



# THE ADVENT OF 5G: SHOULD TECHNOLOGICAL EVOLUTION LEAD TO REGULATORY REVOLUTION?



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## I. INTRODUCTION

The much awaited next generation of mobile technology is referred to as “5G” and is much more than a radio access technology. 5G is constituted by a portfolio of access and connectivity solutions which require the deployment of a new flexible air interface directed to extreme mobile broadband deployment and usually associated with the provision of faster downloads and lower latency.<sup>2</sup> The deployment of 5G technology will deliver virtually ubiquitous, ultra-high bandwidth “connectivity” not only to individual users but also to connected objects. A wide range of applications and sectors will be served in a 5G environment, including professional uses (e.g. assisted driving, eHealth, energy management and possibly safety applications). In order to ensure interoperability with past generations of mobile communications, the availability of LTE networks will provide a key technical bridge between 5G and its predecessor technologies,<sup>3</sup> with 5G deployment embracing previous generations of access modes.

A regulatory commitment has been agreed upon by the Member States and the European Commission (“Commission”) that 5G will be introduced throughout the European

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<sup>2</sup> “Ericsson White Paper – 5G Radio Access” (Uen 284 23-3204 Rev C), April 2016 (available at: <https://www.ericsson.com/res/docs/whitepapers/wp-5g.pdf>).

<sup>3</sup> Ibid., at p. 2.



Union (“EU”) by 2020 at the latest,<sup>4</sup> with the key hardware already scheduled to be made available over the course of the year 2017.<sup>5</sup> Specific objectives have been established to have 5G deployed in at least one major city within the EU by 2020 after a commercial launch in 2018, with all urban areas and major terrestrial transport paths being covered by 2025.<sup>6</sup>

The question which we seek to address below is whether the broad political commitment to fulfilling these 5G objectives across the EU by 2025 can somehow be aligned with the technological changes that will be effected by this new technology and the regulatory changes that might be necessary to accommodate those changes. Moreover, we need to consider the policy implications at the EU level of a failure to adapt regulation to the dictates of the new technological environment which may absorb as much as 500 Billion Euros in investment over the next ten years.

## II. TECHNOLOGICAL EVOLUTION

The introduction of 5G signals the evolution of a number of technological and commercial parameters when compared to what is available currently across the EU. These parameters include:

- massive growth in system capacity;
- very high data rates compared to 4G networks;
- very low latency (i.e. close to the speed of light);
- ultra-high reliability and availability;
- very low device cost and energy consumption, along with the ability to use higher frequencies effectively above 600 GHz; and
- energy-efficient networks.<sup>7</sup>

As noted in the Commission’s Working Paper,<sup>8</sup> 5G proposes to create a wireless link with capacities that approach those of fiber optic networks. From a telecoms industry perspective, two significant changes that are already underway will be greatly enhanced. The first is the rise of Software Defined Networks (“SDNs”), which will allow the control of network resources to be opened up to third parties, with the possibility for these third parties to manage their own physical or virtual resources individually. For example, given that emergency or military networks require complete operational autonomy, 5G could provide them with the capability of being part of an existing network rather than being positioned beside it, as is the case today.

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<sup>4</sup> Commission’s webpage “Towards 5G” (<https://ec.europa.eu/digital-single-market/towards-5g>). See also the Commission Press Release, “EU and Brazil to work together on 5G mobile technology,” February 23, 2016.

<sup>5</sup> See article “Ericsson to start delivering 5G components in 2017- Market Watch,” August 31, 2016 (<http://www.marketwatch.com/story/ericsson-to-start-delivering-5g-components-in-2017-2016-08-31>).

<sup>6</sup> Commission Communication, “Connectivity for a Competitive Digital Single Market - Towards a European Gigabit Society,” COM(2016) 587 final (<https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-587-EN-F1-1.PDF>).

<sup>7</sup> Press Release, “5G enabled by massive capacity, connectivity,” by V. Held, April 20, 2016 (available at: <https://insight.nokia.com/5g-enabled-massive-capacity-connectivity>). See also “Ericsson White Paper – 5G Radio Access,” op. cit. at pp. 3-4.

<sup>8</sup> Commission’s Communication, “5G for Europe: An Action Plan,” COM(2016) 588 final (<https://ec.europa.eu/transparency/regdoc/rep/1/2016/EN/1-2016-588-EN-F1-1.PDF>).



The second is Network Function Virtualization, which offers the prospect of specific network functions being implemented in software which runs on generic hardware, without the need for costly hardware-specific machines; in short, this will provide the speed with which to deploy new services and functions that can otherwise be deployed by traditional telecoms operators over a period of perhaps 18 months or longer. As such, this would approach the dynamics of the Internet in terms of the timing of new deployments.

