

Baldry, Shirley; Steingröver, Markus; Hessler, Markus A.

Conference Paper

The rise of OTT players: What is the appropriate regulatory response?

25th European Regional Conference of the International Telecommunications Society (ITS):
"Disruptive Innovation in the ICT Industries: Challenges for European Policy and Business",
Brussels, Belgium, 22nd-25th June, 2014

Provided in Cooperation with:

International Telecommunications Society (ITS)

Suggested Citation: Baldry, Shirley; Steingröver, Markus; Hessler, Markus A. (2014) : The rise of OTT players: What is the appropriate regulatory response?, 25th European Regional Conference of the International Telecommunications Society (ITS): "Disruptive Innovation in the ICT Industries: Challenges for European Policy and Business", Brussels, Belgium, 22nd-25th June, 2014, International Telecommunications Society (ITS), Calgary

This Version is available at:

<https://hdl.handle.net/10419/101398>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

**25th European Regional Conference of the
International Telecommunication Society**
Brussels, Belgium, 22 – 25 June 2014

Paper

The rise of OTT players – what is the appropriate regulatory response?

Shirley Baldry

Dr. Markus Steingröver

Markus A. Hessler

This Paper is based on the Study “Policy and Regulatory Framework for Governing Internet Applications”, performed by Detecon International GmbH.

Deutsche Telekom Group



Consulting
DETECON

We make ICT strategies work

1 Introduction

The *international dynamics of the internet* will not be halted by national regulations. A major enabler of the net's development has indeed been the *lack of regulation* that it has faced to date. The regulator's objectives must be to *catalyse additional opportunities* offered by the internet to the *benefit of the consumer and to support competition*. While avoiding the trap of regarding the internet as a threat, a further regulatory task must be to *facilitate the reduction or minimization of internet-driven risks*.

The proliferation of IP-based telecommunication networks has facilitated the *decoupling of application and network layers* and enabled OTT providers to deliver their content and applications directly to end users. Accusations that OTT providers are "free riders" in the transport market are not entirely accurate. The operators are paid for the transport of the data – albeit as a flat rate from the user.

While the *competition provided by the OTT application providers* does lead to disruption, a functional market should be able to adapt to the new situation: the Telcos would be expected to change their business cases and prices in line with market demand. As this is not happening, competition is apparently dysfunctional.

A major motivation for governments wishing to intervene in the internet market is the surprising realization that the *rollout of nationwide fixed broadband* – often a political objective - has not occurred "naturally". This is a further indication that the market is not functioning. The main recommendation of this study is that the *fixed broadband markets should be analyzed* and the *regulatory framework* in which the SMP broadband providers must operate should be reviewed to identify the reasons behind such malfunction.

In the second chapter, we give some basic information and explain the problems in the economic field. In the third chapter, there is an interim conclusion followed by some solutions for the economic problems. A short conclusion follows in the fourth chapter.

2 Basics and Problems

2.1 Some Basics

The internet is growing at a rapid pace, dramatically penetrating and in many cases transforming the

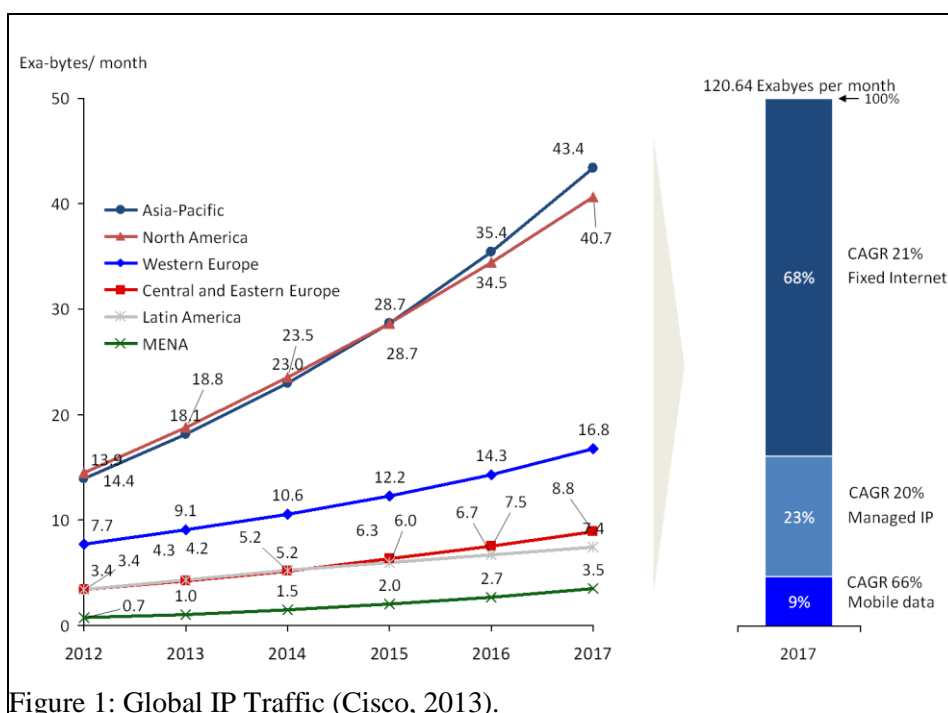


Figure 1: Global IP Traffic (Cisco, 2013).

way people work, play and live. This change is not restricted to the developed world, but is increasingly seen in emerging markets (**Fehler! Verweisquelle konnte nicht gefunden werden.**) and is fueled by the rise of the mobile internet. With growing availability of robust broadband networks, increased competition, and declining price-points, the internet is now available to a

large proportion of people.

This growth of the internet has enabled the rise of firms like Google, Facebook and Amazon, who have taken advantage of its ubiquity and reach to develop into global enterprises. What makes this industry unique is its pace of change and the often disruptive impact that it has on traditional industries.

One of the strongest enablers of this growth has apparently been the lack of clear regulation in this sector – with standardization driven by user forums such as the IETF rather than by inter-governmental bodies such as the ITU. Even to this day, important components such as domain names are governed by quasi-official bodies such as ICANN, pointing to the non-affiliated structure of the internet. This relatively untethered approach has allowed for faster development, and has lowered the barriers to entry. Most existing regulations were developed with more static industries in mind so that, although the internet firms may infringe on the business of legacy industries, these regulations weren't designed to deal with such players. Moreover, the dynamic nature of the internet now demands regulations which continuously evolve rather than being designed as static documents.

When considering how to best manage the internet, policy makers need to recognize the manifold positive impacts it has had on everyday lives. It is imperative that any move towards regulation should serve as a catalyst to drive additional opportunities and create effective competition – rather than viewing the technology as a threat.

From the purely financial perspective the rise of the internet can be correlated with strong economic growth. This can be gauged on three fronts (McKinsey, 2011):

- A strong contribution to GDP (the internet accounts for up to 3.4% of the total GDP in the 13 economies which make up 70% of global GDP);
- An increase in living standards in line with maturity of the internet ecosystem (a real per capita increase of USD 500 when examining “advanced”¹ nations);
- Improved job opportunities and job creation (0.7 million net new jobs attributed to the internet over 15 years in France).

The internet is now responsible for up to 21% of economic growth in developed nations (WRSC, 2014). There is also a major impact on society as internet applications re-define how we communicate, interact and work, and users' average online time continues to increase.

