

European Law and Regulation of Mobile Net Neutrality

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Abstract

"For the vast majority of consumers, the horror of getting a terribly expensive bill acts as a powerful deterrent to enter the Mobile Internet ... Users expect the mobile web to be as open and easy to use as the fixed line"- Commissioner Reding, Speech/08/70(2008)

Mobile is a rapidly growing and potentially major element of the future Internet, and its environment cannot be sensibly considered in isolation from fixed networks [\[2\]](#). A note on terminology: Europe uses the term Mobile Network Operators (MNOs) while the United States uses 'wireless' Internet Service Providers (ISPs) [\[3\]](#). 'Wireless' is somewhat more open in the United States. In Europe, mobile has always made special pleading for forms of self-regulation, as we will see. The article introduces mobile broadband, then considers net neutrality in the fixed environment including the new laws passed in November 2009 in the European Parliament, before considering the mobile net neutrality debate, the degree of price control regulation exerted on European mobiles and the MNOs' vigorous rear-guard anti-regulation defence. Finally, I look at the effects of this regulatory asymmetry and whether MNO calls for mobile to be treated differently from other ISPs can be justified. I conclude by examining what the effect of price and content control on mobile is likely to be for incentives for fixed ISPs and produce a result that I describe as the 'fixed' strategy.

1. Mobile Internet: Content and Control

Mobile services have been used to serve web pages to European users since approximately 2000, though the hype over early adoption disguised technical problems that have taken almost a decade to overcome [\[4\]](#). The first generation of mobile Internet devices used Wireless Application Protocol (WAP) to deliver specially programmed, normally simplistic and graphic-poor pages over narrow-band networks, in Europe dominated by the standard Global System for Mobile (GSM). The screen is typically very small, and the pixilation (granularity) of the screen means that photographic images are cartoonlike. Text services (short messaging services or SMS) have developed as 160-character text messages, rather than WAP-enabled chat or listserv. In fact, sending a text

in the twenty-first century is rather reminiscent of sending a telegraph message in the nineteenth century - and in terms of cost per bit, further reminiscent (a 160 character message costs up to 20 euro cents).

These 2G networks delivered data at about 65% of the speed of the modems used for fixed-line computers circa 1994/5. The simple 2G phone offered 64k colour screens, access at up to 27 kbps to '2.5G' networks and larger screen size. [5] The third generation - especially SmartPhones - and the data-card connected personal digital assistants and laptop computers are all enabled to receive web pages without re-coding for WAP. These are therefore the first portable Internet devices. Accessing the Internet over mobile networks at perhaps 1Mbps while stationary and outdoors, and with WiFi up to several Mbps, they can approximate the wired Internet use experience. With larger full-colour screens, they are fully specified Internet devices for image, sound and video. Note that in late 2008, only 13% of phones shipped to suppliers were SmartPhones, so 87% had inferior browsing experiences even if technically able to support 3G. [6] The surge of interest in the iPhone3G when launched in July 2008, followed by similar devices from Samsung, Nokia, HTC and others, means that in 2010 mobile Internet usage is taking off. Additionally, millions of European users- especially students and renters in their twenties who do not want a fixed phone line and long contract - use 3G mobile 'dongles' with their laptops as their main domestic Internet access. The mobile Internet is a new and rapidly growing market.

The first European commercial 3G broadband networks for mobile were those of Hutchison Whampoa's '3' service in the United Kingdom and Italy. [7] By end of 2004, most EU member territories had metropolitan broadband wireless services - by 3G and WiFi 'hotspots'. Mobile phones could then be used to access the public Internet and download graphic files, sound and video clips. They can be used for adult services and premium services, such as the 3 'G's: girls, video gaming and gambling, however the 'walled garden' for users came with strong content filters that have restricted mobile operators' access to that revenue.

From the consumer's point of view, the main differences between generations of mobile technology are characterized by the different applications they facilitate, which can be summed up as follows:

- 2G allows WAP and SMS applications;
- 2.5G allows multimedia messaging service including low-resolution video games;
- 3G allows rich media, streaming, full-motion high-resolution video.

This means that the policies associated with material accessed via fixed Internet access might also be raised by mobile access to the Internet, with net neutrality, harmful content, spam, viruses and criminal use of networks all possible. Such technological advances have also led to the development of new business models for network operators, which focus largely on collecting revenue from online content. Generally, the provision of content is organized in three major approaches, which may be mixed:

1. 'walled garden' - the MNO creates a users' space for wholly controlled content and services, some of which may be bought in from third-party content providers; the 'walls' around the 'garden' keep consumers tied to these offerings;

2. open access - any website or services over any mobile operator that allows Internet access and has a suitably fast mobile network for multimedia services;
3. semi-open access or web-access approach - as in NTT DoCoMo's i-mode service. This is more open than a 'walled garden' and uses connection to any web-enabled site via its proprietary software, but has two tiers of accessible sites and business partners, where open Internet access is available but 'walled garden' content is accessed more easily.

The different models have obvious implications for the power of the operator within the value chain, with the last offering full functionality and the ability to create a vertically integrated 'walled garden'. Other actors, such as device manufacturers or publishers, also can act to provide portal services and act as aggregators (e.g. Nokia's *Club Nokia* or *Apple's App Store*) [8].

The roll-out of European 3G networks has been slowed by overspending on licences, limiting the funds available for solving technical problems to bring a new and difficult technology to market. [9] Higher data rate services than these are available in some countries, notably South Korea and Japan, but Europe is still behind. The data rate - and its pricing, which goes with network capacity for high bandwidth - is essential in setting the expectations of customers and sales. The data rate sets not just the volume of sales but also the type of content that will sell. Simpler content with lower bandwidth demands such as ringtones and music have been the leaders. In Europe, 3G is being enhanced with next-generation (3.5G) enhancement HSDPA. [10] HSDPA became more widely available to the mass market in 2008-9.

One major trend concerning data rates which has delayed multimedia take-up is the price of data transfers over mobile, as measured against disposable income. Price has been used by MNOs as a way of limiting demand, to protect existing network capacity and delay faster high-capacity networks until existing networks have repaid their capital cost and returned profit (this is akin to telephone companies that resisted broadband in the mid-1990s because they had invested in ISDN lines). Mobile data transfer costs for use of the network to download content or for streaming remain high, so users tend to minimize the amount of data transferred. Moreover, the markets targeted initially for much mobile content are teens and twenty-somethings, [11] with limited income, rather than business. This has acted as a major brake on content sales.

