Launch the European Initiative for Excellence

The Expert Commission sees a need for institutionalised, long-term co-operation between excellent European higher education institutions.[226] In some Member States, such as France, the UK, Denmark, Austria and Germany, national initiatives for excellence are already underway, with the aim of providing selective support to researching institutions and alliances between such institutions. The key criterion for such support is scientific excellence.[227] The Expert Commission proposes that a European Initiative for Excellence be initiated, a mechanism whereby small groups of leading European higher education institutions would form networks and receive institutional support via the EU.[228] Support should provide considerable funding, for sufficient duration to permit the establishments of lastingly stable co-operation relationships. As within the French initiative for excellence, funded institutions should receive an endowment that will yield interest that can be used to finance research and co-operation projects. Supported higher education institutions should have full authority over relevant funding allocations, and they should be permitted to co-ordinate their own research and teaching themselves, outside of any central administration for the effort. By properly co-ordinating curricula, such networks would be able to achieve high mobility potential, from the bachelor's degree level up.

An initiative for excellence at the European level would offer a number of advantages at once. It could help strengthen excellent, co-operative organised basic research in a lasting way, by providing the stable structures and long-term investments that are essentially important for open-ended, pioneering research. Furthermore, it would expand institutionalised EU-wide research co-operation. The networking involved could also help fulfil the aims of the Bologna Process and help reinforce what has been achieved thus far in that process. Before such a far-reaching measure can be planned and introduced, it must be discussed intensively throughout Europe, however. The results of the national initiatives for excellence should enter into such discussion. The European Commission should initiate the necessary discussion process by providing an overarching presentation of the experience gained to date with the national initiatives for excellence.

Strengthen Germany's role in European R&I policy

The era in which R&I policy in Europe was solely national in scope has been over for some time now. The aim of European R&I policy must be to establish Europe, via intensified co-ordination and co-operation, as one of the world's leading knowledge economies. In light of prevailing national interests, and because R&D measures at the European level tend to be inefficiently designed and bureaucratically structured[229], that will be no easy task.

Over the past ten years, the Federal Republic of Germany has recognised this challenge and, on various occasions, has taken an active role in European co-ordination processes. The Expert Commission expressly welcomes such participation. Such efforts need to be further intensified. In today's increasing international competition, Germany will have no chance of success with a nationally oriented R&I policy. It lacks the resources that such a national orientation would call for. Strengthening and developing the European dimension of R&I policy is a matter of Germany's own vital interests, and it is in the interest of other European countries for Germany to take a strong, active role in shaping such policy at the European level. With the experience it has gained with the High-Tech Strategy, the Initiative for Excellence and other political processes, the German policy sector can bring much constructive impetus to the European policy process. At the same time, it must not be afraid to continue learning. Germany can profit from other countries' experience with certain political instruments and strategies.[230] Significantly, in all likelihood, a leading role in shaping of European R&I policy will go hand-in-hand with the loss of some national decision-making authority.

NETWORK NEUTRALITY AND INNOVATION B 3

For years, intensive discussion has been underway in the U.S. regarding the pros and cons of network neutrality, i.e. the issue of whether users or network providers are to decide how the Internet is to be used. This discussion also extends to the issue of whether, or under what circumstances, network providers should be able to block, delay or prioritise certain

content and applications. Yet another aspect has to do with whom network providers should be allowed to impose fees on for access to end customers.[231] The European Union,[232] the Federal Government[233] and the German *Bundestag*[234] have now also begun considering this issue.

BOX 03

Economic importance of the Internet

Internet economy

The spread of the Internet has led to the development of a great number of different services and applications. In 2008, revenue in the German Internet sector amounted to EUR 46 billion, so the Association of the German Internet Industry (eco) and Arthur D. Little GmbH. Of that amount, EUR 23 billion were generated in eCommerce, and EUR 17 billion were generated in the area of network infrastructure and operation.[235]

Internet use

In 2009, a total of 89 percent of all German companies with ten or more employees were using broadband access to the Internet.[236] In that same year, a total of 64.6 percent of all German households had broadband Internet access.[237] With those figures, Germany still only held a middle position, in the categories "Internet use by companies" and "Internet use by households", in a comparison of OECD countries.

BOX 04

Key actors in the Internet sector[239]