In many other ways the internet can be seen as a source of creative destruction (Schumpeter, 1942). It can be considered the dismantling force for several legacy industries (e.g. print news), but at the same time it brings about a new wave of opportunities, making services and content accessible to a larger audience. Since this is happening on a global scale, attempts made by individual nations to control or stop it has seen diverse effects – the most common effect of such attempts being a negative impact on the overall development of the country in question.

This balancing of the pros and cons is an important general consideration for policy-makers talking about internet and internet service regulation. Each measure must be understood and the effects of interventions weighed up. Decisions must also take time into consideration – the fast moving, and changing nature of the internet make it futile to bring about regulation based only upon historical precedent. Future looking policies must be designed and operated so as to be ready to adapt to new technologies, trends and above all new business models.

2.2 Classification of Internet Services

There is no international agreement on the classification or taxonomy of the myriad services that the internet has to offer. Here we will segment applications based on a broad set of use cases (Figure 2) which cover a significant majority of the internet applications.

¹ Scandinavia, North America, the Netherlands, Switzerland, the UK and South Korea (McKinsey, 2011).

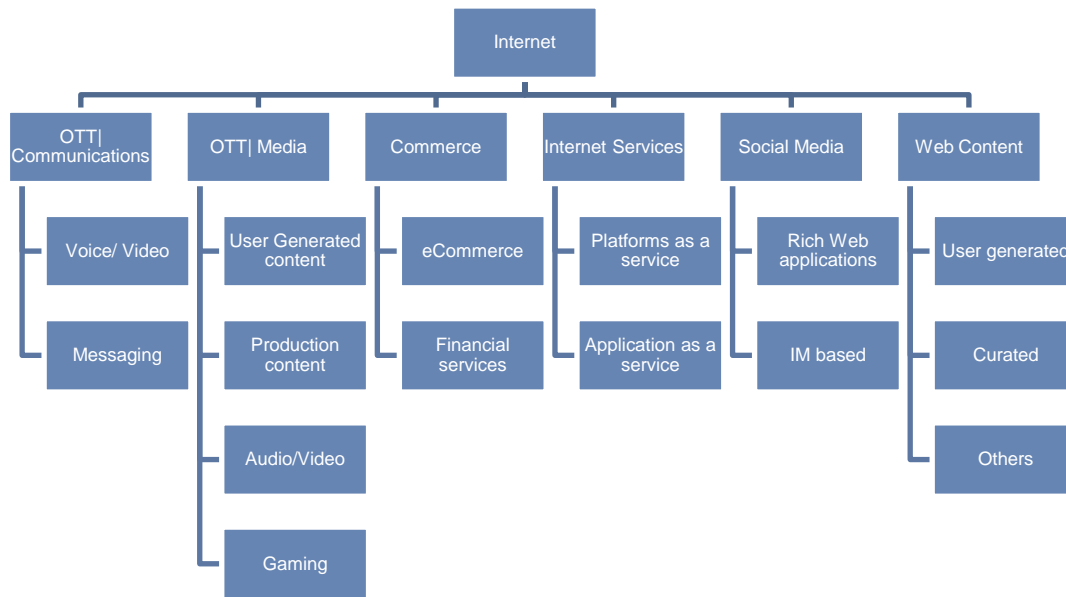


Figure 2: Use Cases Classification (Authors).

OTT Communication refers to services whose primary applications lie in communications but use the internet as the transport medium. This is especially relevant to telecom operators since these services operate in a similar space as traditional voice and messaging services. As fixed networks become more robust, and mobile devices (including larger forms such as tablets) continue to proliferate, an increasing amount of internet traffic is made up of video. *OTT Media* refers to video and audio content being streamed and/ or downloaded over the internet.²

Internet Commerce (or e-Commerce as it is often called) is one of the most important elements underpinning the business models of different internet players and applications. Although more under the purview of financial regulation it is a widely used and accepted internet application and thus its trends should be understood by regulators and operators. *Internet Services* relate to different applications where the end user device behaves more as a user interface rather than a computation and/ or storage medium. These have become increasingly popular with advances in computing power, declining prices for storage, and the rise of cloud computing. Here third party companies function as service providers providing elements such as Platform as a Service (PaaS) or Software as a Service (SaaS) functionality, functions which in legacy systems were an integral part of the offline device itself. *Social Media* is perhaps the fastest growing consumer internet phenomenon today – led by Facebook and others who have secured a worldwide following within a relatively short time-span. Measured by the level of engagement (daily time spent online) and perceived from their sky-high valuations (Facebook \$100 bn at IPO), social media is firmly established as a part of daily life. There are a broad range of *Internet Applications* outside the gamut of what has already been addressed. Since the World Wide Web is so pervasive, it is impossible to categorize all the use cases.

The *business models* for OTT Services vary widely and depend heavily upon the market, customer segment and competition. There are the following Options:

- Subscription based – Users pay a periodical - weekly, monthly or annual – fee to use the service.
- Usage/Transaction – Users have to pay for a specific transaction or the resources they use.
- Advertisements – Users pay attention to a site or service and the supplier sells different types of ads.

² This is not to be confused with IPTV, which uses dedicated IP channels for content and is not characterized as best effort.

- Donations – Some platforms (such as Wikipedia) are funded by donations (Crowd Funding).
- Freemium – Basic features are free to use, but some premium or convenience features are offered at a price.
- Monetization of Information – Users disclose Information about themselves, suppliers monetize these.

Obviously there is a shift from traditional telephony to OTT Communications and a replacement of SMS by OTT Applications like WhatsApp. So traditional Telcos are denied two of their most profitable business lines: SMS and long distance calls. Also the media is under attack by new OTT services for news, audio and video streaming. There is a strong preference for the ‘on demand’ experience. Because of that there is a shift from traditional media to ‘on demand’ media.

2.3 Economic Problems and OTT Services

2.3.1 Introduction

IP technology separates the applications and services described above from the means of transport. At the transport level major changes have also taken place. The first stage of the internet revolution took place in the wireline environment – the web became available on laptops and PCs, applications such as OTT Voice and eCommerce entered the home and the office. The second stage is wireless, and is being driven by the emergence and increasing domination of smart phones. Previously inconceivable capabilities are offered by the internet and its applications to users wherever they are, and there is no end in sight. Market boundaries are breaking down and new players are entering the playing field with innovative business models. The global nature of these services allows the players to achieve economies of scale far beyond those of legacy operators.

This market dynamism has the regulatory world struggling to keep ahead. Just as one issue has been identified the next comes up; a market is finally defined just in time to watch it morphing into something else. The main regulatory challenge is to provide a future-proof framework which maintains its relevance no matter how the market develops. Key words here are *technology-neutrality* and *ex post* rather than *ex ante* regulation. Competitive imbalances between traditional providers and new market players must be evaluated and, as far as necessary and possible, be reflected in new regulation. Further, the effects of the *convergence* of the ICT and broadcasting markets must be examined. A further regulatory trend is towards simplification – the maxime of regulation is that it should only be applied where necessary, and as the markets develop this is less often the case.

Alongside facilitating the development of the communications market to the benefit of the country, the *basic rights of individuals and society* must also be protected by legal and regulatory measures. And a last, but vital, aspect of regulation is that it should provide the market players with *business security* – they must be able to understand and trust the framework in which they work.

Regulators have weighed in on *OTT Communications*. The main reasons for this are that the operators are demanding a regulatory solution to their *revenue difficulties* and the policy makers are searching for the reason behind the *lack of investment in broadband*.