The development of mobile broadband has been much slower than anticipated since the 3G auctions were conducted in summer 2000, with mobile broadband 'taking off' in the period since 2007. In June 2009, benchmarking tests by Epiteiro showed UK broadband running at about 0.9 Mbps in evening peak time, a rate below that which would permit video streaming of the BBC iPlayer. The delays to the network also make it unreliable for video gaming or VOIP [12]:

"users received on average 24% of the maximum 'up to' headline speeds advertised.... During peak hours (6 pm to midnight) speeds dipped by approximately 20% ... web browsing which appeared to be 34% slower than on fixed ADSL connections. Ping times, an important metric for online game playing came in at around 150 ms which is too high for acceptable gaming performance."

Mobile is increasingly substituting for fixed Internet access for many consumers. Lewin, Williamson and Cave state that 'Competition between suppliers using fixed fibre access networks and those using mobile broadband networks for the spend of those at the margins' [13] will be a significant feature, with low-cost low-usage customers opting for mobile broadband - as 64% of Austrian consumers have done. This is despite Cisco's predictions that mobile broadband will account for 0.1-0.3% of total traffic as far as 2012. [14] This limited backhaul demand from fixed networks nevertheless means that they 'expect mobile broadband to offer both a partial substitute for fixed broadband and a complement'. [15] That means it must claim to be a real Internet alternative, not simply a slow and clumsy supplement.

If mobile is replacing fixed connections, then consumers will expect to achieve comparable access to their favoured applications, as well as web browsing and email more generally. If mobile will not, or cannot, offer that comparability, the whole enterprise appears designed to persuade consumers to accept third-best. Television over the mobile device, or P2P file-sharing more generally, will appear patchy at best if streamed over the mobile Internet connection, at least using current technologies and with current network quality and speed. There are of course technological and regulatory short cuts such as broadcasting TV over the Digital Video Broadcasting - Mobile (DVB-M) frequencies, which would mean a mobile device is both an Internet access terminal and a TV set. However, at face value, the current claim is that mobile Internet access can replace fixed for many consumers. If there are real and tangible differences that can never be bridged (or not until Long Term Evolution [LTE] is introduced over the next several years, having been deployed in Sweden and the USA in 2009-10) due to the technological, economic and social constraints of the mobile device, it would be helpful to make plain to consumers what the offer really is.

There is the same pair of problems with mobile as with the fixed Internet, though the problems are for mobile more profound. First, quite clearly speeds are too low and quality too inconsistent to enjoy all the benefits of Internet applications. Second, the value realized by users is too low currently to guarantee future investment in a fast open Internet as opposed to a walled garden of preferred content that can be offered at higher quality in return for greater returns to the network provider. Both these problems - speed and revenue - are compounded in the case of mobile by the number of networks. Where fixed has one or at best two networks to each consumer, mobile offers three, four, five or six (seven in the case of India), depending on national decisions on how many networks to licence. Even with some limited network sharing, it means that mobile networks are taking smaller slices of the mobile pie than fixed operators of their own. It looks like these sums simply will not add up - that the more successful operators might speed up their walled gardens while the less successful operators eke out a living with network sharing and very low data quality.

It is stating the obvious to note that any net neutrality ruling that did not affect wireless carriers would immediately create asymmetrical incentives that would divide the public Internet into mobile 'walled gardens' and fixed open Internet customers. That would most probably increase the mobile Internet's differentiation from fixed service (assuming technological changes at the same pace for both mobile and fixed). In such an asymmetrical world, there would be two classes of Internet access: the true Internet on fixed and the 'walled garden' plus whatever open Internet was permitted on mobile. That

is why the August 2010 news [16] that Google was joined with Verizon [17] in accepting that net neutrality should not apply to wireless in the USA led to a storm of protest that this meant no neutrality in the form of Internet access that is growing fastest, and on which Apple's iPhone policies and exclusivity on one network were already causing enormous controversy.

2. Net Neutrality: Definition and New European Laws

While issues about potential discrimination by ISPs have been current since at least 1999 [18], the term 'network (net) neutrality' was coined by Tim Wu in 2003 [19]. In the period since, the debate was dismissed as 'a solution in search of a problem' or 'an American problem due to abandonment of network unbundling' by various interests close to incumbent ISPs. However, the increasing evidence that the maturation of technology and copyright business models meant that the Internet could become a full-definition video distribution mechanism meant that the 'problem' has continued to grow. Indeed, by 2006 Charlie Dunstone of TalkTalk, one of the most innovative ISP owners and now second-largest in the UK, told Ofcom's Annual Conference that he was receiving constant death threats from computer gamers whose connections his ISP was throttling explicitly in reaction to network capacity constraints [20]. Two years later, British Telecom, the former UK monopoly (whose unbundled lines TalkTalk retails) was throttling the BBC's iPlayer service regularly [21]. Network discrimination had arrived, if not net neutrality regulation.

The review of the European Electronic Communications Package had begun just before the "Dunstone death threats" were emerging, and in its initial explanation of its reasons to review the raft of 2002 Directives [22], the Commission noted the US debate but did no more than discuss the theoretical problem [23]. Over 2007-8, the volume of regulatory reform proposals in the USA, Japan, Canada and Norway had grown along with consumer outrage at ISP malpractice and misleading advertising, notably over notorious fixed and mobile advertisements (e.g. Vodafone for "unlimited 14.4Mbps broadband" in 2008) which presented theoretical laboratory maximum speeds on a dedicated connection with no-one else using it and subject to 'reasonable terms of usage' - which meant capacity constraints on a monthly basis, some of these on mobile as low as 100MB download totals (as I write, Hutchison 3 is advertising nationally its "massive 1GB monthly cap").