More broadly, however, the importance of each of the characteristics listed above will also vary by reference to its application and usage. Very low latency<sup>9</sup> will have many relevant applications ranging from connected cars to a variety of Internet of Things (“IoT”)<sup>10</sup> applications, many of which will need very low bandwidth but also a very low latency (for instance, bespoke advertising). Similarly, medical applications are clear candidates for services requiring reliability and availability, but these characteristics are also required for other types of public services. The low energy and energy consumption characteristics will invariably be very important, especially in remote areas IoT applications such as farming sensors that indicate soil moisture on a fortnightly basis. However, the more general observation is that the advent of 5G promises to deliver connectivity in ways going far beyond the capabilities of the existing telecoms sector which will drive the broader European economy, with many parts of that economy, including transport, manufacturing and health services, benefiting from the availability of these networks (or not operating optimally, as the case may be, in their absence).

### III. REGULATORY REVOLUTION

Whereas the technological changes identified above can rightly be said to constitute the natural evolution (albeit accelerated) of telecoms technology, their impact on the EU regulatory framework for electronic communications networks and services might be more revolutionary, given that the effect of service provision and device capabilities is likely to be very disruptive, with their implications being felt both within the electronic communications sector and well beyond. This can be illustrated by the clear pressures effected on a range of key issues that raise important policy choices that regulators will need to make. For example:

1. The deployment of 5G mobile networks cannot occur in isolation and must be accompanied by a comparable upgrade to the fixed network. Thus, a 1Gbps wireless network is of little value to society if it is backhauled by a 100Mbps backhaul link.<sup>11</sup> The Commission’s regulatory commitment to technological neutrality is under pressure given its industrial policy imperative to achieve latency, bandwidth, jitter and other parameters above certain key thresholds in the fixed network. Hence, the Commission’s identification of “Very High Capacity”<sup>12</sup> limits under fixed technology as embracing three and possibly four solutions, and its parallel emphasis on investment priorities in the

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<sup>9</sup> Latency describes the time taken for data to travel between its source and destination, measured in milliseconds.

<sup>10</sup> The ‘Internet of Things’ is how computers, sensors and objects interact with each other and process data. See the Commission’s Staff Working Document, “Advancing the Internet of Things in Europe,” April 19, 2016: <https://ec.europa.eu/digital-single-market/en/news/staff-working-document-advancing-internet-things-europe>.

<sup>11</sup> “Backhaul” refers to the part of the network that connects local access to the core internet network (or backbone network) to carry and deliver data (see <https://ec.europa.eu/digital-single-market/broadband-glossary>).

<sup>12</sup> Commission’s Proposal for a Directive, “establishing the European Electronic Communications Code (Recast),” COM(2016) 590 final 2016/0288 (COD) ([http://eur-lex.europa.eu/resource.html?uri=cellar:c5ee8d55-7a56-11e6-b076-01aa75ed71a1.0001.02/DOC\\_1&format=PDF](http://eur-lex.europa.eu/resource.html?uri=cellar:c5ee8d55-7a56-11e6-b076-01aa75ed71a1.0001.02/DOC_1&format=PDF)).



Communications Code, seems to reflect a coherent policy designed to achieve such aims.

2. The nature of network ownership and operation, as we understand it, will inevitably change in a 5G environment, given that infrastructures will be able to adopt a multi-tenancy model.<sup>13</sup> This is because the SDN and NFV evolutions can deliver the phenomenon of “network slicing,” which effectively creates separate networks that are housed within one physical infrastructure in a way that is tantamount to them being situated on separate physical infrastructures. In this way, each “physical network” will also be able to host multiple service providers who supply specialist niche services over that network.

Given that network fragmentation manifests itself in terms of the greater availability of niche services, multiple “tenancies” on networks and the proliferation of service providers and software applications, it seems inevitable that the range and form of traditional access relationships will need to be re-assessed. For example, the usual trade-off between the costs of network duplication versus the benefits of end-to-end competition will need to be reconsidered, at least with respect to rural areas. With 5G networks, the benefits of competing physical networks can be delivered even over one network with virtually no loss of autonomy or independence on the part of the operators hosted on that network. The current concerns about network sharing agreements and the point at which such sharing occurs in the network (a Radio Access Network or otherwise) would occur in a very different context under 5G. Faced with very high deployment costs, especially in rural areas, it would be more appropriate for Competition Authorities to promote a more benign policy with respect to network sharing and co-investment in a 5G context.