The big regulatory question has been whether OTT Communications are to be defined as telecom services (voice or data) or telecom infrastructure, and thus whether they should be subject to licensing and regulatory obligations (such as legal intercept and emergency call access) or not. The IP-based messaging services business models are aligned to those of the voice players. Backed by high valuations, their current focus seems to be on establishing market presence rather than monetization.

OTT Communications make regulators nervous because they are out of control. Also, as long as they are not regarded as Telco Services, the OTT Communication providers raise a security concern as they are not obliged to facilitate legal intercept. This has led to them being outright banned in a number of countries (Arab News, 2013) and to attempts to force the service providers to manage and maintain data traffic in other countries. These tactics have however met with limited success.

Recent revelations that firms such as Microsoft (which owns Skype) gave US governmental authorities access to their applications and data traffic have raised further security issues. Nations see their data sovereignty endangered, but have little leverage over the OTT providers which are registered abroad and thus out of jurisdictional reach.

Newer services such as Snapchat are now emerging where messages (text and graphics) are only available for a limited time-span after which they are deleted from the server. Snapchat, which was launched in 2011, had had over a billion pictures shared by November 2012 (Techcrunch, 2012). This is a new challenge in the context of content regulation due to the time bound nature of the message (Gross, 2013).

OTT Media is mainly concerned with the distribution of videos and audio data. This is not a traditional subject for ICT regulation and illustrates a further issue concerning the organization of regulation - the need for a converged regulatory framework for converged service offerings.

OTT Media has also led to a well-publicized consumer protection problem: Most flat rate data plans have a limit on the maximum volume of data allowed, after which a (generally high) volume tariff or throttled transmission speed applies. As improved HD capable devices come on the market and better content is available the streaming of data means that these limits are quickly reached. This has led to cases of “bill-shock” – where users receive astronomical bills as a result of streaming data. How best to resolve this issue is presently an open debate.

The convergence of communications and financial services lead here to the question of how to ensure that the requirements of the different regulatory authorities are combined into one joint path of action. As not just honest citizens can benefit from eCommerce, a further national security issue here is that of surveillance (legal intercept). Where law enforcement agencies previously had warrants to examine the bank accounts of suspects, now access to online financial transactions is vital.

Cloud services are often offered by providers which are located in another country. This may raise sovereignty questions which require adaptations in commercial law. Coordination between the different authorities may also be an issue here.

Social Media is playing a significant role in defining social interactions. Users are voluntarily disclosing personal data (photographs, preferences etc) which are then mined to serve targeted advertisements. This presents opportunities for new enterprises but at the same time raises concerns about privacy, ownership of data and longevity of data among others. Recent changes by Facebook and Google are examples of such issues – e.g. Google with its latest notification indicates that it would have the right to use an individual’s photograph to endorse a product in advertising to others if the user has recommended this product elsewhere in their search (Pinter-Krainer, 2013). Additional complexity arises from social media players’ ever-changing terms of use in tandem with their *lock-in effect* (David, 1985) – which forces many users to continue usage and give up ownership of their content.

In a recent study the BSA (2013) identified seven requirements for internet services and applications to develop optimally in a society. These prerequisites are: privacy protection, information security, cybercrime measures, protection of intellectual property, ensuring data portability, liberalized trade rules, and the availability of the necessary IT infrastructure. Providing the framework to enable these pre-requisites is a government task, implemented to a large extent by the regulatory authority.

We have summarized these seven prerequisites into three main issues. In the original study “Policy and Regulatory Framework for Governing Internet Applications” these were looked at in detail to provide the basis for recommendations concerning regulatory action to be taken in the area of internet applications:

- Consumer security (covering privacy, information security, intellectual property rights, data portability);
- Sustainable business models for telecommunications operators (covering liberalized trade rules, availability of the necessary IT infrastructure);

- National security (covering information security, cybercrime measures).

In this paper we will focus on the second point.

2.3.2 Regulation Imbalances

The proliferation of IP-based telecommunication networks has facilitated the decoupling of application and network layers and enabled OTT providers to deliver their content and applications directly to end users - circumventing the owner and operator of the underlying ICT infrastructures and reducing their function to the well-known term “*bitpipe provider*”. Thus telecommunications operators (“Telcos”) not only have decreasing knowledge and control of the kind of content and applications their networks are carrying, but the amount of data going through their pipes is growing exponentially, forcing them to build even faster networks, which opens them up to even more OTT traffic, eventually trapping them in an endless loop.

The speed with which the internet market has developed has created an imbalance in the regulation of different actors competing in the market, particularly concerning the application providers with the OTT communications use case. A common complaint from network operators is that their business models are determined to a large extent by regulatory requirements, whereas those of the internet application providers (and particularly the OTT players) are free of such limitations. The table 1 below summarizes the regulatory imbalances as seen today.

Area of Regulation	Network Operators	Application Providers
Licensing	Yes, individual licenses – sometimes still technology-specific, but often subject to reform. As operators are generally defined as having SMP, the need for licenses is expected to persist.	Class licenses common. OTT providers often exempted.
Interconnection	Yes, due to general definition of operators as having SMP. Requirement to interconnect produces costs.	No. OTT providers are per definition “over the top” of the network, and don’t require interconnection.
Provision of legal intercept	Required as a license condition.	Required in some cases. Legislation introduced or being developed in nearly all countries.
Access to emergency services	Required as a license condition for basic service offers (PATS).	Required in some cases. Peer-to-peer providers generally exempted.
Quality of Service	Yes. Licenses include requirements for SLAs.	No. The internet technology makes contractually determined QoS difficult. QoS (specifically speed) problems generally blamed on network provider, not service provider.
Net neutrality	Assumes “best effort” transport of data without discrimination, independent of source or nature of data. Concept not applied in MENA and being reviewed at present in other regions (e.g. EU).	No obligations. Their control over the content and freedom of choice concerning customers releases them from restrictions here.

Table 1: Regulatory Imbalances between Network Operators and Application Providers (Authors)

The question of if and how to *license* new internet market players has occupied regulators for more than a decade. The clear distinctions between different technologies and players are a thing of the past and basic assumptions which were valid for licensing in the 1990s are irrelevant now. Definitions are the name of the game when determining who should be regulated and how. Is, for example, an OTT voice provider a provider of voice services? Skype has a very clear position here: “Skype does not have any operations in Singapore [author’s note: or anywhere except Luxembourg]. Users of Skype simply download the Skype software from our Luxembourg operated website...” (Skype, 2010). Many regulatory attitudes only agree on the condition that no connection to the PSTN is made. In the EU

long discussions have taken place concerning the definition of Electronic Communications Networks and Services in the converged world and the treatment of VoIP providers. The EU's new regulatory framework (EU, 2002) has loosened regulations on the players and these are generally technology-neutral, but a wider range of players are subject to the remaining obligations. More recently a slight withdrawal from the "light" regulation trend in Europe can be seen, as the subject of security is becoming more prevalent. There are no licenses necessary in the EU for OTT Voice Providers, but in individual countries (e.g. France, Spain) OTT providers have been blocked when offering voice services that connect to the PSTN. Justification is that the OTT is then behaving like a Telco and should fulfill the obligations of a Telco too (offer emergency services, LI, pay USO etc.).