By May 2009, the European Parliament voted down the reforms at First Reading prior to parliamentary elections in June. This clearly signalled the need for compromise by Commission and Council of Ministers. Therefore, amendments on consumer transparency and network openness were offered to the Parliament in the Conciliation process, collected together by the European Commission in November 2009 in its 'Declaration on Net Neutrality' [24], appended to Directive 2009/140/EC:

"The Commission attaches high importance to preserving the open and neutral character of the Internet, taking full account of the will of the co-legislators now to **enshrine net neutrality as a policy objective and regulatory principle to be promoted by national regulatory authorities** (Article 8(4)(g) Framework Directive), alongside the **strengthening of related transparency requirements** (Articles 20(1)(b) and 21(3)(c) and (d) of the Universal Service Directive) and the creation of **safeguard powers for**

national regulatory authorities to prevent the degradation of services and the hindering or slowing down of traffic over public networks(Article 22(3) of the Universal Service Directive)." (author's emphasis)

There in summary are the concerns about ISPs discriminating against content they dislike, or in favour of affiliated content. The new laws which become effective in Member States in May 2011 [25] states that Member States may take action to ensure particular content is not discriminated against directly (by blocking or slowing it), or indirectly (by speeding up services only for content affiliated with the ISP). The reality is that this declaration, helpful though it is in clarifying the legal situation, will rely heavily on the implementation at national level and proactive monitoring by the Commission itself. Nevertheless, it lays out the principle of openness and net neutrality. The Commission itself adds that it will introduce "a particular focus on how the 'net freedoms' of European citizens are being safeguarded in its annual Progress Report to the European Parliament and the Council" [26].

Member States largely opposed the declaration, and it was only appended as a sop to the European Parliament, which had taken up the consumerist and democratic cause of neutrality, much to the annoyance of the telecoms technical community and economists who insisted it was solving a problem which did not exist, and could not in the super-competitive world of European telecoms (note Mme Reding's rebuttal of this false world view in the opening quotation). This has led to a flurry of consultation on the implementation of net neutrality. Ofcom's 'so-called net neutrality consultation' (it is unclear whether they doubt net neutrality or the need for consultation or both) closed on 9 September 2010 [27]. The European Commission closed its consultation period 30 September 2010 [28]. The club of national regulators, BEREC [29], met in Amsterdam 30 September 2010 [30], in part to discuss their response to the European Commission on net neutrality. The FCC's comment period on their latest Notice was 1 October 2010 [31], specifically asking for answers to regulation of managed specialized services, and wireless net neutrality. It is this last point on which this article is concentrated, but as you will surmise from this flurry of autumn 2010 consultations, much is changing at great speed in the legal response to net neutrality.

3. USA: Wireless Carterfone?

The issue of wireless net neutrality has created more controversy in the United States, where interconnection charges between mobile and fixed are symmetrical and 3G wireless has rolled out more quickly in terms of data use. In particular, the launch of the iPhone by Apple created a sensation for data users, and became the must-have item of 2007. Its launch was controversial, first because it was not originally a 3G phone, second it did not incorporate WiFi and third it was tethered to a single network (AT&T Wireless), which has led to continued calls for the FCC's 'Four Freedoms' to be applied to wireless. [32] The market for 'cracked' iPhones anecdotally appears to have been enormous, with iPhones being exported to other countries prior to their introduction there. The tethered nature of the iPhone appears to have concentrated minds on the fact that the fixed ISP rules just don't apply to mobile: devices are blocked from networks, technologies are excluded,

content is filtered and overall the environment is a 'walled garden' not an open access platform. That inevitably causes significant policy issues to arise.

Tim Wu in 2007 issued a report on net neutrality for US wireless: 'to examine what carrier practices may be harmful for consumers or society.' The report makes four major recommendations:

1. 'Cellphone Carterfone' - The basic and highly successful Carterfone rules allowed any consumer to attach any safe device to his or her phone line through a standardized jack.

I note that this is in part a response to the tethering of devices using network rules that caused such a controversy with the Apple iPhone on AT&T's network. Soon thereafter, Google launched an Android open API phone on T-Mobile's network, which suggests that some kind of competition is occurring in the market without regulation. This is of course at the heart of the Microsoft competition litigation.

2. Basic Network Neutrality Rules - Wireless carriers should be subject to the same core network neutrality principles as fixed operators. Carriers can tier or meter pricing for bandwidth without blocking or degrading consumer choice.

3. Disclosure -In addition to the disclosure of areas lacking coverage and rate-plan information, carriers should disclose fully, prominently and in plain English any limits placed on devices and bandwidth usage or if devices are locked to a single network.

Later, I will consider the solution to this transparency problem presented in the UK mobile broadband code.

4. Standardize Application Platforms - Wu suggests the industry should re-evaluate its 'walled garden' approach to application development, and work together to create clear and unified standards for developers. [\[33\]](#)

This is where an open operating system such as Google's Android can change the nature of mobile development. Rich Miner of Google describes it as:

"A Linux-based mobile phone platform including an operating system, middleware, services and applications - everything you need to build a mobile phone. Open source software stack allowing extensive customization and commercialization; Mobile-centric design optimized for always-on, resource constrained embedded platforms; Rich and robust APIs to enable mobile mash-ups." [\[34\]](#)

Miner also described the 'walled garden' environment that has been the Internet experience: "this was the world we found: billions of mobile users and a mission to connect with them; tools for mobile development that were difficult to use; constrained devices; mobile browsers that delivered a poor experience; complex paths to get our applications to our users." These are undoubtedly the experiences of many users. He describes six drivers of a change, a change fostered by the Open Handset Alliance which Google helped to organize:

- Device innovations are reducing hardware constraints
- 3G is now delivering always on wireless broadband
- Phones have browsers with desktop level capabilities
- People who know software are driving the platforms
- Developers can get mobile apps directly to consumers
- Controlled stacks being replaced by long-tail content.

Google's interest in net neutrality on wireless is not new. As a result of concerted lobbying of the FCC by Google, corporate actors with similar open access strategies and public interest groups, the FCC in 2008 introduced special open access rules for the released broadcast 700MHz spectrum. [35] Prior to the auction, Verizon had charged that offering open access conditions would reduce the price of the spectrum to any private bidder that won, and that this interference was both unjustified and unconstitutional. [36] However, it tactically withdrew its case prior to winning the auction with a price only 3% above Google's reserve price for the spectrum (\$4.74b to \$4.6b). It remains to be seen whether the commitments secured from the auction winner, Verizon, will prove to be another AOL-style 'Kingsbury commitment' - or a one-off sop to net neutrality advocates that is rapidly forgotten as the industry attempts to erect further walled garden barriers.