Operators would also have a degree of independence unimaginable under today’s network architectures.<sup>14</sup> This may affect the nature of the access relationship expected by regulators, in terms of whether or not the usual SMP standard<sup>15</sup> is sufficiently robust to address market failures in a 5G environment (or even if it continues to be necessary to justify any regulatory intervention under the SMP standard). For example, it is foreseeable that, with only one network operator in large parts of a Member State, regulatory concerns might arise. However, with multiple operators in urban areas but sharing a single physical network elsewhere, *a priori*, one would expect a level of competition equivalent to fully deployed separate networks throughout the Member State. Other complicating factors include the multi-sided nature and the particular economic characteristics that are associated with such markets. Consideration should even be given in this context to whether a robust “three criteria” test<sup>16</sup> could even be performed on these potential 5G markets or whether in the short

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<sup>13</sup> Commission supporting document of the 5G Public-Private Partnership, “5G Vision - The 5G Infrastructure Public Private Partnership: the next generation of communication networks and services” (available at: <https://5g-ppp.eu/wp-content/uploads/2015/02/5G-Vision-Brochure-v1.pdf>).

<sup>14</sup> See Commission’s Staff Working Document, “5G Global Developments,” SWD(2016) 306 final (<http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=SWD:2016:306:FIN>).

<sup>15</sup> Commission Guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services, OJ C 165, 11.7.2002, at pp. 6-31.

<sup>16</sup> Under this test, *ex-ante* economic regulation is capable of being imposed if three criteria can be satisfied, namely: (i) insurmountable structural entry barriers exist; (ii) the market structure behind threshold barriers lacks effective



term at least a regulatory exemption or “holiday” should apply.<sup>17</sup>

At another fundamental level, this development also raises the broader question of whether the technological imperative of delivering next generation communications services should indeed continue to occur in a world made up of multiple, fragmented networks, or would be better suited to developing more efficiently in a concentrated environment. The fragmentation in service delivery, spectrum allocation and co-tenancy of networks which could characterize a 5G environment, especially given the technological imperative of delivering much more data much more quickly, seems to be more compatible with the idea that seamless communications services might be delivered better in a more concentrated operator environment. However, any such policy orientation seems to be in conflict with the Commission’s current competition policy in the context of mergers in the communications sector.<sup>18</sup> The question that therefore needs to be asked is whether current competition concerns about network consolidation as a result of electronic communications sector mergers should be tempered with the acknowledgement that there will be a different range of competition/innovation trade-offs that will emerge in the future; in such an environment, the balance maintained under the Commission’s current merger practice might shift after 2020. This is especially the case given that issues such as trust and security will become increasingly more important where it might be a single network infrastructure that hosts many service providers which emerges to deliver all services, both commercial and otherwise.

3. The deployment of 5G technology will support communications within and among the so-called IoT. This will mean that the vast bulk of communications that takes place in the emerging electronic communications environment is one where the traditional value chain collapses. No longer will voice communications be the primary revenue source for operators, nor will they account for the bulk of communications. Instead, machines communicating with machines (e.g. self-driving cars)<sup>19</sup> will provide the momentum for the business case in the sector.

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competition; and (iii) *ex-post* competition law would not adequately address the identified market failure(s). Recital 11 of the Preparatory Working Document of the Commission Recommendation on relevant product and service markets within the electronic communications sector susceptible to *ex-ante* regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services, 9.10.2014 C(2014) 7174 final (“Relevant Markets Recommendation”).

<sup>17</sup> Consistent with the previous approach taken towards the regulatory treatment of ‘emerging markets’ under the EU electronic communications Regulatory Framework, where a policy preference is expressed for only *ex-post* competition rules to apply.

<sup>18</sup> See, most recently, Case M. 7758 *Hutchison 3G / WIND* in the Commission Press Release on September 1, 2016: [http://europa.eu/rapid/press-release\\_IP-16-2932\\_en.htm](http://europa.eu/rapid/press-release_IP-16-2932_en.htm); the Commission Press Release, “Mergers: Commission prohibits Hutchison’s proposed acquisition of Telefónica UK” (IP/16/1704), 11 May 2016. See Case No COMP/M.7612 – *Hutchinson 3G UK / Telefonica* (2016); Case No COMP/M.7419 – *TeliaSonera/Telenor/JV* (abandoned by the parties on the September 24, 2015).

<sup>19</sup> IEEE’s article “Self-Driving Cars Will Be Ready Before Our Laws Are - Putting autonomous vehicles on the road isn’t just a matter of fine-tuning the technology,” By N. A. Greenblatt, January 19, 2016 (available at:

<http://spectrum.ieee.org/transportation/advanced-cars/selfdriving-cars-will-be-ready-before-our-laws-are>); Nokia’s News Blog, “Self driving cars: enroute to 5G,” By T. Sens, June 2016 (available at:

<https://blog.networks.nokia.com/mobile-networks/2016/06/23/self-driving-cars-enroute-5g/>); and Qualcomm’s

News Blog, “The path to 5G: Paving the road to tomorrow’s autonomous vehicles,” June 7, 2016 (available at: <https://www.qualcomm.com/news/onq/2016/06/07/path-5g-paving-road-tomorrows-autonomous-vehicles>).