The very nature of IP communications means that the VoIP connections are often location-independent and the reliance on a functional electricity supply makes them inferior in some disaster scenarios. In an attempt to encourage OTT voice providers to participate in *legal intercept and emergency call access* the UK offers them *geographic numbering* if they agree to behave like Telcos and provide these services – otherwise they are assigned numbers from a specific range which is clearly identifiable as not being "normal" telephone numbers. It is questionable whether the OTT providers regard the different numbering as a real problem, or reason enough to take on the costs of the obligations. The – former European Regulator Group's – now BEREC's common position on VoIP recommends that geographical numbers for traditional telephony services and geographical numbers for VoIP services should share the same number range, i.e. come from a common "number pool" (ERG, 2007).

Transmission over the internet is completely different to that via a PSTN and the provision of end-to-end quality of service cannot be guaranteed. The concept of best effort provision has generally been accepted by the customers, but as dependence on online services grows it is doubtful that this will remain the case.

Here the issue of net neutrality must be considered. This has always been a given for the internet – all traffic is to be treated equally, irrespective of source, destination or content – and is generally the solution that the content providers prefer. But it means that most operators are not allowed to differentiate between traffic for which they receive income and traffic which brings them no economic benefit, nor can they differentiate their products by offering superior quality of service with faster transmission rates and reduced latency. This is of limited relevance as long as there is over-capacity, but in the case of bottlenecks the story is different. This issue has been recognized as a priority and first changes have been made – Ofcom (UK) has announced its intention to allow managed services in the case of network congestion – but then all services of a particular type (e.g. video) must be stopped at the same time to prevent competitive disadvantage. This approach suggests great regulatory involvement – how, for example, is "congestion" to be defined? In 2010 the iDA in Singapore reviewed its stance on network neutrality and came up with the following policy framework (iDA, 2010):

- 1) Operators are not allowed to block legal content;
- 2) They must always comply with competition and interconnection rules;
- 3) They must disclose information to the end-users about their network management practices and typical internet broadband download speeds;
- 4) They must meet minimum QoS standards as defined in their licences; and
- 5) *They are allowed to provide niche or differentiated services.*

In accompanying commentaries it is emphasized that these niche or differentiated services (which may include network management services) are not a replacement for non-discriminatory internet access, but an additional service. The network operating company in Singapore now offers 4 Classes of service: A. Real time; B. Near real time; C. Mission critical and D. Best effort. The regulator puts a special emphasis on the need to educate and inform the end-users, and is also considering a so-called "cooling down" period post contract signature, which enables end - users to withdraw from a service provision agreement within (say) 2 weeks should they be dissatisfied with the traffic management offered by the supplier.

A further use case benefitting from regulatory imbalance is *OTT Media*. Here it is the traditional broadcasting companies which are subject to strict content and copyright restrictions while the OTT media providers enjoy comparative freedom. The situation here is further complicated by the convergence of ICT and broadcasting issues – which is leading to the logical convergence of the different regulatory instances e.g. in the UK – where Ofcom has been established as the result of the convergence of the ICT regulator (Ofcom), spectrum management (RA), the regulator for private television (ITC), the standards commission (BSC), the regulator of independent radio services (Radio Authority) and the overseers of the BBC. In this way consistency in the treatment of different cases can be guaranteed and competence discussions avoided from the outset.

Finally, *data portability* is a regulatory aspect which may aggravate present imbalances if not correctly handled. This concept is akin to that of number portability and is intended to protect consumers from lock-in effects, especially in the case of *cloud data services*. Although a positive concept in terms of consumer protection, its implementation must be planned carefully to ensure that all market players, whether network operators, ISPs or application service providers, are subject to data portability requirements and thus to prevent a distortion of competition. The EU is dealing with this by including data portability as a consumer right in revised data protection legislation – in this way all companies will be equally subject to the legal requirements (Albrecht, 2013).

While some of the imbalances felt by the network operators stem from imposed regulatory obligations, others are in fact simply normal market developments for which regulatory action is inappropriate. Regulatory action which distorts competition is contrary to international developments in regulatory practice and its justification must be examined in detail.

2.3.3 Competition and Business Models

One of the bigger challenges of the internet is that since it *lowers barriers to entry* and *leverages global economies of scale* it is increasingly difficult for traditional firms as well as localized entities to compete with the new market players. For example – an OTT Media player who has a global presence will benefit from lower costs per MB for storage and hosting and be able to negotiate better content deals with providers in comparison to small specialized local players. However, the OTT Media player's business model is only possible using access provided by regulated operators and thus this revenue loss must be part of any equation concerning wholesale price levels. The primary and largest impact that OTT Media has had has been in the sizeable portion of internet traffic now solely concerned with streaming media. Infrastructure providers are having to invest massively in higher and higher capacity infrastructure (both access and core) to meet this demand. The impact is aggravated by the fact that many Telcos' business models include flat rate data plans.

A further problem for some nations' economies arises since the internet application provider can be located anywhere in the world – independent of geography - and the macroeconomic benefits of the business are only enjoyed in their land of domicile. National governments which raise corporate tax are losing tax revenue since users are purchasing services from global players rather than local entities; there are no employment benefits in the host country and also no knock-on effects from the business as such. Although the tax issues are being debated at an international level and can be seen as a globalization and structural shift problem – they are not a subject that should be the focus of regulators.

OTT Comms	OTT Media	Content	Commerce	Services	Social Media
Strategy					
Substitute trad. Telco services with low/no pricing strategy – once market share gained, pricing models expected to change	New services enabled by internet. Provide videos and music on demand. Substitute for MP3/CDs/radio/video shops/payTV	New services enabled by internet network effects. Gaming substitute for "trad" gaming	Marketplaces. Substitute/add'l sales channel for trad. Shops; Facilitate int'l commerce Facilitate int'l payment	Outsource IT storage and provide alternative bus models for software/platform/infrastructure provision. Substitute trad business models	New services enabled by internet network effects. Collect and sell knowledge about individuals for advertising and market research.
Target customers					
Private users; Expanding into business users with VoIP now	Private users	Private and corporate users.	Businesses and private users B2C	Mainly Businesses B2B; Private users too	Mainly private users
Revenue sources					
Services often free of charge; Connection to PSTN against payment; IM annual subscription fee	Basic services often free of charge; Advertising; Subscriptions; Pay per use	Advertising (targeted due to knowledge of user); Pay per click; Auctioned key work references	Margins Transaction fees	Volume-based pricing; Time-based pricing; Subscriptions	Advertising (targeted due to knowledge of user); Product placement

Figure 3: Summary of the OTT Business Models (Authors).

As illustrated in the above summary of the business models behind the OTT use cases – the majority of providers presently concentrate more on *winning customers* than on making money. By using infrastructure paid for by the consumer within the framework of flat-rate data plans the costs are kept to a minimum and the investors' valuation of the business models ensures that capital is available. This model is the kiss of death for many more traditional Telco services for which the consumer has to pay on a per-use basis, but which offer no apparent advantages over their free alternative. This is particularly so in the case of VoIP services (competing with voice services – specifically with international voice) and messaging services such as WhatsApp (competing with SMS). When Skype first took off in the UK, several network operators blocked its use as they saw their revenues in danger – but Ofcom and the EU intervened and used net neutrality as the argument to make them provide access again. Recently Ofcom and other regulators have begun to distance themselves from absolute net neutrality by publically acknowledging the need for capacity management through both price differentiation and traffic differentiation in peak periods – which indicates that they recognize the issues that the network operators are facing. International voice has long been an important source of income for Telcos, often cross-subsidizing local calls subject to tariff regulation. SMS is often quoted as *THE killer application* – but now the “free” alternative is undermining revenues dramatically.