Problems with 'walled garden' mobile are not confined to Europe and the United States. Michael Geist provides an excellent analysis of the ongoing accusations from content owner The Weather Network (you need good forecasts in Canada, and that is its content!) against wireless carriers blocking content. The basic problem is that content sites that do not make a 'walled garden' deal with the wireless carrier find their web pages 'rendered' into a different format by the carrier, with different advertisements substituted. This is a whole different level of discrimination than fixed ISPs are known to have engaged in. They claim:

1. Wireless resellers blocking advertisements from a mobile site
2. Wireless carriers stripping out tracking codes embedded in web pages, thereby limiting ability to deliver advertisements
3. Wireless carriers establishing 'walled gardens' that provide preferential access that reduces data charges for sites within the walled garden
4. Forcing users through the wireless carrier homepage when accessing the Internet on feature phones
5. Prior approval of applications for use on smart phones
6. Extra fees for text messages that include ads
7. Wireless carriers limiting to whom ads in text messages may be sold [37]

It appears surprising, therefore, that mobile operators claim everything in the garden is rosy, that their new 3G 'dongles' (plug-in USB connected wireless modems) can offer a genuine substitute for fixed-line access, and that speeds can be 'up to 14.4 Mbps', which would be genuinely as fast as the theoretical maximums of fixed access. The cap on monthly usage would not suggest quite the confidence that mobile networks claim, with 3 GB or 5 GB quite common high-usage caps, and 1 GB even more frequent for the casual user, based on current advertised rates in the United Kingdom. [38]

4. UK Marketing Code of Conduct

The slow speed and unreliability of mobile broadband led Ofcom to pursue with the mobiles a formally self-regulatory scheme to prevent misleading consumer advertising and marketing of their limited broadband offer. The European Commission noted that the existing fixed ISP Code was not used [39]:

"[In] July [2008] Ofcom published a new voluntary code on broadband speeds. Some 43 ISPs, covering over 90% of broadband customers, had signed up to it by December 2008 ... This Code, however, applies only to fixed broadband and not to mobile broadband, where QoS issues are also highly relevant in particular because of the instability of transmission speeds depending on traffic."

On 1 June 2009, Ofcom released the Mobile Code of Conduct, including information on coverage, as well as the factors that impact download speeds, and pricing [40]. In a section marked 'Monitoring' - somewhat incongruously for self-regulation but in line with its fixed ISP co-regulation 'lite' announced in 2008 - it states:

"Ofcom has been fully consulted throughout the process and our Director of Consumer Policy, Claudio Pollack, said: 'Ofcom welcomes the mobile operators' commitment to give their customers better information about mobile broadband services. We will be undertaking further research and monitoring of mobile broadband to check that consumers' needs are being met.'"

This suggests MNOs are on notice to improve their service and make their customer advertising more truthful and less misleading. The Code of Conduct itself is remarkable for its brevity. It states [41]:

'Principles of Good Practice for selling and promoting Mobile Broadband

...The principles cover:

- Coverage
- Factors that determine download speeds
- Pricing Transparency

Coverage

1. Make coverage information available via a web site (e.g. a map or a post code checker).

Promotion of factors that determine download speeds

2. Download and upload speeds that are given in advertising and promotional material must be achievable by end-users and should be accompanied by an explanation that speeds are variable. An indicative range of download and upload speeds under normal conditions can be given.

3. The factors that determine download speeds should be explained (e.g.

distance from mast, surrounding environment, number of other users, network connection).

4. A glossary should be made available describing technical mobile broadband terms used in customer literature and on on-screen indicators (e.g. 3G, HSDPA).

5. Translate raw data speeds into some real life examples such as: 2 Megabits per second delivers a 5 minute music track in approximately 20 seconds.

Pricing transparency

6. Pricing information should set out the relevant tariff options, including a description of any fair usage limits. There must be an explanation of the consequences of the usage limit or fair usage allowance being exceeded.

7. Where operators make references to Megabits, Megabytes and Gigabytes in close proximity, they should give an explanation of the differences. A description of what, for example, a Megabyte of data usage allows should be provided.

8. Pricing information should include either the roaming charges or a hyperlink to where the roaming charges are set out (which should also set out explanations of what a Mb of usage allows description of fair usage limits and any other relevant information).'

Given that the entire Code is only 365 words, it is presumably a first draft, and details can be added with more 'close consultation' with Ofcom. For instance, there is no mention of upload speeds or of peak congestion (except that allusion to 'number of other users'), which is a huge issue with mobile, as the EC pointed out.

This is thus far the extent of regulation of mobile broadband, and it is a very sparse self-regulatory scheme. The regulation of mobiles in this way is not a surprise to many who have seen the mobile sector declared Europe's telecoms success story in the past two decades. Given the intransigence of fixed-line incumbents to competition through the 1990s, it is perhaps understandable that the member states saw mobile oligopoly as a success story, with rapidly increasing penetration and falling prices. Viewed with hindsight, we can see that social network use of cellular mobile technology was the driver rather than particular European MNO innovation: mobile is a global success story, with vast oligopoly profits and high charges in most countries. It was once said that commercial television was 'a licence to print money': self-regulated MNOs appeared to be the new way to make billions. In the next section, we will see that mobile termination monopolies permitted exponentially higher charges to fixed operators than they could charge back to mobiles, the European mobile subsidy that drained much of the profitability out of fixed phone companies.

5. Mobile Call Termination and the Fixed Subsidy to Mobile

A mobile termination monopoly endures in telecoms, in that you can only call me by routing that call through my mobile network. Mobiles have been able for many years to maintain very high termination prices even under regulation (and especially where not), in contrast to regulated fixed prices. MNOs in Europe have limited competition, with between three and five networks in major markets. The costs of terminating calls on mobile networks, previously unregulated, have recently been examined and regulated particularly vigorously in the United Kingdom, even though regulated termination costs are now lower elsewhere. [42] The European Commission states:

"Mobile termination rates are also typically 10 times higher than fixed termination rates ... [this] cannot be justified by differences in underlying costs, networks or national characteristics. They are an indirect subsidy that benefits mobile operators with a large market share to the detriment of smaller and fixed-line operators. They also direct funds away from critical investments like upgrades to high-speed internet networks, and hinder innovative services like converged fixed-mobile products and competitively-priced bundles of calls." [43]

These termination charges represent a hidden subsidy paid by fixed ISPs to their mobile cousins. Small operators of mobile networks have called for the full abolishment of termination charges, because high terminating rates mean largest companies benefit most. Hutchison 3 has no 2G termination monopoly to exploit with its network, in fact it rents its 2G network and operates as a virtual MNO, making margins only on its 3G network termination. Hutchison 3 is the 'rogue' operator amongst the UK mobiles, because it is lobbying to remove the termination charges it pays its incumbent 2G rivals (T-Mobile which merged with France Telecom's Orange [44], Telefonica's O2, and Vodafone). Its UK Chief Executive Kevin Russell launched a 'Terminate the Rate' campaign with BT on 20 May 2009, stating that:

"The amount of legal authority and PR mobilized by the Big Four is unbelievable ... We get subsidised by BT but we want the subsidy to go." [45]

The reason is that 3 customers call the bigger networks much more than their customers call it, so 3 pays more in termination at the above-cost charges the 'Big Four' are permitted (note that Orange and T-Mobile merged in summer 2010, creating a 'Big Three').

