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# Network Neutrality Regulation: The Fallacies of Regulatory Market Splits

**Network neutrality regulations for the Internet have been discussed for about a decade. In Europe recent efforts have produced a proposal by the European Commission that envisages the introduction of a two-tiered Internet traffic regulation based on a regulatory market split between the markets for "public" Internet traffic services and the markets for specialised services offering higher and ensured quality of data transmission. We argue that regulatory market splits are artificial and the proposed regulation of markets for Internet traffic services constitutes a regulatory fallacy.**

The debate about network neutrality regulation has broadened considerably over time. While facets such as privacy or freedom of speech have gained increasing momentum, at its core the debate is about how data packets should be transmitted over the Internet. There is a controversy about whether traffic service providers[1] should be obliged by regulation to treat all traffic and thus all data packets equally or whether and to what extent deviations from such principles by means of active traffic management should be allowed.[2] Legally enforcing rules ensuring equal treatment of all data packets is tantamount to prescribing the standard of TCP/IP's passive traffic management. Passive traffic management is performed on a decentralised end-to-end basis by the communicating edges. Traffic service providers would be obliged to accept such traffic management and in general should not intervene – their task is to perform the data transmission process according to their "best effort". The quality of data transmission – i.e. best-effort traffic quality – results endogenously, depending on actual traffic flows and available traffic capacities. A corresponding network neutrality regulation is based on a strict interpretation of network neutrality. In contrast, active traffic management allows traffic service providers to autonomously manage traffic within their networks. Deviating from TCP/IP-based best-effort principles, capacity allocation and differentiation strategies may be implemented. Such practices would, however, conflict with network neutrality regulation.

1 Relying on upstream local and long-distance telecommunications infrastructure as inputs, traffic services are IP-based data transmission services. They can be further divided into Internet access services and Internet backbone services. See G. Knieps, P. Zenhaeusern: The fallacies of network neutrality regulation, in: Competition and Regulation in Network Industries, Vol. 9, No. 2, 2008, pp. 119-134, here p. 122.

2 See M. Schwartz, P.J. Weiser: Introduction to a Special Issue on Network Neutrality, in: Review of Network Economics, Vol. 8, No. 1, 2009, pp. 1-12.

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## The debate in the US

The nature and focus of the network neutrality debate have changed over time. In its beginnings, especially in the US, cases in which traffic service providers had discriminated against competitors' traffic in order to strengthen their own position in the market had given rise to concerns regarding the openness of the Internet.[3]

In the following years, the focus shifted towards an assessment of the reasonableness of active traffic management practices. As early as 2006, a number of legislative proposals had been introduced to Congress. In May 2006, the "Net Neutrality Act" was introduced but eventually defeated. The Act had aimed at prohibiting traffic service providers from introducing price and quality differentiations.[4] In October 2009 the US regulator, the Federal Communications Commission (FCC), addressed the future role of net neutrality regulation by

3 In 2005 the Federal Communications Commission had reached a consent decree with a regional telecommunications provider, Madison River, for blocking voice over IP (VoIP) services by Vonage in order to ensure their revenues from traditional voice telephony services. See Federal Communications Commission: In the Matter of Formal Complaint of Free Press and Public Knowledge against Comcast Corporation for Secretly Degrading Peer-to-Peer Applications, File No. EB-08-IH-1518 (FCC 08-183), Memorandum Opinion and Order, Washington DC, adopted 1 August 2008, p. 22.