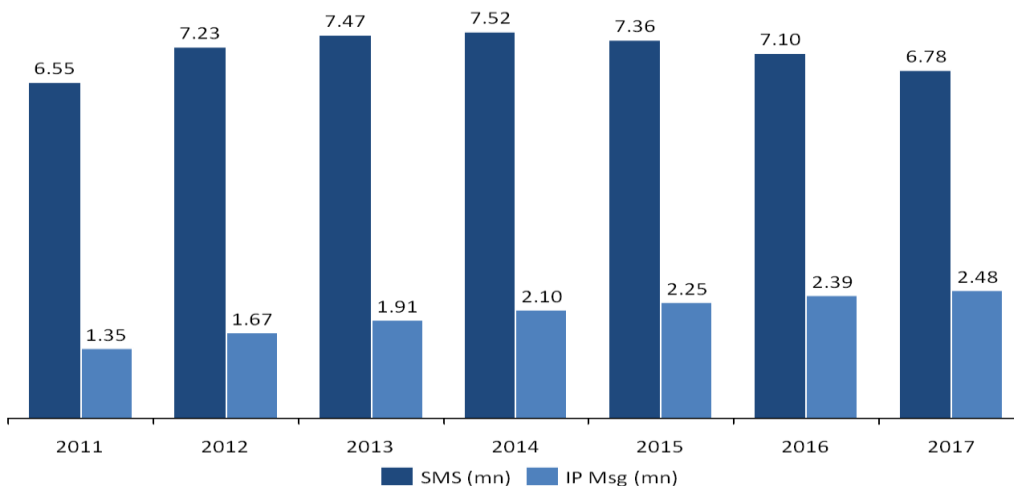


Figure 4: SMS versus OTT messaging (Ovum, 2013).

In Figure 4 it can be seen that worldwide SMS traffic is forecasted to peak by 2014 and then decline. If the same analysis is limited to developed markets, the SMS/ IP substitution has already crossed 25%. A clear impact can be seen in the case of the Dutch operator KPN who analyzed this trend in the Netherlands. According to research (Informa, 2013), every 10% increase in smart-phone penetration reduces voice and messaging revenues by 0.5 – 0.6%.

The Telcos are losing revenues, but no one is gaining them. This is destructive competition resulting from the flat rate business models, and as time goes on the internet application market will develop applications to attack ever-increasing parts of the Telco market – first international telephony, then national telephony and messaging, then local etc. The Telcos should not assume that the attack is temporary and should not have a false sense of security. In a competitive market – which network access is in many countries – this problem should be solved using the principles of supply and demand.

The access providers should rebalance their prices to reflect volume usage. If the customer wants the volume, then they will be willing to pay for it. In many cases the operators will be subject to tariff regulation for their wholesale rates - the regulator will need to take action to rebalance these regulated rates to enable the SMP operators to behave conform to the demands of the market.

Whatever happens, in the long run the OTT providers will also need a strategy to operate profitably. A promising business model available to the operators, but which has mainly been snapped up by third parties, is the role to be played as a content delivery network (CDN).³ OTT providers pay for these services, so the traditional network operators can monetize the relationship by providing this service – and the skills required are already available as CDNs are a natural extension of the transport business.

A further group in the internet market which is suffering from revenue loss as a result of the OTT players is that of the content producers. OTT media services provide flat rate music or video streaming: content which was previously supplied on a unit price basis. Following major legal battles concerning copyright issues, new services now seem to be emerging where the media industry is working together with the OTT providers in a way which is less destructive for the industry – offering streaming options and premium pricing for advertisement-free services. The share of illegally distributed music and video is going down.

2.3.4 Network Investments

In the short term the consumer is sure to be delighted with the effects that the new players in the internet market are having. Prices are falling – in many cases to zero over and above the flat rate paid for the internet connection – and the range of applications on offer grows from day to day.

But there is one major flaw in the market as it is today: *investments in future networks are high risk*. Traditionally carriage and content went together – network operators were willing to invest in network because they knew that they could generate revenues with the provision of content, it was under this premise, and with the expectation that excess capacity would always be available, that flat rate tariff plans emerged. This is no longer true. The Telcos are paid flat rates for the use of their capacity and their role is being reduced to that of a wholesaler. At the same time the prices that they are allowed to charge for their wholesale services is often regulated at a cost-oriented and rather restrictive level. On top of this, due to net neutrality rules it has to date not been possible for the Telcos to offer differentiated QoS with related price differentiation. The *profit and thus the incentive to invest* used to come from the ability to redeem payments from service providers using the network – to a certain extent including income from peering/transit agreements – and from income earned with the network operator's own service and content provision. This is no longer true.

In summary: the services being offered by the OTT providers – particularly *OTT media and content provision* - are *increasing demands on capacity*. Due to the *predominance of flat rate tariff structures*

³ These providers offer local data storage to the OTT providers so that latency is reduced and the consumers' joy of service increased.

this increased traffic brings no financial benefit for the Telcos. The expected market reaction would be for the Telcos to change their tariff structures to reflect demand and to cover the costs necessary for new investments – but either the regulation of their tariffs is stopping them from doing this, or they are consciously delaying an improvement in their situation in the hope that the OTT services will be seen as being destructive for the market and will be banned by the regulator. One of the consequences to be expected is that operators will move away from unlimited (flat rate) data plans. It is already common practice (although rarely openly stated) for operators to throttle bandwidth in case of extreme data transfer volumes, and tiered pricing is the logical next step. Whatever the reasoning, the present situation – with increased capacity demands and no related income – is not a sustainable model for the Telcos.

In the specific case of *cloud services* this problem is particularly acute. Cloud services need a highly resilient network and the synchronization of data to numerous devices demands significant capacity. This in turn requires investments which are generally only paid back after years. But the increasingly wholesale nature of the Telco's business, the international nature of many cloud service providers (giving them access to numerous alternative network operators) and, last but not least, the upcoming demand for data portability combine to ensure that the Telco has absolutely no planning certainty concerning the income to be earned if investments are made.

Unless the business models of the market players (mainly the network operators) are adapted to suit the new market structures investments in the network will ebb. This will have knock on effects on businesses which have learnt to rely on broadband communications for their growth, and thus on the overall economy and the image of the country in question. *Adaptations to the business model* refer here to the rebalancing of the tariff structures – away from flat rates and strict network neutrality and towards traffic and/or quality of service-oriented schemes for data.

To enable the network operators to function in a competitive manner it may be necessary to *change the regulatory guidelines* which they face. Existing regulatory requirements must be reassessed within the framework of the new market situation to re-establish a level playing field and incentives to invest. Although broadband access markets are generally subject to normal competitive conditions, some nations have decided that measures have to be taken if the development of broadband is to be optimized in their market

One option is the *structural separation* of the markets for network provision and service provision. Australia and Singapore have both chosen this option and set up broadband companies specifically to provide nationwide broadband infrastructure⁴. The network operators are then required to sell capacity on a wholesale basis. The rationale here is that the provision of the broadband infrastructure is not a competitive market and will not develop to the benefit of the economy if not supported by regulatory intervention. Such a major intervention into the market can therefore only be recommended if a detailed cost study reveals that a *natural monopoly* situation exists, which is *resistant* as well, and such intervention is thus justified.

A further option would be the introduction or extension of existing *universal service* obligations to cover broadband access – potentially including a funding mechanism for the provision of broadband to be carried by all market players.