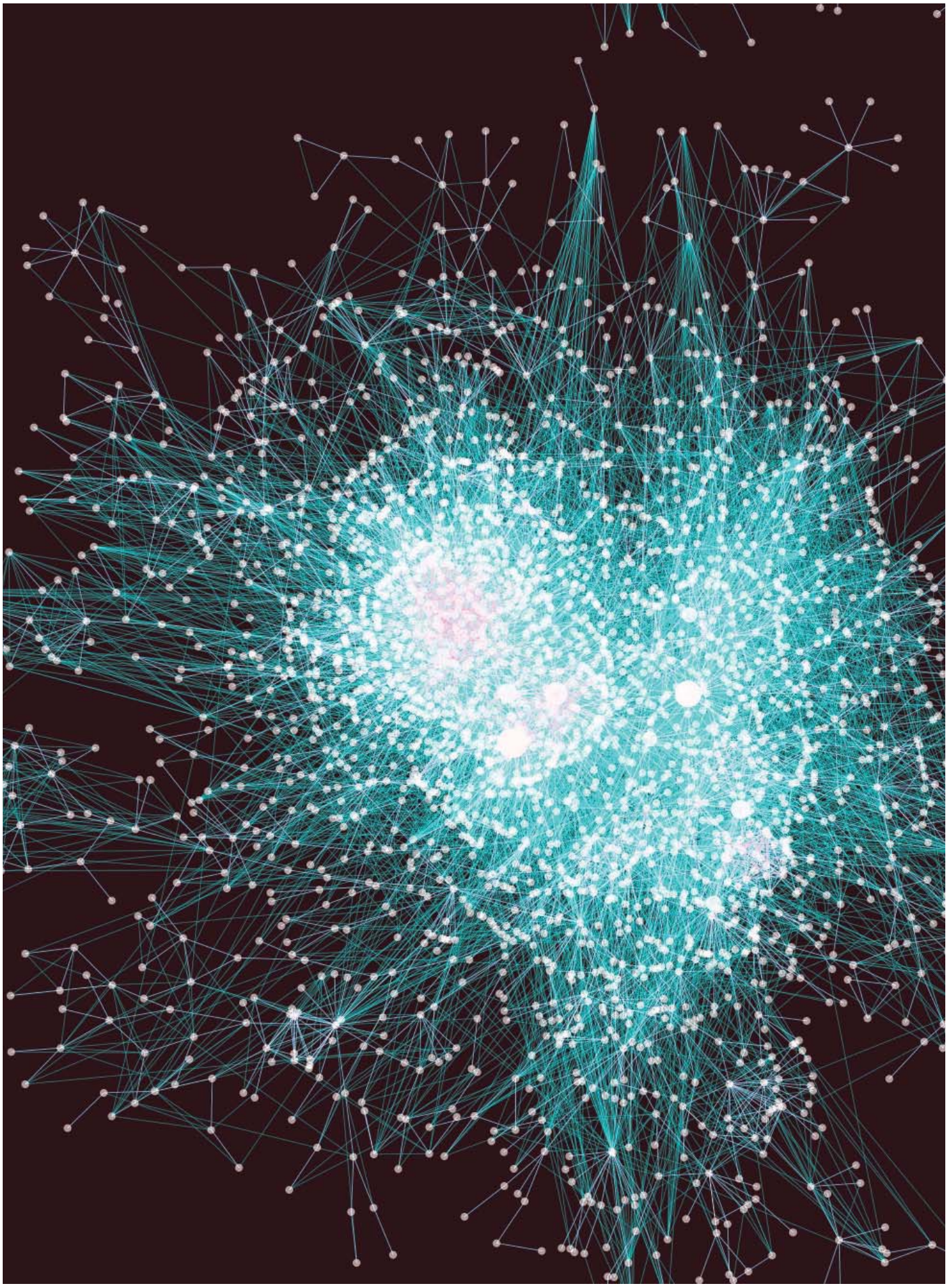
- Commercial providers of information – such as WetterOnline or Reuters – provide both newly created content and edited/processed content in the Internet.
- Private Internet users also contribute significantly to information production and dissemination in the network.
- Virtually all companies, government authorities, non-profit organisations, non-governmental organisations, etc. now have Internet presences via which they offer information, services and transactions.
- Intermediaries combine Internet content and make it available to users. That group includes companies such as Immobilienscout24, studiVZ and XING.
- Internet dealers, Internet-application providers and Internet-services providers, such as Spreadshirt, Pay Pal and Zanox, offer products and services, in the Internet, for companies and households.
- Hosting and domain providers, such as STRATO, United Internet, Host Europe and Denic, make it possible for companies and private persons to take part in the Internet economy.
- Network providers, such as Deutsche Telekom, NetCologne, 1&1 and DE-CIX, offer stationary and mobile access via transmission pathways and access points that they provide.

In light of the Internet's economic significance (cf. Box 03), so the Expert Commission, the question arises as to what impacts regulation or non-regulation of network neutrality would have on the emergence and success of innovation in the Internet.[238] In consideration of such impacts, the interests of the various actors involved (cf. Box 04) must be taken into account.

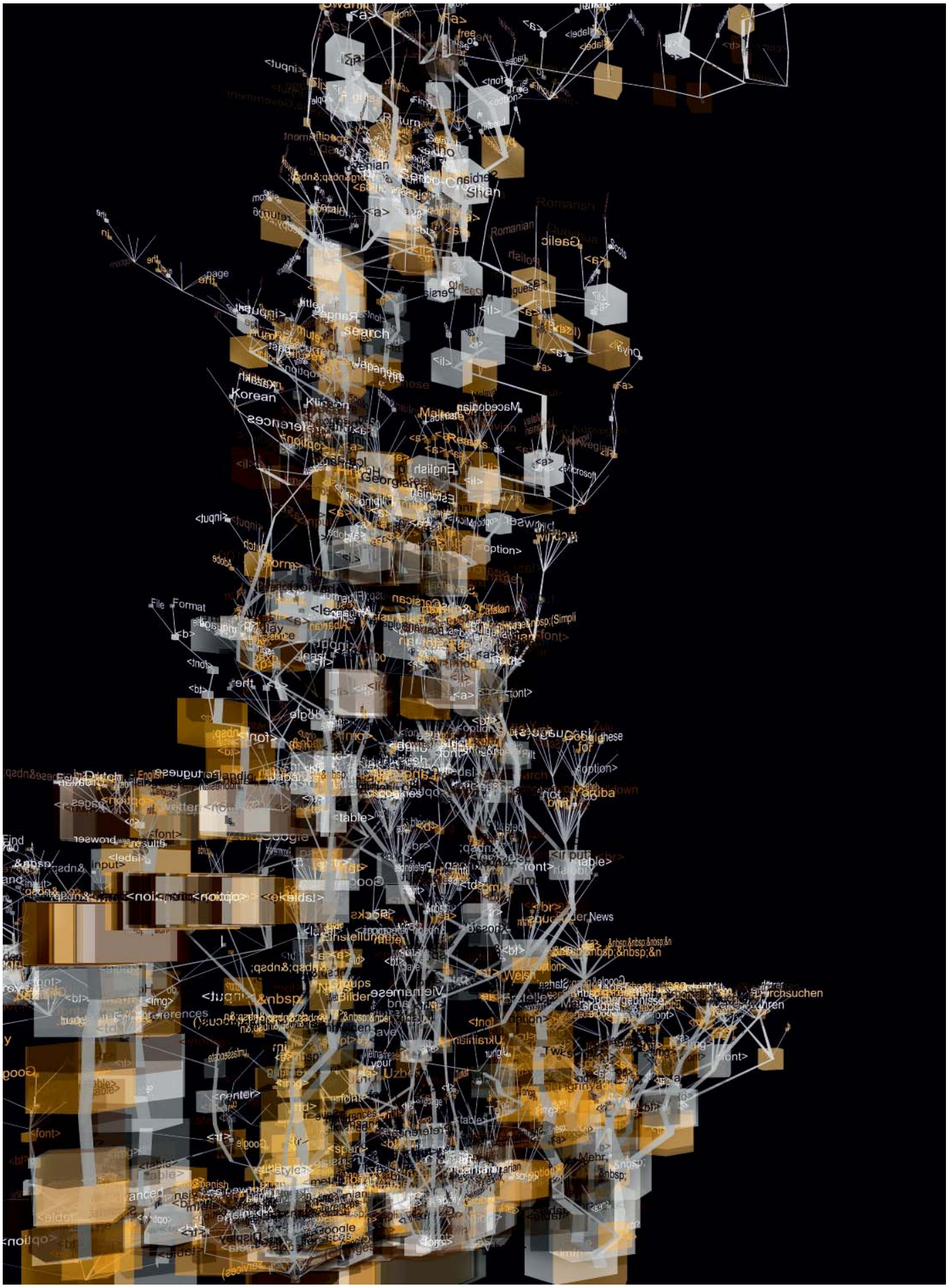
Background to the debate on network neutrality