The effect of compulsory subsidy by European fixed-line customers of their mobile friends, through termination rates ten times above fixed-to-fixed rates, is to increase mobile penetration above cost-oriented levels, such that people who would have chosen to make no call or a fixed-line call, instead used a mobile to either receive a call or send a text: the very cost-conscious have a mobile phone whereas in 'bill and keep' countries they may not. Think of it as a form of unexpected universal service for the poor. The model encourages prepaid as well as monthly subscriptions, so that twice as many UK customers have prepaid SIMs as monthly contracts, though this is highly variable by country, so that France has twice as many monthly contractees as prepaid customers. The more prepaid customers, the lower the monthly minutes used (i.e. lower actual phone utility). [46] Astonishingly, the European average is about 1 minute for every 3 minutes used in the

United States.

In the United States, where termination rates are the same as fixed-line rates (which means networks effectively 'bill and keep' - peer to swap traffic), average minutes per month are 700-800, and subscriber penetration is 84%, though note that Canada with a less competitive market for mobile has much lower penetration and usage (62% and 430 minutes). [47] It may be that penetration growth in 'bill and keep' countries has been slower than in calling party pays (CPP) systems, though figures are obscured by the propensity of more price-sensitive customers in CPP systems to buy multiple SIMs for different networks, such that penetration exceeds 100% by significant levels (otherwise explicable only by many people having own-use and office-use mobile phones, itself a measure of unexpected honesty or insecurity in job tenure). [48] However, overall the statistics appear to indicate that prices lowered faster and earlier in the United States than Europe, by 75% in 1996-2001, hence that very high usage rate, and that penetration achieved saturation slightly slower. Summarizing the US experience as compared with Europe, I draw the following six conclusions:

- Fixed networks have not subsidized mobile, as the 'bill-and-keep' interconnection regulation has ensured parity;
- Mobile penetration levels are almost identical at a saturation 82%;
- Mobile usage per customer is three times higher than in Europe;
- Networks offer continental coverage at identical prices, while in Europe, the hypothetical Euro-traveller would pay 26 countries' roaming charges while doing business in the Internal Market;
- Universal service is maintained by coverage requirements on licences, [49] and spectrum licences remain sufficiently attractive that the open access 700 MHz D Block auction was successfully concluded, though critics claim that it failed to achieve openness via a new market entrant or to garner maximum price for spectrum [50];
- The lack of a special pleading regime for economic pricing of mobile termination has contributed to an inclusive discussion of net neutrality for mobile in the United States, in contrast to that in Europe.

In the EU the average mobile termination rate is 8.7 euro cent (and as high as 15.09 cent in Bulgaria). [51] India's telecoms regulator, TRAI, in March 2009 announced a slashing of the mobile termination rates by a third - from 0.3 rupees per minute to 0.2 rupees per minute on local calls, effective April 2009. That is 0.32 euro cent per minute (or 2% of what the Bulgarians pay). Mobile monthly usage in India has increased in 2003-8 from 326 minutes to 464 minutes, almost twice EU levels. Commissioner Reding stated [52]:

"High mobile termination rates are thus an indirect subsidy for the larger mobile operators - a subsidy that has to be paid by all fixed operators, by smaller mobile operators and by all consumers. While there may have been a greater tolerance of high mobile termination rates when mobile networks were first being rolled out across Europe, they can no longer be justified today, at this advanced stage of mobile market development."

This explains why US users make much larger volumes of calls, and mobile companies

who cannot charge higher termination to fixed operators are therefore not paid the European 'mobile subsidy'. Mobile companies have fought a very long running battle to maintain their high prices, in the case of the United Kingdom for instance it is now over a decade old, but this EC activity indicates that this regulatory episode is drawing to a close. This led the EC to issue an Article 7 Recommendation on mobile termination rates following consultation, under its responsibilities to coordinate a single market for communications within the terms of the Framework Directive. [53] The issuing of a recommendation requires NRAs to take 'utmost account' of EC recommendations, in conjunction with the requirements to ensure accurate cost accounting for wholesale and retail markets. In this case the Recommendation requires that 'NRAs should ensure that termination rates are implemented at a cost-efficient, symmetric level by 31 December 2012' (para 12). [54]

Note again the Commission's argument on the first page of this article: high mobile voice termination rates direct funds away from critical investments in fixed fibre access.

6. Regulatory Symmetry and the 'Fixed Strategy'

In mobile markets, the 'dongle' has led to a surge of substitution of fixed broadband by mobile, as well as new broadband users, with over 100 million 3G broadband users (both 'dongles' and phones). Will mobile broadband users be allowed to exploit their dongles to use the Internet openly as they can on their fixed ISP? *The Economist* stated:

"The growth, however, comes with a couple of big drawbacks for the operators. One is loss of control. Subscribers can do what they want: the operator is merely a 'dumb pipe' to the internet. Next, rates have been falling quickly ... 'Network neutrality', the principle that operators should not discriminate between different forms of traffic, will not succeed on mobile networks, says Holger Knöpke of T-Mobile." [55]

The argument that there are sufficient networks to compete away such a hopeless (from the universal open viewpoint) scenario is based on the success of open wireless platforms offered in particular by the 3G entrants in Europe. While most 3G licensees are extending their 2G networks, we saw that Hutchison 3 began 3G service earlier, and has a more open service, than its rivals, marketing itself as offering Internet service at cheap rates via its 'dongle' and also Skype-to-Skype calls for free on its phone network. [56] I argue that 3 is the exception that proves the rule, as indeed does the United Kingdom. The UK fixed incumbent, BT, sold its mobile network to Telefonica in 2002, under pressure to reduce its debts. As a result, there is not only separation in the United Kingdom between wholesale and retail arms of the incumbent, but between the fixed and mobile incumbents, leading to a much more even regulatory and lobbying battle, even if Russell expresses amazement at the 'Big Four' and their legal expenses. Elsewhere in Europe, for instance in the homes of T-Mobile (Germany), Telefonica (Spain) and France Telecom, there is resoundingly less pressure to regulate the termination monopoly of the mobiles. The renegade 3 may put pressure on regulators in the markets it has entered (including Italy), but without an incumbent to make much bigger noises, all it does is show that in very specific, almost freakish, conditions, as in the United Kingdom, there is a real choice of 'walled garden' or

open access. More importantly that open access is at a price and coverage that makes it somewhat attractive to low-volume transient users.