2.3.5 Net(work) Neutrality

If reduced to the role of wholesale provider, the Telcos will *lose customer contact*. If broadband capacity is seen as a commodity by the customers, brand loyalty will with time fall to zero. Competition may be purely on the basis of price and the customers will cherry pick from each service

⁴ The National Broadband Network in Australia is to provide 93% of homes, schools and businesses with a fiber-to-the-premises broadband connection of up to 100 Mbit/s. The other 7% are to be served with wireless and satellite connections.

The Next Generation NBN in Singapore has separate companies providing dark fiber network and ducts ("Opennet") and active infrastructure ("Nucleus Connect"), while the services are provided to the users by retail service providers (RSPs).

offering, behavior which will be further facilitated by consumer protection activities such as data portability regulations and market transparency provided by the internet.

On the other hand, regulatory developments away from *network neutrality* will enable some differentiation again – particularly in combination with requirements from the regulators that the users are well-informed of the differences in the quality of broadband connections (as in Singapore). As the role played by internet services continues to grow in society, the willingness to pay for high quality will develop in a greater range of customer segments.

The Telco can accept its role as a commodity supplier and adjust its business model accordingly to maximize production efficiency to provide broadband connections to the mass market at minimum price, or it can *search for options for differentiation* in broadband provision and lobby for regulatory freedom to act as a commercial entity. In addition the Telco has the alternative of entering into commercial agreements with internet application or content providers to offer, for example, value added packages to the customers with enhanced quality. Many operators have adopted a *symbiotic approach with partnerships with the OTT players* (e.g. Mobily in Saudi Arabia). In this case, the applications are natively installed on the device, and traffic from these applications is zero-rated when specific bundles are purchased. Although this does not fully compensate for lost SMS revenue, it offers the customers an attractive alternative which may increase loyalty.

Alternatively the operators can *compete with copycat services* such as the European “Rich Communications Suite”, which provides IM, live video footage and files, and presence information across any mobile networks, or “Joyn”⁵, which offers chat capabilities between partnering networks. Most operator responses with competing services have however had limited market success to date. Further alternatives could be to enter into service agreements with OTT providers to provide QoS at a price – a possibility now that the concept of net neutrality has been negated – or to use Apps as a distribution channel for Telco services. The regulator has a very limited role to play here – this is an example of competitive pressure – as experienced by companies in nearly all industries throughout the world on a daily basis.

3 Solutions

3.1 Interim Conclusions

The *international dynamics* of the internet will not be halted by national regulations. A major enabler of the net’s development has indeed been the *lack of regulation* that it has faced to date. The regulator’s objectives must be to catalyse additional opportunities offered by the internet to the benefit of the consumer and to support competition.

The proliferation of IP-based telecommunication networks has facilitated the *decoupling of application and network layers* and enabled OTT providers to deliver their content and applications directly to end users. Structural change always leads to the need for new business models, for a letting go of old practices and the welcoming of *new opportunities*. The tendency to accuse the OTT providers of being “*free riders*” in the transport market is not entirely accurate. The operators are paid for the transport of the data – albeit a flat rate from the user.

OTT providers are compounding the Telcos’ commercial problems by using this flat rate tariffed capacity to provide services (often free of charge) in direct competition to the Telcos’ services, thus *eroding some of their most important revenue sources* (e.g. international telephony and SMS services). While the destructive competition provided by the OTT application providers does lead to disruption, a functional market should be able to adapt to the new situation.

If competition was working, the Telcos would change their tariff plans in line with market demand. As this is not happening, competition is apparently dysfunctional. The research shows that this is a

⁵ Supported by Ideos Claro operators in South America, KT, LG U+, Metro PCS, Movistar, Orange France and Spain, SK Telecom, T-Mobile Germany, and Vodafone Germany and Spain.

situation found throughout the world and for which there is not yet a patent solution – although the root cause apparently lies in the combination of *flat rate tariffs* based on business plan assumptions that no longer hold true in combination with *non-sustainable competition* from OTT players and *regulatory obligations* which make it impossible for the Telcos to react freely to the commercial changes demanded of them. It must be a central regulatory task to analyse this dysfunctionality thoroughly and to introduce measures to eradicate the problem.

Competitive principles should also ensure that broadband infrastructure will be built and operated where demanded and to the commercially feasible extent. The commercially feasible extent may however not be the extent needed to satisfy political goals. International examples show that in this case the provision of the broadband infrastructure may be organized as a state-run business, or further infrastructure may be subsidized either through direct government intervention or through obligations placed on operators.

3.2 Policy and Regulation

3.2.1 Policy Adaptation

A major motivation for governments to investigate the need to intervene in the internet market is the surprising realization that the *rollout of nationwide broadband* – often a political objective – has not occurred “naturally”. It is recognized that a country’s businesses and residents must have access to broadband in order to take full advantage of the benefits offered by the internet and its services and applications, and it was expected that its provision would be driven by the network operators’ recognition of the need to supply more transport capacity in order to sell more applications and services. This market mechanism has not worked to the extent hoped for by governments. If the rollout of broadband is to be facilitated, the reasons behind this malfunction must first be identified and quantified. The following steps are recommended.

Assess the market for broadband:

- Implement research to assess the *economic demand for broadband*, including differentiation for different qualities of service. Such research must combine existing data concerning use of broadband and consumer/business research to assess how much users would be willing to pay for capacity and quality and their elasticity of demand with increasing or decreasing tariffs.
- Based on this research an initial plan for network extension can be drafted and a cost estimate made.
- The feasibility of the network extension can then be calculated.

Three outcomes are possible:

- The extension of the broadband network is feasible and in line with the policy objectives of the government.
- A partial extension of the broadband network is feasible, but the extent of the rollout which is commercially feasible is not in line with the policy objectives of the government,
- The extension of the broadband network is not feasible.

In the second and third cases the government is obliged to make a *policy decision* as to whether and how the broadband rollout is to be supported with regulatory measures:

- The *establishment of a national broadband network* which is not obliged to operate on a purely profit basis;
- The obligation of a network operator to expand the broadband network but with *financial support* either from the government (subsidization) or from a sort of universal fund funded by all players in the market;
- A change in policy decision away from the extension of the broadband network beyond economic demand.

- A further option often chosen in Europe is the setting of *coverage obligations* for SMP license holders (particularly for LTE) – this option is not recommended as it puts the burden of fulfilling political objectives on a limited user group rather than on the general public as a whole.

In the first case a functional market should lead to the installation of broadband and, where this has not happened to the extent hoped for, market structures must be examined in more detail to identify the root cause. Here there are two main potential causes – either *regulatory barriers* (Knieps & Weiß, 2007) are preventing the correct functioning of the market, or the *competitive pressure* on the operator is not strong enough – or too strong – to force a commercial reaction (Aghion, Bloom & Blundell, 2005). An analysis of each of these potential causes is recommended.

The research clearly shows that the entry of OTT providers into the market has changed the network operators' competitive situation dramatically. In a functional market all market players would *adapt their business models* accordingly and a new equilibrium would be found. As this is apparently not happening in the current case there must be market imperfections. This may be because *regulatory obligations* (e.g. tariff regulations) placed on the operators are impeding their attempts to respond appropriately to the competitive challenges they are facing. For this reason it is recommended that the regulatory obligations faced by the operators are reviewed in detail and appropriate adaptations made according to the results revealed.