The net-neutrality debate has developed in light of three main factors.

- In the original architecture of the Internet, network providers were unable to differentiate between the applications, services and content that moved through their network pathways (the network was "application-blind"). That made it impossible for network providers to differentiate between data packets on the basis of services and applications.[240] Now, however, technology has emerged that makes it possible to analyse transmitted data packages in real time. In such analysis, it is possible to determine what sort of application a data packet belongs to (Internet telephony, e-mail, Web-search engine, peer-to-peer network, etc.). As a result, it is now possible for network providers to impose rules defining how different types of data packets are to be handled. Transmission of data packets can then be prioritised, delayed or even blocked on the basis of data packets' origin or application classification.
- The amounts of data being transmitted have increased considerably over the past few years.[241] On the one hand, the number of Internet users has grown.[242] On the other, use of motion pictures,



Computer-generated map of relationships between Weblogs



Visualisation of a source text
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which are bandwidth-intensive, has also been growing. What is more, data-intensive applications such as cloud computing, software as a service (SaaS) and the "Internet of things" are going to grow in importance (cf. Box 05). Such growth in bandwidth-intensive applications and services can lead to bottlenecks, unless investments in network infrastructure are being carried out at the same time. In data transport, the transit time required for transmission of data packets can increase and vary.

– Increasingly, formerly separate telephone, cable TV and mobile-communications networks are being integrated and replaced with networks using the Internet protocol. Network providers can respond to this trend by adding to their services and emphasising vertical integration. As a result, vertically integrated network providers are increasingly competing with independent content providers.

As capacity shortages – either real or supposed – emerge, network providers can have incentives to block or slow certain applications, or certain classes of applications, as a way of managing network bandwidth.[243] In addition, network providers have made it clear that they wish to impose fees on application providers, for access to end customers, in order to be able to share in the profits of successful application providers (such as Google). Such fees could be imposed on application providers, for normal access to end customers, or could be tied to a special service, of the network provider, that gives preferential treatment to the applications in question. For example, paying application providers could receive better transmission quality, or the data packets making up a relevant application would not count toward end customers' monthly volume limits for Internet use. Furthermore, network providers will seek to improve their positions in the access market and the application market. Whether the vertical integration that entails will create incentives to block, delay or prioritise applications, for reasons of market strategy, is currently being debated.

Incentives to block and delay

Network providers can exclude, from their own networks, content that – such as viruses and spam – can be damaging for end customers or can overload the network. Because this is not considered problematic from an overall economic perspective, it is not discussed in detail here.[248] Most proposals relative to network neutrality call for allowing exceptions to net-neutrality rules in such cases.[249] Blocking becomes problematic when vertically integrated network providers use it to exclude applications for reasons of market strategy.[250]

A vertically integrated network provider who blocks applications that compete with his own applications can be doing so simply as a way of increasing demand for his own applications. In the case of pay services, such blocking can thus directly increase profits.[251] In many cases, significant portions of the income earned in the applications market are earned via presentation of third-party advertising. In such arrangements, the provider's incentive to exclude competing applications is the possibility of thereby increasing his own advertising income. Blocking can

Cloud computing, software as a service and the Internet of things BOX 05

In cloud computing, IT services (such as database services) are used in real time, via data networks. A study carried out under commission to BITKOM, the Federal Association for Information Technology, Telecommunications and New Media, predicts that revenue from cloud computing will grow from EUR 1.1 billion in 2010 to EUR 8.2 billion in 2015. In addition, half of that revenue will be earned via cloud services, especially via provision of programmes (software as a service).[244]

Software as a service (SaaS) is an alternative to conventional forms of software licensing.[245] In SaaS, customers download software from the Internet and then pay rent or a leasing fee to use it. Operation of the relevant IT systems (installation, maintenance, updating and data back-up) is the responsibility of the provider.