The special pleading of mobiles, and the relaxed or incompetent regulation of their termination rates (depending on your viewpoint), is greatly to the detriment of consumers with fixed-line connections. The approximate number €100 billion keeps coming up:

1. It is the minimum number in what ECTA claims has been the cross-subsidy effect of distorted fixed-to-mobile termination rates over the past decade;
2. it is what the mobiles 'lost' on the 3G auction due to its timing at the height of the dot-com bubble (the total cost in Europe was substantially higher but the spectrum was never going to be given away);
3. it would make an enormous hole in the cost of getting every European household onto at least 50 Mbps VDSL broadband lines - even if the backhaul would still be a bottleneck. [\[57\]](#)

Should these three numbers be related? The regulatory purists would say no, the realists would say of course they are. The European broadband environment has been enormously distorted by these problems for the past decade, and arguably its one reason why competitive broadband has been patchy at best. The answer to that is to stop deceptive advertising and enforce net neutrality standards on ISPs including mobile, while Ofcom is still trying to avoid including mobiles in its preferred co-regulation. My position is rather more interventionist than most, based on a lack of belief that NRAs are effective at ensuring that consumers are well informed and competition works effectively, and therefore that minimum quality requirements should be necessary. Consumers are misinformed and misled by most ISPs, and competition works ineffectively in general. Of course many NRAs may ignore net neutrality requirements, and the Commission should be careful what it asks for and enforces in the new regulatory package. Therefore, I see a need to fire a legislative shot across the bows of all ISPs to ensure they conform to minimum 'net neutrality lite'. [\[58\]](#) If customers get what they pay for, they might be happier with ISPs.

This leads to some lateral thinking and what I term the 'fixed strategy' - a regulatory option for redressing the balance in the fixed-mobile debate while ensuring at least 'net neutrality lite'. How can ISPs make money on their fibre investments if they continue to over-promise and under-perform? Four options present themselves:

1. PHORM-type behavioural advertising, act as targeted advertisers and extract some of Google's revenue without directly charging them [\[59\]](#).
2. The 'Mobile' option: Discriminate and offer consumers walled gardens of 'approved' (i.e. prioritized) content - exclusive offers where possible, such as with Disney Channel, or the football FA Premier League.
3. Stop spending money on network intelligence and offer customers what they want, high-class Quality of Service without rationing.
4. The 'Fixed strategy'.

The United Kingdom is unique: an incumbent SMP operator, BT, which has no mobile (as opposed to wireless) network, has the Openreach structural solution. It also has a reasonably strong tradition of regulating mobile networks, over a twenty-year siege laid by the most expensive lawyers in London. Yet still the Competition Commission castigated Ofcom's latest attempts to regulate mobile termination. [60] So the 'Fixed' plan to invest in higher bandwidth without the need for behavioural advertising, QoS deployment or 'walled garden' portals is:

- Reduce mobile prices to cost - check Indian termination rates for cost;
- Fixed operators stop losing market share and interconnection charges
- They can invest in higher speed broadband as their advantage over mobile;
- Enforce net neutrality against mobiles too - if mobile broadband is the advertised 14.4 Mbps, they can give their customers the whole Internet.

What does this radical option do? It enforces a transparent cost-based technology-neutral settlement on the operators, and thus a transparent and open access solution for consumers. Will Ofcom and the European Commission do it?

7. Conclusion: Little prospect for mobile net neutrality in Europe

As regulation stands, mobile will be a walled garden for the most part, and fixed ISPs will either move towards that walled garden (reversing the historic strategy of AOL) or a gulf will open between the two types of access. European mobile is likely to offer a safer and more sanitized experience though with less surprises and innovation. US observers may think that European 'lite' net neutrality is a long way backwards from their debates, but it is also a long way forwards from the current situation in most EU countries for fixed ISP access, and for mobile.

[1] School of Law, Essex University.

[2] Generally note Marsden, C. (2010) Net Neutrality: Towards a Co-regulatory Solution, Bloomsbury Academic at Chapter 7 and references therein.

[3] I will use the terms interchangeably, and when I refer to WiFi or WiMAX alternatives to mobile or wireless networks, I will make that specifically clear. Europeans often state 'wireless' when they mean 'non-mobile' - i.e. WiFi and WiMAX.

[4] Predictions of fixed-mobile convergence are numerous over the years: Minges, Michael, Laura Mannisto, Tim Kelly (1999) The future is bright, the future is mobile, 1 info 6 at pp.485-496; Van Heesvelde, Eric (2000) Convergence between fixed and mobile communications, 2 info 3 at pp.271 - 275; Curwen, Peter (2000) Next generation mobile: 2.5G or 3G? 2 info 5 at pp.455-476; Curwen, Peter (2006) Fixed-mobile convergence, 8 info 3 at pp.8-11; Srivastava, Lara (2001) 3G mobile policy: the case of Japan, 3 info 6 at pp.459-484; Rokkas, Theodoros (2009) On the economics of fixed-mobile convergence, 11 info 3 at pp.75-86.

[5] Croxford, Ivan and Marsden, Christopher T. (2001 updated second edition 2002) I Want my WiFi: WLAN Standards and Regulation in Europe at: http://www.3gnewsroom.com/html/whitepapers/I_want_my_Wi-Fi.zip.

[6] Grant, Mike (2008) Analysys Masons: Global Drivers for an Open Mobile Ecosystem, Open Mobile Summit, San Francisco, at <http://www.openmobilesummit.com/pastevent/OM-d11230-MikeGrant.pdf>.

[7] On mobile standards see generally: Grindley, P., Salant, D., Waverman, L. (1999) 'Standards wars: the use of standard setting as a means of facilitating cartels: third generation wireless telecommunications standard setting, 3 Int. J. Comms Law & Policy at http://www.ijclp.net/ijclp_web-doc_2-3-1999.html.

[8] <http://www.nokia.com/clubnokia> and <http://www.apple.com/iphone/apps-for-iphone/>

[9] Forge, S. (2004) Is Fourth Generation Mobile Nirvana, Or... Nothing?, 6 Info 1, pp.12-23.

[10] HSDPA is High Speed Data Packet Access. Estimates from report by SCF Associates (2006) 'Economic Impacts of Spectrum Allocation Methods', mimeo.