The following tasks must be implemented:

- Initial check that the *SMP status of the operator* is still maintained and that the specific ex-ante regulation is thus still justified. This check involves a market study in line with general regulatory practice and may result in the removal of specific regulated services from tariff obligations.
- Detailed analysis of the SMP operators' *costs and cost structure* taking the shift in business from services to transport into account.
- If so required, *allocate the costs* of the required broadband expansion to the operator in line with government objectives – so that these are also reflected in any new tariff regulations.
- *Review existing regulated tariffs* to take new cost structure and expected market developments into account.
- *Review of other regulatory obligations/decisions*⁶ to reflect changes in the market situation.
- *Public consultation* and hearing on planned changes.
- *Finalization* and implementation of changes.

As a result of this work, *regulatory imbalances preventing the network operators from reacting to competitive challenges should be removed*.

3.2.2 Destructive Competition

A further hypothesis concerning the root cause of the market's malfunction is that the OTT providers' *competitive behavior is unfair*. The basis for this hypothesis is that the competition created by the OTT providers is destructive and not sustainable, as indicated by the fact that they are loss-making and their *financing is based on extremely high stock market valuations* rather than on solid business cases. In the medium to long term their business cases will have to be adapted to be profitable, but if their short term behavior forces other providers into cut throat (negative margin) price competition the detrimental effects on the market may not be reversible. This hypothesis must be tested and if proved it may be beneficial to the market if the provision of free OTT services which are in direct competition with the network operators are temporarily blocked (or, alternatively, deprioritized in transport) until the above-described rebalancing of the Telcos' tariff structures has been facilitated.

⁶ Here a case in point is the recent verdict of a civil court case in Germany which has prevented Deutsche Telekom from redefining its transport tariff in line with market developments.

The negative public relations effects of such action should not be underestimated. It is extremely important that the regulatory justification of such an action is *transparent and made freely available* to the market and to the general public. In the short term alternative business models for the OTT providers – such as joining forces with local ISPs to provide services – could reduce negative impact as well as providing *legislative control* over the OTT service provision through the ISPs.

However, in the medium/long term it is strongly recommended that license-free OTT application providers continue to be tolerated in the market. The *destructive nature* of their competition will be reduced as shareholder pressure forces them to charge for services in order to make a profit. *A ban destroys competition and limits innovation* – in a functional market it should absolutely not be necessary.

3.2.3 Competitive Pressure

A further reason for the lack of investment in broadband may simply be that the operator is *not subject to enough competition* to be forced to react. Despite a strong natural tendency to protect the incumbent telecommunications operators, regulators should resist the temptation to do so. In the other hand, it is possible that the competitive pressure is so strong that the operator can't expect to earn any profit out of its investment. The regulatory task is the *facilitation of fair competition* – not tipping the scales in favor of a particular player. It is recommended that, once regulatory limitations have been removed, an assessment of competition in the transport market is implemented. The following steps are necessary:

- *Identify market players* in the transport market for broadband services (these will now include mobile broadband operators).
- *Assess degree of competition.*
- In case of limited competition *develop framework to open up the market*. Here the option of structural separation may be particularly relevant.
- In case of too strong competition, *adapt the regulatory framework*.
- *Develop implementation plan.*

3.2.4 Framework for Net Neutrality

Although international trends show that *network neutrality* is becoming less strict, it is recommended that basic neutrality guidelines should be maintained or introduced to *protect consumers' interests*. This is particularly relevant as the trend towards differentiated/ tiered service offers could, without a framework, lead to some internet traffic being neglected completely. It is recommended that the net neutrality guidelines issued in Singapore are used as the basis for discussion (See section 2.3.2).

3.2.5 Coordination and combination of Regulation

It is recommended that coordination procedures are established between the authorities responsible for financial service regulation, data privacy and protection regulation, broadcasting/publishing regulation (PPP Law) and communications regulation to ensure that measures taken are consistent and coherent.

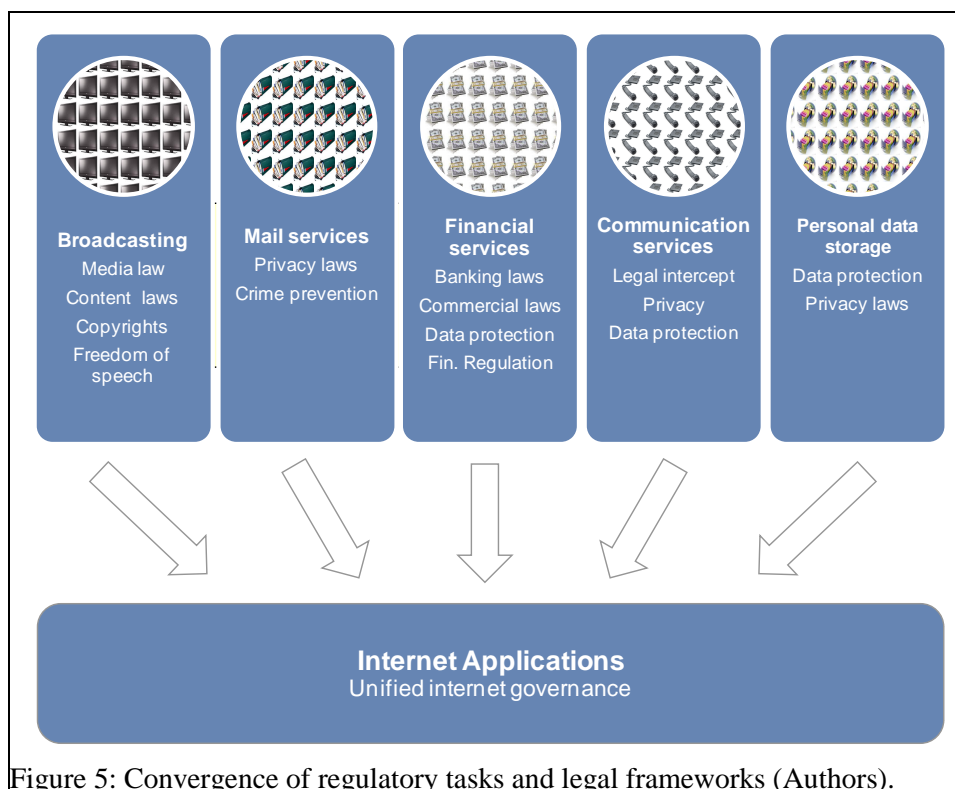


Figure 5: Convergence of regulatory tasks and legal frameworks (Authors).

The internet is already playing a central role in both business and private life, and this can be expected to become even more important in the future. In some countries (e.g. Germany), there are even calls for an “Internet Ministry” to be established. This creation of new bureaucracy is not recommended, but coordination of existing bodies is absolutely vital.

It is further suggested that the convergence of the broadcasting, communications (and publishing) markets makes the *convergence of their regulation* logical. As the barriers between the markets are blurring this would help ensure *consistent treatment of market players*. To verify this hypothesis the feasibility of such convergence should be assessed in a first step and, if proved, a *single regulatory body* set up. The feasibility study should include:

- A quantified *assessment of the benefits/synergies* of combining the authorities and councils responsible for broadcasting, communications (and publishing) into one regulatory unit. Broadcasting and communications are already an integrated area in some jurisdictions.
- *Assessment of the costs* of such a convergence.
- Determination of the plan’s *feasibility* and securing of *political approval*.
- *Implementation* if appropriate.

4 Conclusion

We have worked out some recommendations, which we summarize here shortly:

The Policymaker or Regulator should:

- Re-assess the broadband market to determine whether political rollout targets are commercially viable, develop/adapt policy as appropriate.
- Implement a review of regulations faced by network operators to ensure that these reflect the changed market situation and rebalance obligations as found to be necessary.