The Internet of things can integrate virtually any type of physical objects within its infrastructure (i.e. not only computers and mobile terminal devices), thereby allowing them to be providers or consumers of various digital services. To be so integrated, objects must be equipped with suitable sensors (such as radio-frequency identification tags).[246] Uses of the Internet of things include control of logistics processes and creation of assistance systems for senior citizens.[247]

also have the purpose of excluding applications of independent providers that compete with one's own applications in third-party markets.[252]

The benefits that vertically integrated network providers can gain by excluding competing applications can be offset by losses of market share in the Internet-access market. The key factor in this regard is the number of customers who switch to a different access provider as a result of the blocking.[253] And that, in turn, depends on customers' willingness to pay for the blocked content, as well as on the degree to which the costs of switching providers influence customers' behaviour. In each case, the factors influencing the costs of switching providers include the period for which the customer is bound by agreement to his access provider; whether the service in question includes a package of different telecommunications services; and whether the customer is able to retain his or her e-mail adress when he or she switches providers. Customers often greatly overestimate the costs of switching providers and thus are even less willing to make such switches.[254] The perceived costs of switching providers must be assumed to play an important role – especially in the short term.

"Delaying" involves intentional slowing of the transport of certain types of data packets. Delaying can be used as a way of restricting use of data-intensive applications (such as peer-to-peer applications), in order to prevent overloading of the network infrastructure.[255] In addition, delaying can be used for the same reasons of market strategy that are used to justify blocking. While delaying, when in force, is less apparent to customers than is exclusion of applications, it can greatly impair applications' functionality – and, thus, their attractiveness. Since speed is an important competitive factor, affected applications can be subject to considerable losses of customer demand by comparison to the situation without delaying. Services such as Internet telephony and online games are highly time-critical. For customers, therefore, delays can render services less attractive or even completely useless. When customers are not aware that services are being delayed intentionally, they may fail to see a need to switch providers. They may think that their independent application providers – the providers whose data packets are being delayed in transport – are responsible for the poor services quality they are seeing. As a result, one would expect that network providers' revenue would suffer less from use of delaying tactics than it would from use of blocking.

Prioritisation and quality of service

"Prioritisation" means giving selected data packets preferential treatment over other data. For example, prioritisation might be applied to data packets from certain users, from certain application providers or of certain application types (such as Internet telephony or Internet TV). A closely related term is the so-called quality of service (QoS), which refers to a defined measure of performance. Network providers can offer different QoS levels for different types of data.

When data-transmission volumes near the available capacity limits, certain types of QoS frameworks can enhance efficiency. The many different types of applications offered/used in the Internet differ in their sensitivity to delays, jitter and data-packet losses. For example, Web-search and e-mail services are less sensitive to delays than are Internet telephony, online games and Internet TV. Different QoS levels can also make sense in that not all users of a given application attach the same importance to (optimal) data transport for the application.

Quality of Service (QoS) BOX 06

The term Quality of Service refers to a defined performance level, provided via various procedures for influencing data streams in the network. A service / application with a given QoS has to reach its recipient with the corresponding quality intact.

For example, quality can be defined in terms of the delays that data packets experience before they reach their intended recipients, in terms of jitter and in terms of maximum levels of packet losses. Quality of Service can be achieved via a range of different techniques. Quality of Service architectures, for example, differ in terms of whether users or network providers assign QoS to applications or data packets, and of whether the pertinent quality criteria are defined relatively or absolutely (relatively: for example, in terms of less delay than would be experienced if all data packets were treated the same way; absolutely: for example, in terms of maximum delay allowed).

In overload situations, treatment of all data packets in exactly the same way can generate inefficiencies, as a result of differences in applications' quality sensitivity and in users' own preferences. During temporary capacity shortages, e-mails, whose technical quality does not suffer at all from short delays, may be transported prior to data packets for an Internet-telephony application, for example. Such preference would make the telephony application less attractive for users. It is possible that services that react sensitively to delays, jitter or packet losses could be forced out of the market.[257]

Although provision of different QoS levels is basically a way of enhancing data-transport efficiency in the network, it can have undesired economic effects.[258] A vertically integrated network provider could have an incentive to slow an existing service, or to cause an overload intentionally, in order to convince more customers to opt for an expensive QoS level. A vertically integrated network provider might also treat different application providers in different ways. For example, for certain types of applications he might give preferential treatment only to his own content. In addition, a provider could auction off QoS services to the highest bidders, with a view to weakening the market position of competing providers. The results of such tactics would be similar to those of blocking and delaying. QoS architectures in which the network provider determines what applications receive what services quality normally fit users' preferences less well than architectures in which that determination is left up to users themselves.[259] For innovators, the first of the two types of architectures presents additional hindrances: before a new application can receive the QoS it requires, the application provider might have to convince a range of network providers that the application indeed does require the pertinent QoS level. In comparison to architectures in which users decide on QoS, such QoS architectures make it less likely for new applications to receive the QoS they actually require.[260]

Use of QoS levels can have both positive and negative impacts. It is thus not possible to generalise about Quality of Service architectures. From an economic perspective, QoS architectures have to be assessed in a differentiated way, taking account of their specific characteristics.[261]

Innovation-related aspects of the net-neutrality debate

The Internet is considered to be one of the most dynamic and innovative "places" in the globalised economy. Protecting its dynamic and innovative aspects should be a central goal of all regulatory efforts in the area of information and communications technology.