This tends to have a tremendous impact on the potential for distributional welfare in the EU, as innovation and efficiency inure to the benefit of a myriad of industries in which Europe is a leader, including pharmaceuticals, motor vehicles, robot technology, mechanized food production and so forth. Moreover, given that Europe is home to two of the world's three largest equipment manufacturers, the benefits to the European economy become self-evident. Given that traffic volumes in the IoT will exceed mobile communications as soon as 2018, and given the increasing amount of functionality being built into the Cloud to cater for such traffic, fundamental questions might need to be asked about the extent to which consumer harm will occur (and the nature of that harm) if traditional access relationships are not maintained. However, it will also need to be taken into account that issues of quality and ubiquity of access will invariably be much more important criteria relative to price in the framing of access relationships in an IoT environment.

4. The technical capabilities which 5G will bring are such that they are capable of rendering highly problematic any attempt to enforce the Net Neutrality rules currently contained in the TSM Regulation.<sup>20</sup> The result of increased demand in a 5G world will inevitably lead to greater challenges in network management and will render the notion of “best efforts” an unworkable legal standard in an environment where real-time, high capacity communications are required. In the words of the United Kingdom's 5G Innovation Centre, 5G networks will be optimizing traffic flows on the basis of “user and network context information such as where, when, why, who and what is being requested.”<sup>21</sup>

A unique feature of 5G technology is that it will allow for flexible transport programmability, which facilitates the division of transport resources into multiple (isolated) slices or parallel channels. This will enable network operators to exploit their networks to optimize their resources across different segments of available spectrum (understood to be primarily in the 3400-3800 GHz bands, although 5G will in all likelihood involve a mix of frequencies and technologies). Indeed, one of the key innovations introduced by 5G technology – network slicing – would be effectively undermined in terms of its commercial effects if the parallel channels available under a 5G environment were not permitted greater flexibility in their differential treatment of traffic in light of its physical properties and economic value.

The open question is whether mobile network operators will be able to manage their networks in such a way as to be able to implement Net Neutrality principles as between these separate capacity streams or channels, especially given the surge in traffic loads and the number of connected devices that will be capable of being sustained in a 5G environment. One can anticipate in these circumstances a backhaul

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<sup>20</sup> Regulation (EU) 2015/2120 of the European Parliament and of the Council of November 25, 2015 laying down measures concerning open internet access and amending Directive 2002/22/EC on universal service and users' rights relating to electronic communications networks and services and Regulation (EU) No 531/2012 on roaming on public mobile communications networks within the Union (“*TSM Regulation*”), OJ L 310, 26.11.2015, pp. 1–18. See also BEREC “Guidelines to National Regulatory Authorities (NRAs) on the implementation of the new net neutrality,” August 30, 2016 available at:

[http://berec.europa.eu/eng/document\\_register/subject\\_matter/berec/regulatory\\_best\\_practices/guidelines/6160-berec-guidelines-on-the-implementation-by-national-regulators-of-european-net-neutrality-rules](http://berec.europa.eu/eng/document_register/subject_matter/berec/regulatory_best_practices/guidelines/6160-berec-guidelines-on-the-implementation-by-national-regulators-of-european-net-neutrality-rules)).

<sup>21</sup> See Institute for Communication Systems 5G Innovation Centre (in association with University of Surrey), “5G Whitepaper: The Flat Distributed Cloud (FDC) 5G Architecture Revolution,” January 2016, at p. 2.



bottleneck being present that goes well beyond the data capacity shortages experienced currently by customers in the wireless access segment.<sup>22</sup> In such a case, the advent of 5G technology will challenge the basic working assumptions about how capacity can and should be managed. As one commentator notes: “This seems completely incompatible with traffic management limited to technical requirements. Thus, strictly drafted net neutrality guidelines may hamper Europe’s 5G aspirations.”<sup>23</sup>

Accordingly, an acknowledgement of the importance of traffic management techniques in the 5G environment sits most comfortably with the policy imperative of adopting a flexible approach to the issue of “discrimination” that is consistent with competition law principles. By contrast, excessive regulatory intervention is likely to distort competitive industry structures business models in advance of the deployment of 5G technology by 2020, at which time fundamental questions will need to be asked about the scope of the Net Neutrality concept.<sup>24</sup> An overly-expansive approach to Net Neutrality, as has recently been undertaken by BEREC,<sup>25</sup> has a logic which runs the risk of dissuading operators from providing differentiated services. As such, the approach towards Net Neutrality sits very uncomfortably with a next generation of 5G technology which facilitates the provision of such differentiated services. European policymakers may come to regret what appears to be their current failure to interpret and apply Net Neutrality policy in a manner which takes due account of the technological benefits capable of being delivered by 5G technology.