- Determine whether the provision of specific (free) OTT services represents unfair competition and is detrimental to the development of the market as well as take action as required.
- Determine whether a lack of competitive pressure on the fixed broadband providers is preventing the market from functioning. If so, take steps to open up the market to more competition.
- Define a framework for net neutrality regulations to enable commercial service offers and cost-oriented market pricing while protecting the consumers' interests.
- Update the license/operating conditions of existing operators and service providers to reflect the findings of this study concerning net.
- At a minimum, establish coordination procedures between financial service regulation, data privacy and protection regulation, broadcasting/publishing regulation (e.g. PPP Law) and communications regulation to reflect the convergence resulting from the internet and to ensure that all regulatory measures are consistent and coherent. At a maximum, consider the integration of broadcasting, communications (and publishing) regulation.

Literature

AdjustYour Privacy (2012): <http://adjustyourprivacy.com/privacy-tools/>.

Aghion, Bloom & Blundell (2005): Competition and innovation: an inverted-U relationship, in *The Quarterly Journal of Economics*, 120 (2), 701-728.

Albrecht (2013): Großer Schritt für starken EU Datenschutz, <http://www.janalbrecht.eu/presse/pressemitteilungen/grosser-schritt-fuer-starken-eu-datenschutz.html>.

Arab News (2013): CITC: WhatsApp to be blocked before Ramadan, <http://www.arabnews.com/news/454997>.

Bachman (2011): Web Privacy Self-Regulation Accelerates, in *Adweek*, <http://www.adweek.com/news/technology/web-privacy-self-regulation-accelerates-125397>.

Bort (2013): Security Researchers Prove That Dropbox Can Be Hacked, in *Business Insider*, <http://www.businessinsider.com/researchers-prove-dropbox-can-be-hacked-2013-8>.

Brown (2001): MSN Messenger fails for more than 10 million users, in: IT World Canada, July 2001, <http://www.itworldcanada.com/article/msn-messenger-fails-for-more-than-10-million-users/30632>.

BSA (2013): BSA (Broadband Software Alliance) Global Cloud Computing Scorecard Study 2013, www.bsa.org.

Cabinet Office & Deltica (2012): British 2012 Report on Measuring the Cost of Cyber Crime.

Cisco (2013): Cisco Visual Networking Index (VNI) 2013.

Computer Fraud & Security (2013): European outages hit mobile and Internet services, in *Computer Fraud & Security*, Issue 9, 20.

Curry (2009): Instant-Messaging Security, in *Computer and Information Security Handbook*, 453-466.

David, P. A. (1985): Clio and the economics of QWERTY, in *American Economic Review* **75**: 332-337.

Davidow (2012): Overconnected: The Promise and Threat of the Internet, Delphinium.

EC (2012): Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the protection of individuals with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation), http://ec.europa.eu/justice/data-protection/document/review2012/com_2012_11_en.pdf.

EC (2014): Self-regulation for a Better Internet for Kids, <http://ec.europa.eu/digital-agenda/en/self-regulation-better-internet-kids>.

Engel (2007): Sichere Nachrichtenübermittlung mit Off-the-Record-Messaging, <http://public.tfh-berlin.de/~s30935/off-the-record-messaging.pdf>.

ENISA (2009): Cloud Computing: Benefits, risks and recommendations for information security.

ERG (2007): ERG COMMON POSITION ON VoIP ERG (07) 56rev2 December, 2007.

EU (2002): 2002 New Regulatory Framework.

EU Directive on Electronic Commerce (2000): EU Directive on Electronic Commerce.

Galdy (2008): Soziale Netzwerke: Datenschutz mangelhaft, <http://www.cio.de/knowledgecenter/security/859286>.

Gold (2012): Security in VoIP, in *Network Security*, March 2012, 15.

Gross (2013): Snapchat: Sexting tool, or the next Instagram?, <http://edition.cnn.com/2013/01/03/tech/mobile/snapchat/index.html>.

iDA (2010): Consultation on Policy Framework for Net Neutrality, <http://www.ida.gov.sg/Policies-and-Regulations/Consultation-Papers-and-Decisions/Store/Consultation-on-Policy-Framework-for-Net-Neutrality>.

Informa (2013): Telecoms and Media Report, 2013.

Ioannou (2013): Internet Security Fundamentals, Boolean Logical Ltd.

IT News Africa (2013): Malware, a growing threat to Smartphone users, <http://www.itnewsafrika.com/2013/07/malware-a-growing-threat-to-smartphone-users/>.

Knieps & Weiß (2007): Regulatory agencies and regulatory risk, <http://www.econstor.eu/bitstream/10419/32323/1/550550895.pdf>.

McKinsey (2011): Impact of Internet on Economic Growth, McKinsey Global Institute, 2011.

Mickus (2013): Technology: FTC and self-regulatory frameworks regarding online behavioral advertising, in *Inside Counsel*, <http://www.insidecounsel.com/2013/10/18/technology-ftc-and-self-regulatory-frameworks-rega>.

OIF (2014): Office for Internet Safety: Industry Self-Regulation in Ireland, <http://www.internetsafety.ie/website/ois/oisweb.nsf/page/regulation-en>.

Ovum (2013): Mobile Messaging and Traffic Forecast, 2013.

Pinter-Krainer (2013): Google to include user photos in web advertising, <http://www.onenewspage.com/n/Business/74w2qvnnf/Google-to-include-user-photos-in-web-advertising.htm>.

Prevett (2013): How to manage the malware threat to business, in startups, 2013. <http://www.growingbusiness.co.uk/managing-the-malware-threat.html>.

Safesoft (2014): Solutions for Next Generation Networks, http://www.safesoft.eu/safelims_ngn.htm.

Schumpeter (1942): Capitalism, Socialism and Democracy.

Skype (2010): Comments to the Consultation Paper issued by the Info-Communications Development Authority of Singapore (IDA) on Net Neutrality, 11 November 2010, https://www.ida.gov.sg/~media/Files/PCDG/Consultations/20101111_Netneutrality/Skype.pdf.

Storm (2013): 10 yrs later, DHS still plagued with cybersecurity, critical infrastructure problems, in: Computerworld, Darlene Storm, <http://blogs.computerworld.com/cybercrime-and-hacking/22800/10-yrs-later-dhs-still-plagued-cybersecurity-critical-infrastructure-problems> .

Symantec (2013): Internet Security Threat Report 2013.

Techcrunch (2012): Techcrunch, December 2012.

ULD (2011): Dialog with Facebook does not hinder data protection enforcement, <https://www.datenschutzzentrum.de/presse/20110930-facebook-enforce-privacy.html>.

Unuth (o.J.): Security Threats In VoIP, <http://voip.about.com/od/security/a/SecuThreats.htm>.

Walter (2009): Internet Security, in *Computer Information Security Handbook*: 93.

Widmer (2009): Cloud Computing and Data Protection, in: Information Technology, July 2009, <http://whoswholegal.com/news/features/article/18246/>.

Williams (2013): Study: social media malware on the rise, in *Security*, Posted on Monday, June 3rd, 2013.

Wing & Patil (2009): VoIP Security, in *Computer and Information Security Handbook*, 558-559.

WRSC (2014): World Resources Sim Center, www.wrsc.org.

Zhang, Li & Zheng (2004): Intrusion prevention system design, in *Computer and Information Technology*, 386-390.