4 United States Congress: Network Neutrality Act of 2006, H.R. 5273, 109th Congress, introduced on 2 May 2006 but not enacted.

selecting the regulatory delineation between reasonable and unreasonable traffic management practices as the guiding principle of its regulatory policy.[5] In the same vein, the FCC remarked that the provision of specialised services – alongside traditional Internet access services – could be allowed, given that their provision would not harm the benefits of an open, best-effort Internet.[6] Despite all efforts, at present, there is no regulatory authority explicitly endowed with the competency to determine rules for the organisation of traffic management in the Internet. This is due to the classification of broadband Internet access services as information services exempt from common carriage regulation. In fact, the FCC's efforts regarding a net neutrality regulation based on a case-by-case basis were taken to appeal and eventually defeated.[7]

Against the background of an unclear regulatory authority for the regulation of Internet traffic management, the FCC's latest proposal for regulation from May 2014 must be evaluated critically.[8] While some notions regarding transparency obligations for traffic service providers have been approved by the courts, the FCC claims the authority to assess the type and extent of "reasonable" traffic management in the Internet on a case-by-case basis. In particular, the definition and enforcement of the legal standard of "commercially reasonable" traffic management includes pricing as a further dimension for consideration. Regarding specialised services, the FCC considers them to bear the potential of being both beneficial to users by stimulating network investments and harmful as they might threaten the open nature of the TCP/IP-based best-effort Internet. While the current proposal does not give a precise definition of specialised services, it is recognised that exemptions from Internet rules may give traffic service providers adverse incentives for circumventing Internet rules by labelling Internet application services as specialised services.[9] In the meantime, the debate on the role of the FCC to enforce network neutrality regulation is ongoing, including the plea for a classification of broadband Internet access services as common carriage services under full regulatory competence of the FCC.[10]

## European scepticism about network neutrality regulation

In Europe, there had been scepticism about network neutrality regulation for a long time. The prevalent conviction was that regulation of significant market power in upstream local loops and the application of general competition law and consumer protection laws were sufficient to ensure competitive downstream Internet traffic services markets. So, in most European countries, traffic management is not governed by net neutrality regulation. Exceptions can be found in the Netherlands and in Slovenia.[11] In both countries, Internet access services are regulated in accordance with the principle of strict network neutrality. Paid prioritisation is prohibited, whereas exceptions for "reasonable" active traffic management for reasons of congestion management, spam or security threats are granted. Specialised services are not explicitly addressed.

Legislative proposals have been made in some member states, including Belgium and Germany. In Germany, the Ministry of Economic Affairs issued a proposal for a net neutrality regulation on 31 July 2013.[12] The proposal includes a regulatory market split between best-effort Internet access services and specialised services. To date, the regulation has not been adopted. In its special report on telecommunications of 16 December 2013, the German Monopolies Commission has advised against the introduction of network neutrality regulations, due to fundamental considerations. In particular, the Monopolies Commission opposes regulatory obligations for passive best-effort traffic management, effectively restricting active traffic management. It finds no fundamental reasons against the formation of quality-specific traffic classes and corresponding prioritisation strategies in order to use traffic capacities more efficiently as long as practices are transparent and non-discriminatory. Instead, application of the general competition law is considered sufficient.[13]

5 See Federal Communications Commission: In the matter of preserving the open Internet; Broadband industry practices, Notice of proposed rulemaking, GN Docket No. 09-191, WC Docket No. 07-52, FCC 09-93, Washington DC, adopted 22 October 2009, p. 42.

6 See Federal Communications Commission: In the Matter of Preserving the Open Internet; Broadband industry practices, Report and Order, GN Docket No. 09-191, WC Docket No. 07-52, FCC 10-201, Washington DC, adopted 21 December 2010, pp. 61-62.

7 The case Verizon v. FCC, 740 F.3d 623 (D.C. Cir. 2014) has gained particular importance. It centred around the question whether the FCC as a regulator of public telecommunications networks has the authority to regulate traffic management in the Internet based on the Communications Act. The D.C. Circuit Court denied the FCC the authority.

8 See Federal Communications Commission: In the Matter of Protecting and Promoting the Open Internet, Notice of Proposed Rulemaking, GN Docket No. 14-28, FCC 14-61, Washington DC, released 15 May 2014.

9 See Federal Communications Commission: In the Matter of Protecting …, op. cit., pp. 21ff. and 42-43.

10 See e.g. Federal Communications Commission: FCC Chairman Tom Wheeler's Statement on President Barack Obama's Statement Regarding Open Internet, News Media Information, 10 November 2014; and A. Wilhelm: The FCC fires back at the President's net neutrality plan, 10 November 2014.