Four central characteristics that the Internet has retained to the present day are cited as the reasons for the great diversity of innovation seen in the network:[262]

- Innovators' freedom of choice: potential innovators themselves decide what applications they want to develop. They require no support or permission from network providers in order to implement their ideas for new applications.
- Users' freedom of choice: Internet users themselves decide, without the involvement of network providers, what applications they want to use.
- Application-"blindness" (the network infrastructure treats all applications in the same way): The network's application-blindness prevents network providers from influencing users' and innovators' decisions, from distorting competition between applications, services and content and from imposing access fees that skim off shares of, and thus reduce, relevant providers' profits.
- Low costs for innovation and access: the low costs entailed in development of innovative applications, and the low costs of access to users, make it possible to offer an enormous range of different applications. What is more, the low costs involved tend to increase the number and diversity of potential innovators.

It is precisely these characteristics that are acutely at risk, when network providers are permitted, without restriction, to block applications, services and content, to treat different applications, services and content in different ways and to impose access fees for applications. If content providers, for example, before providing their applications to users, first had to consult with their network providers and negotiate pertinent prices with them, two central strengths of the Internet would be lost: a) the possibility of creating innovations without having to make major investments, and b) the freedom to

TAB 04 **Open Internet and non-open Internet: a comparison of their characteristics and of the resulting risks for innovation in the network**

Open Internet (Application-blind, no blocking, no access restrictions)	**Non-open Internet** (Decisions regarding discrimination, blocking and accesses are made by access providers and network operators)
Innovations in network infrastructure	
The commercial importance of the infrastructure is smaller than the commercial importance of applications. Developments to date indicate that such a framework still provides incentives for innovation in network infrastructure.	The commercial importance of the network infrastructure grows. Investments and innovation activities can intensify. (Prerequisite: network providers have to be competing)
Innovations in the area of applications	
High potential for innovation, since the barriers to market entry by small, independent providers are low. Many Internet participants are able to implement and apply creative ideas.	Low potential for innovation, since the barriers to market entry by small, independent providers are high. Many Internet participants refrain from implementing their ideas. Network providers' own innovation is unable to compensate for the small number of innovators involved. Innovation-hindering impacts can be mitigated somewhat by having end users, rather than providers, bear the costs of data transport.
Costs for applications	
Strong competition between application providers causes prices to fall. The fees for data transport are low, for both application providers and users.	Low competition between application providers causes prices to rise. Data-transport fees increase prices further still.
Chances of success for small, independent providers	
Low barriers to market entry: the chances of success for small, independent providers increase.	High costs, along with dependence on network providers, reduce the chances of success for small, independent providers. Higher risks make it difficult to raise capital.

Source: Dauchert and Meurer (2011).

bring new applications to the market without first having to obtain permission. The neutral infrastructure has proven to be an excellent field for experimentation with new ideas.[263]

Widespread introduction of discriminatory price differentiation, and of access fees, along with establishment of market alliances between network providers and market-dominant application providers, would place the network's openness at risk. Such actions would also mean the end of the age of simple market entry. All in all, the overall climate for digital innovations would worsen, since the following negative effects could be expected to occur:

– In the long term, incentives for network providers to invest in new networks, or to expand existing ones, could diminish.[264] After all, when bandwidth, a limited "resource", grows scarce, then higher prices can be commanded for it.[265]
– Introduction of access fees for providers of Internet applications would lead to higher costs, since providers would then have to pay more to place their services in the network. What is more, such access fees would presumably be high, because network providers would have sole, unsupervised control of access to end customers.[266]
– The entrepreneurial risks for start-ups in the application sector would increase, and thus the costs

for start-ups would increase as well. Finally, along with the usual entrepreneurial risks, application providers would incur the risk of network providers' delaying their new applications in transit (i.e. delaying them in comparison to transport of other products), thereby rendering the applications unattractive for potential users. Independent application providers would find it increasingly difficult to obtain affordable loans.[267]

In the past, successful applications, such as e-mail, the World Wide Web, search engines and social networks, have mainly been developed by independent companies and by individual persons. Established telecommunications companies, on the other hand, have not played a key role as innovators.[268] In the interest of the Internet's innovative power, it is important to ensure that small, independent companies have non-discriminatory access to the Internet.

While there are many well-documented examples of the innovative power of the open, accessible and non-discriminatory Internet, some analysts have seen those same characteristics as hindrances for innovation and, especially, as a threat to long-term investments in the network's infrastructure.

Such critics begin from the assumption that access fees, along with blocking and discriminatory treatment of applications, increase profits of network providers.[269] With such additional profits, so the critics, network providers not only would move forward innovation in the area of network infrastructure, they would also intensify their own innovation activities in the area of applications.[270] Finally, so the critics, if network providers were allowed a free hand in prioritisation of, and differential pricing for, data streams, they would have considerably higher incentives to develop services of their own than they now have.[271] All in all, so this perspective, the end of the open Internet would terminate persisting neglect of the network infrastructure. In addition, it would spur innovation in the areas of applications and infrastructure, thereby enhancing the Internet's economic benefits.[272] Whether the innovation expected from the small group of network providers could surpass the innovation achieved by millions of Internet users, must be doubted.[273] And there are good reasons to assume that network providers' incentives to privatise their additional profits would generally be greater than their incentives to reinvest such profits in upgrading the network's infrastructure.[274] What is more, there is virtually no empirical evidence that an open Internet promotes innovations only in the area of applications, while allowing the network infrastructure to be neglected. The extensive technological progress made in the infrastructure sector over the past few years clearly tells a different story.[275]

In light of the aforementioned risks of access fees and network-provider intervention in data traffic, strategies need to be formulated for balancing the efficiency-enhancing effects of QoS with the need to protect the network's innovative power. QoS architectures need to be developed in which users decide, in keeping with their own preferences, what applications are to receive what quality of service.[276] Such user-defined architectures would free innovators from having to negotiate QoS agreements with network providers, before bringing applications to market. The principle of "innovation without permission" would remain intact. In general, three rules can be formulated regarding what is needed to make QoS innovation-friendly:[277]

- Network providers must offer various qualities of service, on a non-discriminatory basis.
- Users, and not network providers, must be able to decide what applications receive what qualities of service.
- Network providers must not be able to charge individual application providers for prioritised transport of their services; instead, they should only be able to charge users, in accordance with a sliding scale, for receipt of particular qualities of service.