5. Whereas so-called Over-the-top (“OTT”) operators are proving to be a new competitive force in the current 3G-4G environment which is challenging the market power of traditional incumbent network operators,<sup>26</sup> it will be software providers which will provide competitive impetus in the new 5G environment. That environment will have many of the characteristics of a multi-sided market. In such markets, traditional forms of regulation can do more harm than good,<sup>27</sup> given that below-cost pricing by an operator on one side of the market may be necessary, even if that operator is dominant on the relevant market identified for antitrust purposes; put another way, cost-based pricing in such an environment is just as likely to kill a market before it ever starts.

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<sup>22</sup> See Radio Access and Spectrum White Paper, “5G Radio Network Architecture,” February 3, 2014, at p. 14.

<sup>23</sup> See R. Kenny, “Net Neutrality: Guidelines or straitjackets?,” EurActiv.com, May 2, 2016. (Available at: <http://www.euractiv.com/section/digital/opinion/net-neutrality-guidelines-or-straitjackets/>).

<sup>24</sup> See P. Alexiadis, “EU Net Neutrality Policy and the Mobile Sector: The Need for Competition Law Standards,” *Chilling Competition* (<https://chillingcompetition.com/2016/05/16/eu-net-neutrality-policy-and-the-mobile-sector-the-need-for-competition-law-standards-by-peter-alexiadis/>) and *Concurrences No.3-2016*.

<sup>25</sup> Op. Cit. at footnote 20. BEREC is the pan-European body representing National Regulatory Authorities established in 2009 under the terms of Regulation (EC) No.1211/2009.

<sup>26</sup> “BEREC Report on OTT services” (“BoR (16) 35”), January 29, 2016 (available at: [http://berec.europa.eu/eng/document\\_register/subject\\_matter/berec/reports/5751-berec-report-on-ott-services](http://berec.europa.eu/eng/document_register/subject_matter/berec/reports/5751-berec-report-on-ott-services)).

<sup>27</sup> Two-sided markets (a simpler form of a multi-sided market) can be identified where “the platform can affect the volume of transactions by charging more to one side of the market and reducing the price by the other side by an equal amount; in other words, the price structure matters”; see J.C. Rochet and J. Tirole (2003), “Platform Competition in Two-sided Markets,” *Journal of the European Economic Association*. Related multi-sided platforms have been defined as having “two or more groups of consumers” (...) “who need each other” (...) “who cannot capture the value of their mutual attraction”; and who “rely on a catalyst to facilitate” their interaction”. See Evans and Schmalensee, *The Antitrust Analysis of Multi-Sided Platform Businesses* (National Bureau of Economic Research, Working Paper No w18783, 2012).



The inability of sector-specific regulators and competition authorities to deal with the necessary economic balancing which comes with markets being genuinely multi-sided may mean that network operators are at a relative competitive disadvantage *vis-a-vis* those OTT operators that can seize upon advantages of scale and scope to target those parts of the value chain that are most commercially attractive. So much of what will occur in competition terms under 5G is likely to take place in the context of such multi-sided markets, the impact of which is little understood under sector-specific regulation or, indeed, even under competition policy as it stands today.

6. Another area where regulation has recently “evolved” with particular consequences for 5G deployment and operations is likely to be the domain of roaming. In a context where download and upload speeds will be measured in Gbps, “squaring the circle” of wholesale pricing for roaming services becomes more important (if no less clear) given that average monthly mobile consumption is forecast to be at least 50GB<sup>28</sup> by 2022.<sup>29</sup> While some commentators have floated the idea of retail roaming restrictions in the form of offers that do not even offer roaming services,<sup>30</sup> others have suggested that the very high cost of wholesale data roaming may impede the development of 5G in the first place. The Roaming Regulation undermines operators’ ability to put forward special packages for one sector or another (connected cars, logistics, etc.) since the ability to price discriminate under the Roaming Regulation is greatly curtailed. Consolidation provides one possible solution to the revenue shortfall being experienced by smaller EU Member State-specific operators, but the idea of an automated car crossing EU borders without an efficient roaming regime in place raises serious issues about the creation of a single EU market.

Alternative pricing solutions will therefore need to be found to deal with large data volumes, and a means of purchasing wholesale WiFi might be required if no market solutions emerge. Moreover, given the potentially below-cost roaming obligations to which mobile operators might be subject under the latest legislation supporting the Roam Like At Home (“RLAH”) regime, it is difficult to envisage how smaller mobile network operators will survive economically, especially if they are expected to invest in 5G.

7. While the relative importance of competitive telecoms offerings has in the past not only been seen to be important in its own right but as also providing a strong pricing bedrock upon which other economic sectors in the EU can flourish (e.g. cheap telecoms services fuel a more efficient financial services sector), 5G will now create an environment in which the telecoms service is itself entwined into most high-value primary economic activities taking place within the EU. Thus, in the IoT (as discussed above), it will be the telecoms industry which becomes the technological backbone for many industries

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<sup>28</sup> See “Assessment of the cost of providing wholesale roaming services” in the EU FINAL REPORT, a study prepared for the Commission DG Communications Networks, Content & Technology by TERA Consultants. Contract number: 30-CE-0738141/00-00 SMART number: 2015/0006.