11 Non-official translations of relevant legislation documents can be accessed at http://de.scribd.com/doc/144614369/Slovenia-Net-Neutrality-law-2012 [accessed: 31 October 2014] for Slovenia and at https://www.bof.nl/2011/06/27/translations-of-key-dutch-internet-freedom-provisions/ [accessed: 31 October 2014] for the Netherlands.

12 See Federal Ministry for Economic Affairs and Energy: 2. Entwurf einer Netzneutralitätsverordnung nach § 41a Abs. 1 TKG, 31 July 2013.

13 See Monopolkommission: Telekommunikation 2013: Vielfalt auf den Märkten erhalten, Sondergutachten der Monopolkommission gemäß § 121 Abs. 2 TKG, 2013, pp. 10-11, 62-68.

## Towards a regulatory market split in Europe

At the supranational European level, a paradigm shift occurred in September 2013 when the European Commission issued a proposal including a network neutrality regulation.[14] The proposal is still going through the legislative procedure. Approved with some amendments by the European Parliament in its first reading on 3 April 2014, articles 23 and 24 in particular consider the implementation of a net neutrality regulation, which – if approved by the European Council – would be applicable in all member states.[15] The regulation stipulates a two-tiered regulation of traffic services based on a regulatory split between a market for best-effort Internet access services and a market for specialised services. Article 23(2) specifies this regulatory market split, allowing the provision of specialised services endowed with higher and guaranteed levels of traffic quality, as long as general best-effort traffic quality of the public Internet is not impaired "in a recurring or continuous manner".[16] Irrespective of detailed specifications of the network neutrality regulations under debate, the downstream service market for Internet traffic services is intended to fall under the competence of the regulators. Instead of globally prohibiting price and quality differentiations based on active traffic management, two "walled gardens" are created: one for the public Internet and another for specialised services. Beyond strict regulation of traffic management in the "public" Internet obliging traffic service providers to treat all Internet traffic equal, it is to be expected that regulators will closely monitor traffic service providers.[17] Regulators will want to make sure that traditional best-effort traffic quality in the public Internet is not seriously hampered by the provision of specialised services.

## All-IP, specialised services and the need for market-driven quality differentiation

In order to assess traffic service providers' incentives to implement price and quality differentiation strategies, we take a look at the evolution of the Internet. In the course of a convergence process towards all-IP multipurpose traffic architectures, a single market for traffic services is being created. At the same time, the Internet is becoming increasingly heterogeneous, and the provision of differentiated traffic qualities based on active traffic management gains relevance.

### Convergence towards all-IP networks

Within the last two decades, the emergence and evolution of the Internet has spurred a convergence process of the telecommunications, information technology and media sectors. In the course of this convergence process, physically separated single-purpose infrastructures have evolved into multipurpose infrastructures capable of carrying both telecommunications and broadcasting services. Traditionally, communications and broadcasting services were provided over parallel isolated single-purpose infrastructures. Circuit-switched voice telephony was provided over the plain old telephone system (POTS) infrastructure, while cable, radio and satellite networks mainly provided broadcasting services. After the commercialisation of the Internet in the 1990s, packet-switched narrowband Internet access services were provided on an IP basis alongside circuit-switched voice telephony over the POTS infrastructure. Technological progress resulted in broadband Internet access technologies initially complementing and later increasingly replacing narrowband Internet access. Concomitant innovation in application services produced services like VoIP or IPTV, constituting IP-based substitutes for traditional voice telephony and broadcasting services. Those could be provided irrespective of the underlying infrastructure, i.e. on a platform-independent basis.[18] Further advances in access technologies resulted in data rates enabling the simultaneous use of multiple IP-based application services (e.g. voice, video and data). Instead of different networks specialised either in telecommunications, broadcasting or content delivery based on different logistics, convergence towards all-IP multipurpose traffic architectures leads to common logistics based on harmonised standards. A blueprint for all-IP networks and corresponding traffic management has been provided in the context of next generation networks.[19] As a global trend towards all-IP infrastructures is observable, a fundamental challenge inherent to all-IP multipurpose infrastructures gains importance: how can the full functionality of application services requiring heterogeneous traffic qualities be ensured? As heterogeneous traffic qualities become essential, the efficient provision of differentiated traffic services must inevitably be based on active traffic management.