If enforced, such rules would protect application providers against discrimination and would preserve the low financial threshold for entry into the Internet market. A segmented Internet, on the other hand, in which companies have to pay entry fees – in the form of fees for QoS – would greatly reduce the network's innovative power, since small, innovative companies – unlike well-established major companies – often lack the financial resources needed for implementing prioritised data transport for their products.[278] If the Internet were not open, a sector newcomer such as Amazon would probably have been unable to survive in competition with the established bookseller Barnes&Noble, Microsoft Search could well have forced Google to shut down and Skype would not have achieved its current popularity.[279]

The EU's new legal framework for electronic communications: impacts on Germany

In Europe, responsibility for regulating electronic communications lies primarily with the European Commission. And the Commission has been relatively late in considering the issue of threats to network neutrality, while in the U.S. policymakers, industry and the public have been discussing it for nearly ten years. What is more, it soon became apparent that the European Commission considers interventions in network neutrality, and prioritisation of services, to be "generally advantageous" for the market,[280] at least as long as users have the possibility of choosing among different providers. With its amended directives on electronic communications – known as the Telcoms Package (*Telekompaket*) – the EU confirmed that view.[281] For example, in its new legal framework the EU has refrained from formally enshrining network neutrality as a basic principle, and has failed to define binding minimum standards for Internet services.[282] Instead, the European Commission has been emphasising transparency. In future, so the Commission, the Member States must ensure that users are regularly informed, both before and after signing relevant agreements, when providers restrict their (users') access to legal content. Those information obligations apply even in cases in which users promulgate content themseves or use legal applications. What is more, network providers can be required to publish current and suitable information, in a form supporting relevant comparisons, regarding the quality of their services.[283] In addition, national regulatory authorities – such as Germany's Federal Network Agency (*Bundesnetzagentur*, BNetzA) – have been authorised to establish, in consultation with the Commission, minimum requirements for the quality of provided services.[284]

German lawmakers have until May 2011 to transpose the Telcoms Package into national law. With its draft, presented at the beginning of October 2010, of an act for amendment of telecommunications-law regulations (draft of an amended version of the Telecommunications Act (*Telekommunikationsgesetz*, TKG)), the Federal Government has taken a first major step in transposing the Telcoms Package. In its justifications for the draft, the Federal Government specified network neutrality as a political aim of the act.[285] Since a definition of network neutrality is still lacking, and since the term is not used in the rest of the relevant text, that specification is not particularly meaningful. In addition, the TKG draft does not state how network neutrality is to be protected. The TKG draft simply adopts the information obligations for network providers, as defined in the relevant EU directives, and complements them with regulations designed to make it easier for users to switch between Internet providers.[286] Furthermore, the TKG draft gives the Federal Network Agency the option of defining minimum standards for quality of service, with a view to preventing the worsening of services and applications quality that could occur via blocking or slowing of data traffic. The TKG draft does not precisely describe such standards, nor does it provide a legal definition of the term quality of service.[287] What is more, network providers are still allowed to block their customers' access to certain applications. When such blocking is carried out, users simply have to be informed about the relevant restrictions (see above).[288]

All in all, analysis of the TKG draft shows that German lawmakers have simply adopted the provisions of the EU's Telcom Package.[289] And it does not seem likely at present that German lawmakers will move beyond the EU's requirements. Consequently, the Expert Commission maintains that network neutrality, and the Internet's innovative power, are acutely at risk.

Threats to an open Internet, in spite of competition and transparency

The Expert Commission doubts that applicable legal regulations, which are based solely on the ideal of transparency, will suffice to resolve the problems relating to network management. And that doubt weighs all the more heavily in that no special rights of termination are in place with which users could respond to direct intervention by network providers' in their data traffic. The situation is made all the more threatening in that it is virtually impossible, in practice, to prove that quality has been reduced. While the Federal Network Agency (BNetzA) can require network providers to provide information about their own network management, it remains to be seen how those information obligations will be applied.[290]

To be effective, transparency requirements have to be supported by a controlling body that monitors and en-

forces compliance, and they have to be applied in the presence of functioning competition. Unless independent network providers are able to offer alternatives, transparency requirements are ineffective. In particular, there is a danger that the TKG draft's transparency provisions would prove useless in the rapidly growing mobile-Internet market. While there are still several independent network providers in the stationary-services market, Germany's mobile-Internet market is now dominated by only three companies.[291] In addition, the following problems can hinder competition even when there are a number of different providers:

- When all providers block a given application, switching providers provides no escape from blocking.[292]
- Users have little chance of determining why their applications are functioning poorly. If they are unaware that their network provider is behind the problem, then they have no incentive to switch providers.[293]
- The costs of switching reduce the disciplining effects of competition (cf. "Incentives to block or delay"). The trend toward package plans – such as plans combining TV, telephone and Internet services from a single source – can make the idea of switching providers even less attractive.[294]
- A provider's incentives to resolve capacity problems via discriminatory network management grow as the competitive pressures that the provider faces increase. In the UK and Canada, for example, discriminatory network management has already become standard practice.[295]
- The problems arising via imposition of access fees on application providers are also not eliminated via competition.[296]

To create innovation-friendly, economically useful regulations, one must implement measures that move beyond simple transparency requirements.[297] Effective relevant measures would include a prohibition on discrimination, such as that sought by the Federal Communications Commission (FCC), the U.S. regulatory authority (cf. Box 07), and would establish minimum standards for Internet services.

