also have low incentives to invest and innovate because they expect that profits from their innovation are going to be competed away. Incentives to innovate are largest in highly contestable or oligopoly markets. Innovations allow firms to differentiate from each other and thus lessen competitive pressure or prevent rivals from "catching up." Strategic considerations may provide additional incentives to invest, for example, to deter entry or the expansion of rivals.

Principle 6: Network industries benefit from interoperability. Network effects are similar to economies of scale: as the number of buyers and sellers both increase, the surplus available to each agent also increases. Therefore, the more members a network attracts the more value it generates for its members. Also, network effects often involve externalities in the sense that prices do not fully incorporate the benefits of one person's entry into the network on existing members. This leads to the under-adoption of the network. Interoperability between different networks increases the size of the overall network available to end users and hence increases welfare.

Principle 7: Economic decisions involve trade-offs. Economic decisions usually involve making a trade-off. This also applies to regulatory decisions which affect how business is carried out on the Internet. Some important trade-offs are discussed in the report:

- Consumer benefits from lower prices today versus consumer benefits from new content related products and services tomorrow
- High quality of service for some versus average quality of service for all content providers or end users
- Incentives to innovate in content and services vs. incentives to invest/innovate in infrastructure provision (for non-complementary network and content investments)
- Net benefits of ex ante versus ex post regulation (antitrust enforcement)

The welfare perspective: Pros and cons of the four Internet business models

Based on these economic first principles and trade-offs we identify the major social benefits and costs linked to each business model and discuss regulatory options in relation to the different business models. Each of the business models may lead to a different overall welfare implication (e.g., increasing overall efficiency or the utilization of the infrastructure) as well as to different financial transfers across market participants (e.g., from content providers to ISPs or vice versa). To the extent that there are asymmetries in the geographic distribution of different players (e.g., many large content providers are located in the US), financial transfers across market participants may also imply financial transfers across different world regions (e.g., from Europe to the US, or vice versa).

For the **"Congestion-Based Model,"** we find that it reduces congestion and allows more efficient utilization of the existing infrastructure. However, it is unlikely to provide sufficient incentives to entirely eliminate congestion. Still, it offers an increased participation of (light) users and increased incentives to invest in infrastructure due to better utilization (which does not necessarily result in more investment relative to a counterfactual without peak-load pricing as peak traffic demands are smoothed). Content providers will be negatively affected in so far as they produce heavy traffic and cannot shape the traffic according to peak times. To the contrary, off-peak services (and investments in such services) could rise. From a broader policy perspective a minor drawback is that uncoordinated implementation can lead to increased complexity for content providers as well as subsequently end users.

In the **"Best Effort Plus"** scenario ISPs gain the option to offer premium services to content providers who need their content delivered at a premium rate (value added service). Guaranteed reserved bandwidth for priority novel services would ensure their quality or even viability, and thereby induce the creation of new services. Prices for best effort services are not expected to change. However, end users have additional access to separately marketed innovative services. However, the risk of foreclosure due to exclusive agreements and bundling strategies might be increased. This concern is alleviated within the European environment with its existing access regulation.

For the **"Quality Classes – Content Pays"** model, we find that higher qualities facilitate new content. Charging content providers rather than users for the higher

quality levels is likely to maximize the value of the platform, and thereby increases incentives to invest both in infrastructure and content. The model, however, introduces a risk of under-investment into the infrastructure due to a strategic incentive: degrading quality in best effort might hike up the price for higher quality levels. The effect is substantially reduced or even eliminated, though, in an environment with limited market power of individual ISPs in the best effort segment. In so far as the model proves to be problematic, a minimum quality of standard regulation might be required.

Like the business model previously discussed, the **"Quality Classes – User Pays"** model also facilitates new content through higher qualities. However, charging users rather than the content provider for the higher quality levels is likely to lead to lower value and lower incentives to invest for the platform than in the previous business model. The regulatory risk related to foreclosure strategies seems smaller though: the ability of a dominant ISP to favor a vertically-integrated content provider is lower. Both business models, "Quality Classes – Content Pays" and "Quality Classes – User Pays," bear the risk of fragmentation in so far as no common Internet standard emerges.

Should I stay or should I go: Regulatory choices for net neutrality

The implementation of different forms of net neutrality regulation impact the above business models to a different extent:

- The implementation of a **strong form of net neutrality** prevents "Best Effort Plus" and "Quality Classes - Content Pays," but still allows the other two business models. This implies that some benefits of these new business models can be reaped with net neutrality regulation whereas other efficiencies cannot materialize: congestion-based pricing could decrease congestion to some extent and the ability to have differentiation quality classes for end users would open the possibility for higher quality content offerings. However, charging users rather than content providers for the higher quality levels is likely to lead to lower value and lower incentives to invest for the platform than a scenario where the content provider (also) pays. Furthermore, it might still be the case that delay-sensitive content is crowded-out of the network.
- In contrast, the implementation of a **weaker form of net neutrality** would enable the adoption of a business model which prices content providers for higher qualities. The comparison between content pays and user pays scenarios involves the following trade-off: the increased risk of foreclosure in the content pays model must be weighed against inefficiency related to pricing the consumer side.
- Finally, under the "Best Effort Plus" model any **net neutrality regulation could only apply to traditional services** while novel innovative services would not be subjected to these rules. Ultimately, the crucial comparison is between this type of regulation versus a modest, but comprehensive net neutrality regulation. This comparison is, however, very complex and involves the quantification of effects as both models tend to increase the participation of end users and both open the way for content demanding higher quality of service.

As a consequence, in implementing the new EU regulatory framework for electronic communications, policy makers and regulators should carefully consider its impact on business models and the foregone benefits associated with those models in the short and long run. Since it is difficult to predict with any certainty which business models will dominate in the future, economic analysis suggests that authorities

apply a patient “wait and see” approach: closely monitoring market developments and forcefully reacting to any emerging competitive threats rather than acting preemptively and therewith preventing some beneficial business models from developing.

The authors

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About ESMT

ESMT European School of Management and Technology was founded in October 2002 by 25 leading global companies and institutions. The international business school offers Full-time MBA and Executive MBA programs, as well as executive education in the form of open enrollment and customized programs. The School also features in-house research-oriented consulting services. ESMT is a private university based in Berlin, Germany, with an additional location in Schloss Gracht near Cologne.

About ESMT Competition Analysis

ESMT Competition Analysis works on central topics in the field of competition policy and regulation. These include case-related work on European competition matters, for example, merger, antitrust, or state aid cases, economic analysis within regulatory procedures and studies for international organizations on competition policy issues. ESMT Competition Analysis applies rigorous economic thinking with a unique combination of creativity and robustness in order to meet the highest quality standards of international clients. As partner of the international business school ESMT European School of Management and Technology, Competition Analysis works closely together with ESMT professors and professionals on leading-edge research in industrial organization and quantitative methods.

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