14 See European Commission: Proposal for a Regulation of the European Parliament and of the Council laying down measures concerning the European single market for electronic communications and to achieve a Connected Continent, and amending Directives 2002/20/EC, 2002/21/EC and 2002/22/EC and Regulations (EC) No. 1211/2009 and (EU) No. 531/2012, COM(2013) 627 final, Brussels, 11 September 2013.

15 See European Commission: European Parliament votes to end roaming charges, expand consumer rights and make it easier to create better telecoms, press release, 3 April 2014.

16 European Commission: Proposal for a Regulation … , op. cit., p. 51.

17 For an overview of monitoring practices, see Body of European Regulators for Electronic Communications: Monitoring quality of Internet access services in the context of net neutrality, BoR (14) 117, 25 September 2014.

18 See e.g. G. Knieps: Competition in Telecommunications and Internet Services: A Dynamic Perspective, in: C.E. Barfield, G. Heiduk, P.J.J. Welfens (eds.): Internet, Economic Growth and Globalization – Perspectives on the New Economy in Europe, Japan and the US, Heidelberg 2003, Springer, pp. 217-227. Typically, cable-based broadband providers offer quality-guaranteed VoIP services as substitutes for traditional circuit-switched voice telephony services.

19 See e.g. International Telecommunications Union: ITU-T Recommendation Y.2011: General principles and general reference model for Next Generation Networks, 2004.

### The entrepreneurial search for active traffic management

Best-effort TCP/IP is inherently incapable of reflecting heterogeneous demand for traffic qualities. Instead of providing differentiated traffic services, it provides average traffic quality for all Internet data traffic. In case of congestion, TCP/IP-based best-effort average traffic quality creates discrimination potentials. On the one hand, bandwidth-intensive application services congest traffic capacities while non-bandwidth-intensive application services suffer from the resulting poorer traffic quality. On the other hand, quality-sensitive application services are discriminated against by quality-tolerant application services.[20] The insufficiencies of best-effort TCP/IP were recognised early on, and strategies to increase average traffic quality were soon developed. Traffic service providers may impose user restrictions (e.g. volume caps) or follow over-provisioning strategies, i.e. excessively invest in traffic capacities. Although not violating strict network neutrality, rationing or over-provisioning strategies fail to ensure efficient congestion management. Moreover, tailored traffic qualities cannot be provided.[21] Overlay networks enable the provision of differentiated traffic qualities by circumventing rather than violating strict network neutrality.[22] Against payments, content delivery networks provide "better-than-best-effort" traffic quality by caching content on strategically distributed nodes, thus reducing the distance data packets have to travel to end-users. Moreover, intelligent routing algorithms increase routing efficiency. However, even these strategies for mitigating the insufficiencies of TCP/IP have limited capabilities and cannot ensure tailored provision of interactive real-time VoIP or video teleconferences.

Within converged all-IP Internet architectures, it is only by means of active traffic management that traffic service providers can realise required traffic service differentiation strategies taking into account demand heterogeneity. The growing demand for active traffic management is emphasised by the increasing importance of specialised services. Based on the same capacities as Internet traffic services, specialised services are bundled IP-based services (e.g. IPTV or VoIP) consisting of an application service based on tailored and quality-ensured specialised traffic services provided by means of active traffic management. As specialised services are provided with end-to-end guarantees for traffic quality and hence application functionality, they provide "advanced" substitutes for Internet application services (e.g. proprietary VoIP services vs. Skype). Between underlying traffic services, there is rivalry in consumption for the same traffic capacities. It becomes clear that as a result of the convergence process towards all-IP traffic capacities capable of providing any required traffic qualities, a single relevant market for traffic service provision is created. The market split is artificial. Instead, only the integrated optimisation of traffic capacities can possibly reflect heterogeneous demand for traffic qualities. Hence, a migration towards a market-driven quality differentiation based on unrestricted entrepreneurial search processes for optimal differentiation strategies is inevitable in order to ensure the economically efficient use of traffic capacities.