BOX 07

The situation in the U.S.

The national regulatory authority for the U.S., the Federal Communications Commission (FCC), has been working for years to protect network neutrality. In 2005, it formulated four principles that, inter alia, entitle Internet users to use all legal applications and services and to download all legal content.[298] In August 2008, after Comcast, the largest cable-network provider and Internet-access provider in the U.S., had blocked and slowed peer-to-peer applications such as BitTorrent, the FCC, referring to those principles, ordered Comcast to terminate those bandwidth-management practices.[299] During his presidential campaign, Barack Obama declared that, if he were elected, his administration would issue formal net-neutrality regulations. In early 2009, after the new administration had taken office, that aim was achieved, initially, in the framework of state promotion of broadband systems. Network providers who receive state funding from the economic-stimulus package must comply with net-neutrality regulations.[300] In fall 2009, the FCC launched an Open Internet process, aimed at issuing formal net-neutrality regulations. The FCC's emphatic support for network neutrality has mobilised influential opponents who claim the FCC is overstepping the bounds of its legal authority.[301] In December 2010, then, the FCC issued formal net-neutrality regulations.[302] Pursuant to those regulations, the following provisions apply to providers of fixed-line and stationary wireless broadband Internet-access services:

- Prohibition against blocking: Blocking of legal Internet applications, services and content is prohibited.
- Prohibition against discrimination: Providers may not discriminate in unreasonable ways. The meaning of unreasonable is decided on a case-by-case basis.[303]
- Reasonable network management: The rules against blocking and discriminating do not apply to reasonable network management. To fall within this exception, a relevant affected measure must have a legitimate network-management aim, such as protection of network security or supporting of broadband management.[304]
- Transparency: Providers must provide accurate information about their network-management practices, about the performance characteristics of their broadband Internet-access services and about the agreement terms for their broadband Internet-access services.[305]

BOX 08

The situation in Canada

The situation in Canada is interesting for Germany because Canada's market structure is very similar to that of Germany: it has an unbundled telephone network, many independent Internet providers and strong cable-network providers.[306]

In one case, Canada's regulatory authority, the Canadian Radio-Television and Telecommunications Commission (CRTC), studied Canadian providers' network-management practices in detail. In October 2009, in its final decision in that action, it issued detailed rules for network management.[307] From the perspective of the CRTC, network providers should seek to solve the problem of network overload primarily by investing in additional network capacities. Economic measures, such as changes in price structures, would be the next option, so the CRTC. On the other hand, so the CRTC, certain network-management measures could become necessary in responding to temporary network problems, or to changing conditions in the network, or as a way of making provision of innovative services possible.[308] Economic and technical network-management practices of access providers and vertically integrated network providers must conform to the following conditions:[309]

– Network-management practices in support of broadband management must affect all applications, services and content equally. Where a problem cannot be solved without discrimination or preferential treatment, not only must the measure fulfill the declared goal, the discrimination or preferential treatment caused by the selected measure, and the resulting damages for users and access providers, must be kept to a minimum.[310]
– Use of network-management practices that result in blocking of applications, services or content, and use of measures that noticeably delay real-time applications, are subject to the prior consent of the regulatory authority, the CRTC.[311]
– Providers must inform their customers in detail about the network-management techniques they use. They must explain what measures they use, and when; what types of Internet traffic are affected by the network management; and how relevant measures will affect user experience, especially with regard to data-transport speed.[312]

Analysts maintain that these transparency regulations are not being followed by all Canadian network providers and access providers. For example, analysts have accused some of the six major network providers of violating transparency requirements by failing to inform their customers, or failing to inform them adequately, about interventions in data traffic (such as bandwidth reductions).[313]

The European Commission and (subsequently), the Federal Government have decided against applying such far-reaching provisions. The responsible Commissioner, Viviane Reding, and German legal experts have justified those decisions by claiming that the new transparency regulations, along with the existing legal framework, can be effective in preventing abusive interventions in data traffic.[314] The following section briefly describes that framework for Germany.

The body responsible for overseeing telecommunications providers – and, thus, network providers – is the Federal Network Agency (Bundesnetzagentur – BNetzA). The amendment of the Telecommunications Act (TKG) will not change that responsibility. The Federal Network Agency is responsible for monitoring compliance with the TKG's provisions on network management. Those provisions cover the areas of network access, charges, abuses of market power and the secrecy of telecommunications.[315] Pursuant to access regulations, network providers are not obligated to grant application providers access to their networks. That right is limited to transport services, however, which normally are not considered to include Internet applications. In addition, provisions on regulation of charges, and on oversight with regard to abuses, do not stand in the way of unequal treatment of applications, as long as there are objective, well-founded reasons for such treatment.[316] The possibilities described here for intervening in data traffic apply for all network providers, i.e. including those who, as a result of their size, have significant market power.[317] The TKG's data-privacy provisions also do not provide for restrictions on network management. For example, network providers are permitted to have access to traffic data for the data packets they transport.[318] Such traffic data support provision of, and payment for, services; provide information about the nature of the applications being used (for example, whether a music

or film file is concerned, whether Internet telephony is being used or whether a file is a peer-to-peer file) and identify Internet accesses of recipients. A network provider may thus legally obtain and process the information that he needs to carry out discriminatory network management.[319]

Legal restrictions of network management only apply to arbitrary blocking of content. If a network provider blocks undesired content – especially political content – an affected user can protest on the basis of the principle of telecommunications secrecy and of the right of freedom of opinion pursuant to Article 5 of Germany's Basic Law. The last of the aforementioned provisions also has to be applied to general business terms and conditions. Serious violations of the right of freedom of opinion can thus render certain contractually agreed clauses null and void.[320]

It may thus be concluded that blocking of, discrimination in management of, or imposing of fees for, third-party access to end customers all remain permissible, within an imprecisely defined framework, and will remain permissible even after the amended Telecommunications Act (TKG) enters into force. While the new transparency regulations are certainly to be welcomed,[321] they won't be sufficient to ward off the threats to the Internet's innovative power that the aforementioned practices entail. In the view of the Expert Commission, therefore, the existing legal framework needs to be more precisely defined, and expanded.