<sup>29</sup> Based on the Commission’s current proposed wholesale charges, this would represent a monthly roaming wholesale charge of €425.

<sup>30</sup> Such a commercial option would challenge the prospects for “Roam Like At Home” services: see BRUGEL WORKING PAPER | Issue 3 | 2016 by J. Scott Marcus & Georgios Petropoulos.





which rely on machine-to-machine communications,<sup>31</sup> rather than merely providing them with a competitive wholesale “input” which needs to be provided at a competitive price.

Accordingly, when considering the range of legitimate public policy issues affecting the contours of an access relationship and the pricing of that access, sector-specific regulators will inevitably need to take into account welfare benefits and efficiencies which are not only more dynamic (rather than the current static policy goals) but which are also much more complex because they involve considerations going far beyond the traditional issues which are usually relevant only to the electronic communications sector.<sup>32</sup>

8. Given that the basis of asymmetric economic regulation of operators under the current EU Regulatory Framework has been based on the identification of relevant “markets” that are worthy of *ex-ante* regulation,<sup>33</sup> 5G threatens to disrupt traditional market analysis techniques in the sector, *inter alia*, because:

- It will be unclear whether the advent of new technology creates a new relevant service market (or markets) in terms of patterns of supply (e.g. different spectrum and differently priced spectrum, mixed spectrum, a mixture of technologies and so forth)<sup>34</sup> and demand (e.g. premium prices for certain specialist services).<sup>35</sup>
- It will be similarly unclear whether we have a situation characterized by the phenomenon of chain substitution over the years in which the full transition from current generation networks to 5G will materialize (as occurred in the migration between narrowband and broadband on traditional copper networks),<sup>36</sup> or whether we can assume that 5G will assimilate older generation technologies within its scope.

As a result of these inevitable tensions, given that market definition lies at the heart of the market analysis approach which underpins the current EU Regulatory Framework, the potential for the fundamentally different assessment of market power might materialize in a 5G environment. The policy momentum might therefore shift from the current asymmetric approach to economic regulation to an approach which might forego the initial analytical step in defining relevant markets by progressing directly to the identification of market power because of its likely impact on competitive

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<sup>31</sup> For example, industrial sensors, self-driving cars and other emerging uses of the Internet have needs that cannot be satisfied by the operations of a “general purpose” network.

<sup>32</sup> Refer to the criteria listed in Articles 8 and 12 of the *Access Directive* (Directive 2002/19/EC).

<sup>33</sup> For example, Commission Recommendation 9.10.2014 C(2014) 7174 final (“Relevant Markets Recommendation”).

<sup>34</sup> Higher frequency bands will offer greater capacities with disruptive technological capabilities, such as a large number of simultaneous communications with users/devices, and will open up the prospect for user data rates that can meet the International Telecommunication Union (ITU) requirements for 5G (i.e. exceeding 10 Gb/s).

<sup>35</sup> The characteristics of 5G represent in most cases such a shift in capacity that chain of substitution issues are much less likely to arise. Like narrowband and broadband internet access, even if pricing would enable a chain of substitution analysis, certain services will not work on one but not the other. The old “click here for narrowband” “click here for broadband” options or some equivalent will likely re-appear in a 5G context, suggesting the existence of separate markets.

<sup>36</sup> See paras. 57 and 58 of the Commission Notice on the definition of relevant market for the purposes of Community competition law, OJ C 372, 9.12.1997, pp. 5-13.



constraints.<sup>37</sup> A more appropriate response, as suggested above, might be for regulators to declare that the markets which are being reviewed are “emerging markets” insofar as the three criteria test cannot be applied effectively, given the various unknowns in the market. A future review of the market’s status might be signaled at some period in the future, perhaps five years out from initial deployment. This kind of clarity could be very beneficial to network roll-out plans.

9. The deployment of 5G technology will also put pressure on two unrelated areas which have to date played a relatively insignificant role in the development of regulatory policy, namely:
  - As noted above, the pressure on treating the provision of backhaul as a regulated service will invariably increase as fixed and mobile service offerings become increasingly offered on a seamless basis. As the recent controversy involving access to BT’s backhaul service has illustrated,<sup>38</sup> obtaining full and seamless access to backhaul will be a matter of increasing focus for mobile operators keen on providing converged fixed-mobile service offerings in a much more diverse 5G environment.
  - There is every reason to suggest that environmental issues will increasingly need to be considered as a very important policy trade-off in a sector-specific analysis, under the sort of approach usually conducted under Article 101(3) TFEU,<sup>39</sup> given that 5G networks are especially environmentally-friendly and the fact that their deployment would be consistent with the EU satisfying other environmental goals.<sup>40</sup>
10. As the capacity of networks to carry more data grows, the greater will be the relevance of competition concerns about “big data.”<sup>41</sup> With more specialist niches in which data

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<sup>37</sup> For an example of such an approach in the merger context, see Joseph Farrell and Carl Shapiro, “Antitrust Evaluation of Horizontal Mergers: an Economic Alternative to Market Definition,” *The B.E. Journal of Theoretical Economics* 1, 2010.