### Market-driven network neutrality and the Generalized Differentiated Services architecture

Optimal allocations of traffic capacities can be ensured by price and quality differentiation strategies based on the opportunity costs of network usage. Based on active traffic management, the specification of number and quality characteristics of traffic classes are entrepreneurial decision parameters reflecting heterogeneity in demand for traffic quality. While traditional Internet application services such as email are quality-tolerant and require neither high nor stable levels of traffic quality, interactive real-time application services such as video teleconferences are rather sensitive to traffic quality distortions – jitter (i.e. variations in delay) is especially problematic. Other application services like video streaming are sensitive to packet loss, while broadcast video services require low jitter and low packet loss. Application services with similar traffic quality requirements can be grouped into service classes.[23]

An innovative framework enabling the implementation of quality differentiation strategies is the Generalized Differentiated Services (DiffServ) architecture.[24] Taking the Generalized DiffServ architecture as "envelope architecture", it allows for combinations of prioritisation and capacity reservation strategies. The traffic service provider's entrepreneurial task is the choice and implementation of an architectural design for active traffic management. In view of heterogeneous demand for traffic services, the Generalized DiffServ architecture supplies traffic service providers with the tools to optimally solve capacity allocation problems. It allows the provision and control of any required traffic quality, including deterministic guarantees

20 See G. Knieps: Network neutrality and the evolution of the internet, in: International Journal of Management and Network Economics, Vol. 2, No. 1, 2011, pp. 24-38, here pp. 27ff.

21 G. Knieps: Market Driven Network Neutrality and the Fallacies of Internet Traffic Quality Regulation, in: International Telecommunications Policy Review, Vol. 18, No. 3, 2011, pp. 1-22, here p. 11.

22 Overlay networks are networks "on top" of the basic Internet providing additional functionality. For an overview of overlay networks, see D.D. Clark, W. Lehr, S. Bauer, P. Faratin, R. Sami, J. Wroclawski: Overlay Networks and the Future of the Internet, in: Communications & Strategies, Vol. 63, No. 3, 2006, pp. 109-129.

23 See e.g. G. Ash, A. Morton, M. Dolly, P. Tarapore, C. Dvorak, Y. El Mghazli: Y.1541-QOSM: Model for Networks using Y.1541 Quality-of-Service Classes, RFC 5976, 2010, p. 5.

24 For a detailed introduction of the Generalized DiffServ architecture, see G. Knieps: The Evolution of the Generalized Differentiated Services Architecture and the Changing Role of the Internet Engineering Task Force, Paper presented at the 41st Research Conference on Communication, Information and Internet Policy, 27-29 September 2013, George Mason University, Arlington, VA.

(worst-case guarantees for delay, jitter and packet loss rate values are given) and stochastic guarantees (relative guarantees represented by mean, statistical or probabilistic delay, jitter or packet loss). Whereas deterministic guarantees are based on capacity reservation and admission control mechanisms, stochastic guarantees can be realised by prioritisation mechanisms. Hence, traffic service providers have the entrepreneurial flexibility to exploit the potentials of building intelligent multipurpose traffic architectures capable of providing tailored traffic services for a wide range of heterogeneous application services.[25] Interactive real-time application services such as IP-based substitutes for traditional voice telephony particularly benefit from traffic services endowed with deterministic guarantees for traffic quality. As such guarantees are based on the reservation of traffic capacities, corresponding traffic services are more resource-consuming than those with stochastic traffic qualities (e.g. for video streaming) by means of prioritisation mechanisms or no guarantees at all (e.g. email).[26] This translates into a hierarchy of opportunity costs in network usage for different traffic services.