Final considerations, and recommendations

Vertically integrated network providers have growing incentives to treat different applications in the Internet in different ways. It is true that blocking and delaying – if they are noticed – can prompt customers to switch providers. The Expert Commission doubts, however, that such potential losses of customers could keep vertically integrated network providers from applying discriminatory techniques – especially delays. It that light, therefore, it must be assumed that restrictions on network neutrality are going to grow, especially since the EU's current legal framework, and the emerging relevant legal framework in Germany, offer little that could counter such restrictions. For this reason, it seems increasingly likely that innovation incentives for independent application providers will diminish. Such developments would have a negative impact on start-up emergence in this area.

In the net-neutrality debate, vertically integrated network providers often argue that extensive legal guarantees of network neutrality would constrain market forces. In fact, the opposite is true. Vertically integrated network providers must not be permitted to reduce the diversity of Internet services and applications by using such techniques as blocking, delaying, prioritisation and strategic pricing. Most importantly, they must not be permitted to hinder young companies from entering the market. Only if the costs of market entry are kept as low as possible for independent providers, all relevant actors, with their different innovation ideas and business models, will be able to compete fairly. Where such costs are not kept low, welfare losses will result in the long term.

The Expert Commission recommends a range of measures for strengthening the Internet's potential for innovation.

- Network providers' customers must be offered the greatest possible degree of transparency. The transparency provisions in the planned TKG amendment are only a first step in that direction. In the interest of transparency in a competitive framework, customers should have special rights of termination in cases in which network providers apply discrimination that exceeds the bounds of the illustrative cases described in connection with the signing of the relevant agreement.
- In general, the amended version of the Telecommunications Act (TKG) should prohibit blocking.
- In the case of capacity shortages, price differentiation in accordance with quality levels is justified: network providers must offer quality-of-service classes on a non-discriminatory basis. In each case, the decision as to which quality-of-service class a given application is to receive must be left solely up to the end user.
- To ensure that market entry of new providers is not hampered, QoS differentiation should solely take the form of differentiation of prices for end users.
- The Federal Network Agency should monitor compliance with the aforementioned rules, and should penalise violators. Furthermore, the Federal Network Agency should define minimum standards for quality of service, in order to prevent strategically

motivated worsening of services, and hindering of data traffic. Such minimum standards should be updated continually in keeping with technological progress.

B 4 INNOVATION WITHOUT RESEARCH AND DEVELOPMENT

A review of developments in R&I policy

In many countries, R&I-policy priorities have changed over the past decades. In the 1960s, "innovation" simply meant technological innovation in industry. Research and experimental development[322] within the meaning of the Frascati Manual, i.e. activities aimed at creation of new knowledge, were considered to be the main drivers of such innovation. In subsequent years, that definition proved to be too narrow. The "Oslo Manual" then brought a broader definition of innovation. In addition, it departed from the view whereby innovation was the same as R&D. The innovation surveys based on that manual – known in Europe as "Community Innovation Surveys" – brought a wealth of relevant new findings. Increasingly, policymakers in Germany and other industrialised countries began to view innovation as a key factor in growth. Policymakers' strong focus on funding research and development gave way to more broadly based innovation policies.

The broader definition of innovation, and the growing interest in more broadly based R&I policy, are to be welcomed, since many other forms of innovation, in addition to technological innovations, can provide benefits for society and private individuals alike. For this reason, in its first annual report (2008), the Expert Commission already applied a broadly based definition of innovation (cf. Box 09). The definition it uses includes not only technical innovation, but also innovation in services, and innovative organisational structures in private and public institutions.[323]

Innovation as defined in these ways has to do with combining something new with application, or at least attempted application, of that something new. It can be empirically proven that innovation often builds on R&D. At the same time, a not inconsiderable share of companies that are involved in innovation rely on R&D either rarely or not at all. It would thus be wrong to equate R&D and innovation. Innovation processes are too complex and too diverse to be reduced to such a simple formula. What is more, the group of innovators without R&D, like the group of non-innovators, both have potential for economically significant productivity improvements, potential that policymakers need to focus on. That is why in this chapter the Expert Commission describes the phenomenon of "innovation without R&D" and discusses the relevant implications for R&D policy.

Innovation BOX 09

The Expert Commission uses a broad definition of innovation. In that definition, innovation includes technical, organisational, social and other innovations that are already being implemented or for which implementation is at least being attempted. A "good idea" is not sufficient by itself. In a market system, innovation refers to development and marketing of new products and services, as well as internal deployment of such innovations (process innovation). In public institutions, innovation means the introduction of new procedures, workflows and approaches.

For innovative companies, innovation can provide lasting competitive advantages.

Innovation and R&D – measurement and differentiation problems

To determine what share of innovators carry out no R&D of their own, one must carry out empirical analyses. The necessary analyses have been carried out in the context of a report commissioned by the Expert Commission.[324] Box 10 summarises important definitions upon which those analyses were based.

Figure 05 gives a first impression of the importance of innovators without R&D. To begin with, R&D frequency increases with company size. Occasional R&D activities, however, can be particularly observed within smaller companies. In the services sector, R&D is carried out considerably less frequently than it is in the manufacturing industry.[325] R&D frequency correlates with company size and sector. Between 18 percent (companies with 5–9 employees) and 88 per-