<sup>38</sup> *BT / EE* merger (closed, January 2016) cleared conditionally by the UK Competition and Markets Authority (<https://www.gov.uk/cma-cases/bt-ee-merger-inquiry>) (and the NewsTalk article, “Telecom companies raise concerns as BT’s £12.5bn EE takeover is cleared by regulators,” January 15, 2016 (available at: <http://www.newstalk.com/Telecom-companies-raise-concerns-as-BTs-125bn-EE-takeover-is-cleared-by-regulators>)). See also the Ofcom Press Release, “Plans to make digital communications work for everyone,” July 26, 2016 (available at: <http://media.ofcom.org.uk/news/2016/making-digital-communications-work-openreach-bt/>).

<sup>39</sup> Recital 24 of the *Access Directive* (Directive 2002/19/EC), OJ L 108, 24.4.2002, pp. 7-20, already provides that: “The development of the electronic communications market, with its associated infrastructure, could have adverse effects on the environment and the landscape. Member States should therefore monitor this process and, if necessary, take action to minimise any such effects by means of appropriate agreements and other arrangements with the relevant authorities.”

<sup>40</sup> For example, Orange Press Release, “The 5G of the future: a network that will have the environment and low energy embedded in its technological DNA,” November 4, 2015 (available at: <http://www.orange.com/en/Responsibility/Environment/COP21/5G>). Article 101(3) TFEU foresees the exemption from the Article 101(1) prohibition in circumstances where *two* sets of positive and negative conditions can be fulfilled. Refer also to para. 49 of the Communication from the Commission Guidelines on the applicability of Article 101 of the Treaty on the Functioning of the European Union to horizontal co-operation agreements, OJ C 11, 14.1.2011, pp. 1-72.

<sup>41</sup> The UK Competition and Markets Authority published a report, “The commercial use of consumer data,” in June 2015, while the Commission and Germany’s Federal Cartel Office have begun to consider the issue in the context of their investigations into both Google and Facebook. The French and German competition authorities announced (at the end of 2015) reviews of the significance of big data and published a report on 10 May 2016 (titled: “Competition Law and Data,” available at:



can be collected and an increasing array of related or neighboring markets in which that market power can be exploited, the difficulties faced in determining whether the dangers of big data outweigh the benefits of mass data collection and processing will multiply for competition authorities and sector-specific regulators alike in a 5G environment.<sup>42</sup> Depending on the business model used and the industrial sector addressed, companies will assess the value of data with great difficulty given the different types of data at issue (e.g. real-time or historical), amounts of relevant data and the quality of the data being used. Accordingly, companies availing themselves of 5G technology may value data differently and be more or less inclined towards the restriction of access to it.<sup>43</sup> This is because the amalgamation of data sets creates value that benefits from significant “network effects,” which means that the value of combined data sets will increase in a non-linear manner. With the adoption of the new General Data Protection Regulation,<sup>44</sup> which sets new standards for the protection of personal data in the EU, including through the enhancement of individuals’ control over their data (e.g. via a new right for data portability), it is no surprise that competition authorities have already started to test the applicability of competition law tools to big data issues.

#### IV. CONCLUSIONS

The question which needs to be addressed is whether the current review of the EU Regulatory Framework for electronic communications, which was showcased by Commission President Juncker on September 14, 2016<sup>45</sup> and considered in the debates at the Digital Assembly in Bratislava on September 28-29, 2016,<sup>46</sup> is sufficiently flexible and robust to accommodate technological imperatives alongside difficult policy choices. As some commentators have argued, the failure to create the right environment in which 5G can flourish might have serious repercussions on the EU’s economic growth.<sup>47</sup>

In general, the legislative Proposals put forward by the Commission in the context of a

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[http://www.bundeskartellamt.de/SharedDocs/Publikation/DE/Berichte/Big%20Data%20Papier.pdf?\\_\\_blob=publicationFile&v=2](http://www.bundeskartellamt.de/SharedDocs/Publikation/DE/Berichte/Big%20Data%20Papier.pdf?__blob=publicationFile&v=2).

<sup>42</sup> Op. cit., “Competition Law and Data” Report, published (on May 10, 2016) by the French and German authorities. See also, *Big Data and Competition Policy*, by Maurice Stucke and Allen P. Grunes (Oxford University Press, 2016). In addition, for an overview of the EU investigations into “Big data” concerns, refer to the article “European Antitrust Enforcers Move on Holders of Big Data,” Kluwer Competition Law Blog (available at: <http://kluwercompetitionlawblog.com/2016/05/26/european-antitrust-enforcers-move-on-holders-of-big-data/>).