In order to prevent arbitrage and to ensure incentive compatibility, top-down traffic management between traffic classes and the resulting monotony in traffic qualities must be supplemented by a corresponding pricing scheme – only efficient price differentiation can ensure the required quality differentiation. In contrast to strict network neutrality, an economically desirable concept of network neutrality requires the market-driven principle of pricing based on opportunity costs of network usage as the relevant reference point.[27] The implementation of market-driven network neutrality in an all-IP environment necessitates the entrepreneurial design of price and quality differentiation comprising all IP-based data traffic – including specialised services – in such a way that each application service is priced according to the opportunity costs of traffic capacities used. Only then will providers of traffic services act neutrally (i.e. non-discriminatorily) vis-à-vis application services with different capacity requirements – there are no incentives to discriminate against application services causing high opportunity costs. Market-driven network neutrality is the relevant reference point for an economically desirable outcome.[28]

25 See G. Knieps: The Evolution of . . . , op. cit.

26 See e.g. S. Martin, P. Minet, L. George: Deterministic End-to-End Guarantees for Real-Time Applications in a DiffServ-MPLS Domain, in: C.V. Ramamoorthy, R.L. Lee, K.W. Lee (eds.): Software Engineering Research and Applications, Lecture Notes in Computer Science 3026, Berlin et al. 2004, Springer, pp. 51-73, here p. 54.

27 See G. Knieps: Network neutrality and . . . , op. cit., p. 25.

28 See G. Knieps: Network neutrality and . . . , op. cit. and G. Knieps, V. Stocker: Market Driven Network Neutrality and the Fallacy of a Two-Tiered Internet Traffic Regulation, Paper presented at the 42nd Research Conference on Communication, Information and Internet Policy, 12-14 September 2014, George Mason University, Arlington, VA, 2014.

## The fallacies of traffic management regulations

As known from the disaggregated regulatory framework of network economics, the markets for network services are disciplined by active or potential competition. Even in the presence of advantages from bundling and subsequent economies of scale and scope, potential competition can unfold due to the absence of irreversible costs. Competition on downstream markets for network services in general is workable. If there are no alternative broadband access infrastructures available, workable competition on downstream service markets requires the disaggregated regulation of upstream monopolistic bottleneck components in local telecommunications infrastructure. It is essential to discipline network-specific market power at its root in order to prevent traffic service providers from leveraging market power into downstream service markets.[29] The application of general competition law and consumer protection laws should be preferred over the implementation of market power regulation in traffic service markets in the Internet, as the latter constitutes an over-regulation that is not only superfluous but also detrimental.

Regulatory interventions in Internet traffic service markets interfere with entrepreneurial incentives for traffic management and disturb potentials for market-driven solutions. Hence, regulatory market splits naturally conflict with the entrepreneurial freedom to implement market-driven quality differentiations based on active traffic management. There are three forms of regulatory market splits currently discussed in the course of the network neutrality debate: two-tiered Internet traffic regulation, regulation of quality differentiation strategies and regulation of minimum levels of traffic quality.

### Two-tiered Internet traffic regulation

The issue is whether from a regulatory perspective specialised (traffic) services are to be considered “outside” the public Internet and hence exempt from “Internet rules”. Even if active traffic management were only focused on specialised services, the provision of specialised services must by no means be considered isolated outside the public Internet. Rather, both service types are provided based on a common resource pool. Any IP-based data transmission ultimately requires the use of the same traffic capacities, irrespective of which application services they are serving as inputs for. An adequate pricing model taking into account prioritisation as well as capacity reservation strategies is developed in Knieps and Stocker.[30] Based on the opportunity costs of network us-

29 See G. Knieps, P. Zenhaeusern: The fallacies of network . . . , op. cit., here pp. 127ff.

30 G. Knieps, V. Stocker: Market Driven Network . . . , op. cit., here pp. 9ff.

age, the model takes an integrated perspective, reflecting rivalry in consumption for scarce traffic capacities within the entire market for traffic services – a market split into best-effort Internet traffic services and specialised services is neither incentive compatible nor economically efficient.[31]

### Regulation of quality differentiation strategies

By prescribing the number and specification of traffic classes that traffic service providers are allowed to offer, necessary deviations for adjusting quality differentiation strategies to satisfy actual demand are artificially constrained. Entrepreneurial search processes for optimal price and quality differentiation strategies cannot unfold. This is also the case when discussing the case-by-case assessment of the reasonableness of traffic management practices.