[11] Customers and types of users so far have been early adopters, both male and female and largely below 40 years. Games have been taken up by the 8- to 28-year-old male population in Europe more enthusiastically than other customer segments. Again, music downloads have attracted this age group, especially as mobile multimedia marketing is now concentrated into two major categories: 10-18 years and 18-30 years, with other age groups largely ignored. Some marketing teams for multimedia mobile feel that today's real markets effectively stop at 25 years as far as promotion is concerned, so the product designs are largely oriented to lower age groups.

[12] Thinkbroadband (2009) Average mobile broadband speed clocks in at 0.9 meg, 10 June at <http://www.thinkbroadband.com/news/p/2.html> having performed over 1.4 million tests from over 1,300 testing agents throughout the United Kingdom using its isposure software.

[13] Lewin, D., B. Williamson and M. Cave (2009) Regulating next-generation fixed access to telecommunications services , 11 info 4 at pp. 3-18.

[14] Cisco (2008) Cisco Visual Networking Index, 2007-2012, available at: www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-481360_ns827_Networking_Solutions

[15] Lewin, D., B. Williamson and M. Cave (2009) supra n.13.

[16] Davidson, Alan and Tom Tauke (2010) A joint policy proposal for an open Internet, August 9, 2010 at <http://googlepublicpolicy.blogspot.com/2010/08/joint-policy-proposal-for-open-internet.html>

and Whitt, R. (2010) Facts about our net neutrality policy, 12 August at <http://googlepublicpolicy.blogspot.com/2010/08/facts-about-our-network-neutrality.html>

[17] Verizon owns both Verizon as a fixed ISP - formerly Bell Atlantic merged with GTE, MCI-WorldCom and other companies - and Verizon Wireless, the largest US wireless

provider and a joint venture with UK mobile multinational Vodafone, which has 347million mobile network customers internationally. See

http://www.vodafone.com/start/about_vodafone/where_we_are.html and

<http://investor.verizon.com/profile/history/index.aspx?tabId=1>

[18] See M.A. Lemley and L. Lessig (2000) The End of the end-to-end: preserving the architecture of the Internet in the broadband era, available at UC Berkeley Law & Econ Research Paper No. 2000-19; Stanford Law & Economics Olin Working Paper No. 207; UC Berkeley Public Law Research Paper No. 37. See further Chapter 1 in Marsden (2010) supra n.1.

[19] Wu, T. (2003) Network Neutrality, broadband discrimination, *Journal on Telecommunications and High-Tech Law*, (2) 141. Particularly relevant to net neutrality is Meisel (2007) The emergence of the internet to deliver video programming: economic and regulatory issues; 9 info 1 at pp. 52 - 64, who states: 'Public policy makers throughout the world are faced with the need to update, replace, and/or revise existing regulations that govern the relationships between and among traditional video distribution platforms, such as over-the-air and cable/satellite providers, as the internet emerges as a viable video distribution platform.'

[20] Helpfully one of the first videos Ofcom placed on their YouTube channel on December 1, 2006: <http://www.youtube.com/user/ofcom#p/u/43/xllkkgKZD64>

[21] On these developments, see Marsden (2010) supra n.2. at Chapters 2 and 6.

[22] See Directive 2002/21/EC ("Framework Directive"), Directive 2002/20/EC ("Authorisation Directive"), Directive 2002/19/EC ("Access Directive"), Directive 2002/22/EC ("Universal Service Directive"), Directive 2002/58 on Privacy and Electronic Communications.

[23] COM(2006) 334 final Review of the EU Regulatory Framework for electronic communications networks and services, Brussels, 29 June 2006 at section 6.2-6.4.

[24] European Commission (2009) Declaration on Net Neutrality, appended to Dir. 2009/140/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 November 2009 amending Directives 2002/21/EC on a common regulatory framework for electronic communications networks and services, 2002/19/EC on access to, and interconnection of, electronic communications networks and associated facilities, and 2002/20/EC on the authorisation of electronic communications networks and services, OJEU L337/37 at p69, 18 December 2009 at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:337:0037:0069:EN:PDF>

[25] Directive 2009/136/EC (the "Citizens Rights Directive") and Directive 2009/140/EC (the "Better Regulation Directive") both of 25 November 2009, which must be implemented within 18 months.

[26] Supra n.16.

[27] <http://stakeholders.ofcom.org.uk/consultations/net-neutrality/?showResponses=true>

[28] http://ec.europa.eu/information_society/policy/ecomm/library/public_consult/net_neutralit

y/index_en.htm

[29] European Parliament and EC Council Regulation 1211/2009 (OJ L337, 18.12.2009, p 1) establishing the Body of European Regulators for Electronic Communications (BEREC) and the Office

[30] http://www.erg.eu.int/meetings/index_en.htm

[31] http://www.fcc.gov/Daily_Releases/Daily_Business/2010/db0901/DA-10-1667A1.pdf

[32] See Kerry, John (2009) Kerry, Wicker, Dorgan, Klobuchar Call for Increased Choice for Wireless Consumers, Letter to FCC 15 June at <http://kerry.senate.gov/cfm/record.cfm?id=314462>: "We ask that you consider the following factors in making this determination: Whether exclusivity agreements are becoming increasingly prevalent between dominant wireless carriers and handset manufacturers; whether exclusivity agreements are restricting consumer choice with respect to which handsets are available depending on a consumer's geographic region, particularly for consumers living in rural America; whether exclusivity agreements place limitations on a consumer's ability to take full advantage of handset technologies, such as the ability to send multimedia messages or the ability to 'tether' a device to a computer for internet use; whether exclusivity agreements are manipulating the competitive marketplace between commercial wireless carriers. Specifically, whether the ability for a dominant carrier to reach an exclusive agreement with a handset manufacturer is inhibiting the ability of smaller, more regional carriers to compete, and whether exclusivity agreements play a role in encouraging or discouraging innovation within the handset marketplace."

[33] Wu, Tim (2007) Wireless Net Neutrality: Cellular Carterfone And Consumer Choice In Mobile Broadband, New America Foundation Wireless Future Program Working Paper #17 February at p2.