<sup>43</sup> See discussion in O. Batura, “Challenges in personal data for the competition law analysis,” *Network Industries Quarterly*, Vol. 18, No. 3, 2016, pp. 3-6.

<sup>44</sup> Regulation (EU) 2016/679 of the European Parliament and of the Council of April 27, 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation).

<sup>45</sup> Commission Press Release, “State of the Union 2016: Commission paves the way for more and better internet connectivity for all citizens and businesses,” September 14, 2016 (available at: [http://europa.eu/rapid/press-release\\_IP-16-3008\\_en.htm](http://europa.eu/rapid/press-release_IP-16-3008_en.htm)).

<sup>46</sup> Commission Article, “Digital Assembly 2016 in Bratislava: “Putting the Digital Single Market at the heart of Europe,”” September 22, 2016 (available at: <https://ec.europa.eu/digital-single-market/en/digital-assembly-2016-bratislava>).

<sup>47</sup> See L. Proud, “Europe may end up behind the curve on 5G internet,” Reuters.com, September 1, 2016 (Available at: <http://blogs.reuters.com/breakingviews/2016/09/01/europe-may-end-up-behind-the-curve-on-5g-internet/>).



future Electronic Communications Code appear to be coherent both in broader policy terms and with respect to the related work streams within the Commission which relate to 5G deployment (e.g. 5GPPP, 5GAPWG, RSPG and so forth). The perspective taken by the Commission is holistic and recognizes that these technologies form part of a large and diverse communications ecosystem. As such, many of the key enablers for successful 5G deployment seem to be addressed in a manner that is targeted and appropriate.

In particular, the Commission's emphasis on encouraging investment not only in 5G but also in the fixed infrastructure upon which 5G mobile deployments will depend, seems to be well considered. The Proposals on spectrum also seek to ensure a more coordinated approach, and given the importance of scale and timing for 5G, this may be an issue whose time has come. Similarly, other aspects of the Proposals such as those on network security and service integrity, appear to be appropriate for a 5G environment which will demand more exacting standards. As regards a number of the regulatory fine-tuning measures that might need to occur in order to accommodate fully 5G deployment, there is nothing in them to suggest that key policy drivers expressed in relation to the launch of the Proposals are not sufficiently flexible to be able to achieve such an aim.

However, there remain concerns, and the most significant issues arise from either recent legislation in the form of the TSM legislative package<sup>48</sup> or issues which lie outside the competence of the Commission's DG CNECT, which is responsible for regulatory policy in the communications sector. Thus, while reference is made in the Proposals to the need to update State Aid rules, this subject-matter lies firmly within the competence of the Commission's DG Competition. Similarly, network sharing (even for rural areas) and indeed future consolidation through mergers, which may be critical aspects of the industry's evolution, will remain within DG Competition's exclusive sphere of competence. It may be that network consolidation might address the latter of these concerns in the event that DG Competition softens its current position on mobile mergers by focusing more on the qualitative dimensions of competition and a more all-encompassing consumer welfare standard (as opposed to narrower consumer pricing concerns).

Perhaps the greatest threats, however, come from the recently adopted TSM legislative package (which, unlike the current Proposals, is largely incoherent with other policymaking). Both the Net Neutrality provisions, as interpreted by BEREC, and the Fair Use Policy roaming proposals<sup>49</sup> create significant obstacles to the business case which underpins 5G. As noted above, the Net Neutrality provisions in particular risk undermining one of the principal characteristics of 5G – namely, network splicing and the commercial exploitation of fragmented networks. The authors firmly believe that the Commission needs to clarify the application of doctrine of Net Neutrality in a 5G context if existing networks are to be enabled for 5G.

While the question of how to regulate roaming generally and wholesale roaming charges more specifically is a more prosaic issue, it is nonetheless an important issue in terms of the likely commercial success of 5G within the prescribed 2020 timeframe. Given the enormous changes to the volumes of data consumed that will be enabled by 5G, wholesale costs of data

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<sup>48</sup> Regulation (EU) 2015/2120 of the European Parliament and of the Council of November 25, 2015, laying down measures concerning open internet access and amending Directive 2002/22/EC on universal service and users' rights relating to electronic communications networks and services and Regulation (EU) No 531/2012 on roaming on public mobile communications networks within the Union.

<sup>49</sup> Draft Proposal at [http://ec.europa.eu/newsroom/dae/document.cfm?doc\\_id=17681](http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=17681).



must be consistent with operators' domestic rates if the RLAH policy is to continue in the manner in which it has been proposed. However, achieving this level of wholesale charging without eroding the value of network operators also remains a challenge in response to which no solution has emerged.