The underlying question is whether regulation of traffic services should protect users or providers of Internet application services from the abuse of market power by owners of upstream infrastructure.[32] As competition among Internet traffic (access) service providers is workable, from a regulatory policy perspective this question becomes irrelevant. There are no incentives for discrimination. In view of revenues, traffic service providers are indifferent between providing high-quality traffic services based on which high-quality application services are offered by third-party providers and providing equivalent "bundled" application services themselves. The regulation of quality differentiation strategies is a fallacy.

### Regulation of minimum levels of traffic quality

The regulation of minimum traffic quality is based on the conviction that – supposedly anticipating traffic service providers' incentives to create "dirt roads" for Internet users in order to increase revenues[33] – national regulators should be endowed with the competence to enforce minimum levels of traffic quality that traffic service providers must comply with. Beyond concerns over how to determine relevant parameters, adequate values and the control of these by regulators, such regulation fundamentally conflicts with the entrepreneurial choice of traffic service classes and the implementation of incentive-compatible pricing strategies. As a consequence, demand for low quality traffic services runs up against regulations requiring excessively high minimum traffic quality standards, again increasing average prices. If the objective of regulation is the universal provision of socially desirable quality-sensitive application services, required traffic services should not be based on a regulatory one-size-fits-all minimum traffic quality regulation. Rather, required traffic quality can be provided by premium traffic services based on active traffic management, which should evolve from entrepreneurial search processes and could be subsidised.[34]

## Conclusion

While Internet traffic services should be generally unregulated – as with any other service markets, general competition law and consumer protection laws should be applied – the European Commission's proposal stipulates a network neutrality regulation restricting active traffic management via economically desirable price and quality differentiation strategies. From a regulatory policy perspective, such regulation of traffic services not only contradicts the fundamental principle of liberalised service markets, it also constitutes an over-regulation significantly restricting entrepreneurial search processes for innovative price and quality differentiation strategies by the providers of Internet traffic services. Instead, the task of the regulator should be exclusively restricted to the regulation of upstream local telecommunications infrastructure as long as there are no alternative network infrastructures available.

The general result for all three forms of market splits considered in this article is that the regulation of traffic service markets unduly restricts entrepreneurial search processes and hence constitutes a regulatory fallacy. The regulatory market split in best-effort traffic services in the public Internet and quality-ensured specialised services as proposed by the European Commission is artificial and hampers entrepreneurial search processes for innovative architectures, thus preventing the efficient provision of tailored traffic services reflecting heterogeneous demand for traffic qualities.

From a network economic perspective, only a price and quality differentiation strategy based on the opportunity costs of traffic capacity usage can be stable. By means of prioritisation and resource reservation, specific levels of traffic quality can be guaranteed on a deterministic or stochastic basis. Taking this into account, market-driven price and quality differentiation strategies can be developed.

31 See G. Knieps: The Evolution of..., op. cit., here pp. 18ff.

32 See e.g. N. Economides: "Net Neutrality", Non-Discrimination and Digital Distribution of Content Through the Internet, in: I/S: A Journal of Law and Policy for the Information Society, Vol. 4, No. 2, 2008, pp. 209-233, here p. 210.

33 For a critical assessment of the dirt road argumentation, see e.g. J.G. Sidak, D. Teece: Innovation Spillovers and the "Dirt Road" Fallacy: The Intellectual Bankruptcy of Banning Optional Transactions for Enhanced Delivery over the Internet, in: Journal of Competition Law & Economics, Vol. 6, No. 3, 2010, pp. 521-594, here pp. 566ff.

34 See G. Knieps: Market Driven Network..., op. cit., here pp. 17ff.