[34] Miner, Rich (2008) GoogleVision: Why the mobile Internet needs to be open, 20 November 2008 at <http://www.openmobilesummit.com/pastevent/OM-d2930-RichMiner.pdf>

[35] Auction 73 was started by the FCC on 24 January 2008 for the rights to operate the 700 MHz Block C, with 'open access' requirements set down by the FCC Second Report and Order, at http://fjallfoss.fcc.gov/edocs_public/attachmatch/DA-07-3415A1.pdf

[36] For a highly jaundiced and unofficial contemporary view of the lawsuit, see <http://www.wired.com/epicenter/2007/09/verizon-dumps-o/>

[37] See <http://www.michaelgeist.ca/content/view/3700/125/> and <http://chrismarsden.blogspot.com/2009/02/canada-analyzes-while-us-republicans.html>

[38] Note that these will fluctuate wildly as the months pass, so your guess will by the time of reading be better than mine, for instance, Rogers in Canada in June 2009 charged \$67/month for 3 GB of data on a 'dongle'.

[39] European Commission (2009) 14th Annual Implementation Report, Appendix: United Kingdom http://ec.europa.eu/information_society/policy/ecomm/doc/implementation_enforcement/annualreports/14threport/uk.pdf at p8.

- [40] Ofcom (2009b) Mobile Broadband, 1 June at <http://www.ofcom.org.uk/media/features/mobbroadguide>
- [41] Mobile Broadband Group (2009) Principles of Good Practice for selling and promoting Mobile Broadband, 1 June at http://www.mobilebroadbandgroup.com/documents/mbg_mobile_broadband_gpp_010609.pdf
- [42] See http://www.ofcom.org.uk/static/archive/oftel/publications/mobile/ctm_2002/docs_index.htm for a full list of documents submitted by Oftel, or the full Competition Commission report at http://www.ofcom.org.uk/static/archive/oftel/publications/mobile/ctm_2003/ctm2.pdf . The Report is 15 chapters with 9 appendices and took a year to research and publish.
- [43] See the main (and supporting) documents IP/09/710 and EC(2009) 3359 with Articles 9, 11 and 13 in conjunction with Recital 20 of Directive 2002/19/EC and Commission Recommendation 2005/698/EC.
- [44] See BBC News (2010) Orange and T-Mobile merge networks, 6 September at <http://www.bbc.co.uk/news/technology-11199786>
- [45] See http://www.theregister.co.uk/2009/05/20/termination_rates/ and <http://www.terminatetherate.org/Pages/MTRs.aspx>
- [46] A nice simple recent analysis is Kende, Michael (2007) Which party pays: the impact on mobile markets, 1 August, AnalysysMasons at <http://www.analysismason.com/About-Us/News/Newsletter/Previous-news-articles/Which-party-pays-the-impact-on-mobile-markets/>.
- [47] ITU (2009) The ICT Development Index, at <http://www.itu.int/ITU-D/ict/publications/idi/2009/index.html>.
- [48] Sutherland, E. (2009) Counting customers, subscribers and mobile phone numbers, 11 info 2 at pp.6-23 explains at p11 that 'The possible reasons for an individual having more than one SIM card, telephone number or cellphone include: overcoming patchy or poor network coverage; avoiding network congestion; saving money by making on-net calls; benefiting from discounted or bundled tariffs; receiving calls or voicemail to an older number; and having separate voice and data network operators.' A Jordanian survey discovered that the majority of cases involved cost saving, with some using a second SIM because numbers were not ported when networks were changed (using the old SIM and number, but only to check voicemail). In the United Kingdom, 82% of the population has mobile phones, though networks report over 120 per 100 population.
- [49] Hass, Douglas A. (2008) The Never-Was-Neutral Net and Why Informed End Users Can End the Net Neutrality Debates. Berkeley Technology Law Journal, Vol. 22, p. 1563; Indiana Legal Studies Research Paper No. 82 at SSRN: <http://ssrn.com/abstract=957373> states that 'mobile and fixed wireless technologies, as well as satellite broadband, overcome many of the physical reach limitations of wired cable and DSL services, meaning that broader coverage of rural zip codes is possible.'
- [50] See Goth, Greg (2007) Opening the Mobile Net, IEEE Distributed Systems Online, vol.

8, no. 11, art. no. 0711-oy004 and Bazelon C. (2009) Too many goals: Problems with the 700MHz auction, *Information Economics and Policy*, Volume 21, Issue 2, pp.115-127.

[51] Cellular News (2009) Mobile Termination Rates Cut in India, 9 March at <http://www.cellular-news.com/story/36431.php> and <http://uk.reuters.com/article/allBreakingNews/idUKL56132720090205?pageNumber=1&virtualBrandChannel=0>

[52] SPEECH/09/222.

[53] Article 19(1) of Directive 2002/21/EC.

[54] C(2009) 3359 Recommendation on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:124:0067:0074:EN:PDF> and SEC(2009) 600 Explanatory note of the Recommendation at http://ec.europa.eu/information_society/policy/ecomm/doc/implementation_enforcement/eu_consultation_procedures/explanatory_note.pdf. See the historical reductions in rates achieved in a report recently for the Commission by Teligen (2009) Report on Telecoms Price Developments from 1998 to 2008, 02 April at http://ec.europa.eu/information_society/policy/ecomm/doc/library/ext_studies/price_developments_1998_2008/tariff_trends_report_1998_2008.pdf

[55] Economist (2009) Priming the pipe: The boom in mobile broadband, 5 March at http://www.economist.com/displayStory.cfm?story_id=13234973&mode=comment&intent=readBottom

[56] It is notable that T-Mobile has also been integrating WiFi with its 3G service in the United States, and its Web'n'Walk plan in the United Kingdom.

[57] See sources in <http://chrismarsden.blogspot.com/2009/03/more-on-mobile-termination-rates.html> with <http://essextelecoms.blogspot.com/2009/03/european-parliament-caps-roaming.html>

[58] I summarized for Ofcom's 2008 conference in <http://www.ofcom.org.uk/event/ConferencePapers/chrismarsden.pdf>

[59] See Marsden (2010) *supra* n.2 at Chapter 2.

[60] See <http://essextelecoms.blogspot.com/2009/02/two-summaries-of-cat-decision-on-mobile.html> and Competition Appeal Tribunal (2008) Case(s): 1092/3/3/07 Cable & Wireless and others v Office of Communications (Termination Rate Dispute)1091/3/3/07 Hutchison 3G UK Limited v Office of Communications (Termination Rate Dispute)1089/3/3/07 T-Mobile (UK) Limited v Office of Communications (Termination Rate Dispute)1090/3/3/07 British Telecommunications plc v Office of Communications (Termination Rate Dispute) [2008] CAT 12, 20 May 2008: at <http://www.catribunal.org.uk/238-1928/Judgment-%28Core-issues%29.html>