

Standards and competition in communications technology

Axel Gautier & Justine Bulkaert,
Liège University, HEC Liège, LCII

Abstract:

Given network externalities, the joint use of technical standards increases the compatibility between goods and thus benefits users. In recent years, communications technology has developed thanks to shared standards drafted in standardization organizations. A standard includes patents that are said to be “essential” to it and for which users must obtain a license. These “essential” patents are a bottleneck in the process. They grant a major competitive advantage to the patent-holders, whence questions about the relation between standardization and competition. The issue of whether regulatory authorities should intervene is being debated. This brief discussion of the consequences of standardization on competition both upstream from, and downstream in, the market takes mobile communications as an example.

The phrase “network effect” has to do with goods and services with a value for users that increases along with the number of users. Its defining property is network externality: the presence of an additional user benefits the whole community of users. The externality might be direct, when value is gained directly from the presence of other users, as in communication systems where a higher number of users multiplies the possibilities for communicating. Or it might be indirect, when what adds value is the presence not of other users as such but of additional goods and services, as in the case of an operating system, where the increasing availability of compatible software programs and applications is important to users. Since the increasing availability of goods or services depends on the number of users however, an increase in the number of users indirectly increases the value added.¹

When network externalities come into play, a joint technical standard allows for more compatibility between goods and services — to the benefit of users. Thanks to the use of a standardized format for electric plugs and sockets (type E in France), users can plug in any electric device, regardless of the brand. However they will have to purchase an adapter when traveling to England, where a different standard prevails. This example clearly points to the benefits of using a common standard and the costs of using different standards. In recent years, mobile communication technology has developed out of common standards. Tomorrow, owing to the Internet of things, the demand for communications will rise even more; and the use of joint standards for connected devices will facilitate their dissemination.

¹ This article has been translated from French by Noal Mellott (Omaha Beach, France). The translation into English has, with the editor’s approval, completed a few bibliographical references.

Standards are set in two ways. A *de facto* standard prevails in the market whereas a *de jure* standard results from a formal process of standardization. A *de jure* standard comes out of a complicated process involving both competition and coordination among firms — coordination, since defining a technical standard entails cooperation among several developers, a cooperation often organized under the auspices of a standards development organization (SDO). The latter, private or public, designs technical standards and identifies the techniques it uses, in particular the patents essential to it. Since the firms taking part in standardization voluntarily declare these “standard-essential patents”, the question of their essentiality is, it is worth pointing out, somewhat subjective and should be approached with care. Some studies have pointed to an overdeclaration of standard-essential patents (CONTRERAS 2018, STITZING *et al.* 2017).

Nor does cooperation within the standard-setting organization forestall competition. Techniques are in competition for inclusion during the drafting of a standard. The firms that take part in this drafting try to convince the SDO that their technological proposal is the best and must be adopted. Since consumers and the market ultimately decide whether a technique will be successful or not, competition also comes into play once the standard is adopted: competition between either manufacturers who use the same standard or between rival standards. An example of the latter was the competition, between the wireless technology standards WiFi and HiperLAN. WiFi, the American standard, soon had the upper hand over its European rival and eliminated it from the market.

This article discusses the consequences of standardization on competition, both upstream in the technology market and downstream in the market of goods and services. This question has sparked intense debates. Some authors think that standardization leads to “supramonopolistic” prices, whence the need for public regulatory authorities to intervene, whereas others think that the market regulates itself without any reason for systematic interventions in it.

Standards and standardization organizations

WiFi, Bluetooth and 3G are standardized communication technologies used by various and numerous devices around the world. They are developed not by a single company but by several firms. For example, the 3G standard includes more than 8000 patented inventions belonging to more than 60 different firms. Table 1 lists the number of standard-essential patents and the number of firms holding them for 2G, 3G and 4G. As we see, this number has continually grown as technology evolves, this being evidence of rising technological complexity.

Table 1: The number of standard-essential patents and firms contributing to the 2G, 3G and 4G standards			
	<i>2G</i>	<i>3G</i>	<i>4G</i>
Number of patents	2380	8454	10992
Number of firms	60	67	73
<i>Source:</i> Authors’ calculations based on the Searle Center Database on Technology Standards & ETSI			

Standardization organizations coordinate the process of setting complex technical standards that incorporate inventions from several firms. They are technical forums where the parties that have made inventions and the parties that use them are brought together for the purpose of finding a working technical solution.

In telecommunications, drafting a standard is an extremely hierarchized and codified process. The 3rd Generation Partnership Project (3GPP) is responsible for standards in mobile telephony (2G, 3G, 4G). It is a consortium of seven standardization organizations and of the firms that take part in this process. Engineers attend meetings several times a year. The agenda lists the requests for discussion submitted prior to the meeting by the firms. During these meetings, proposals are debated, approved or rejected, by all members in attendance. If a point is approved, 3GPP sets up a new work group for drafting technical specifications (BARON & POHLMANN 2018). In other words, the firms that are, together, developing the technology in question direct the standardization process. Service-providers, research laboratories, etc., might also be members of an SDO and take part in its activities even though they hold no patents.

This process for drafting a technical standard identifies the underlying technology: the “standard-essential patents”. To ensure a wide diffusion of the standardized technology — which is, after all, the goal — SDOs impose two obligations on participants: to make their standard-essential patents public and to offer licenses for them. The exact formulation of these obligations varies from one SDO to another (LAYNE-FARRAR 2018). These obligations see to the standard’s wide diffusion by offering potential users the guarantee that they can have access to all the patents incorporated in the standard. For this, the users have to obtain a license for all these patents.

The licensing obligation usually entails being fair, reasonable and nondiscriminatory (FRAND). To fight against the risk of endowing the patent-holder with greater market power owing to the essentiality of his patent, FRAND provides a framework for negotiations about royalties between patent-holders and potential users, and seeks to make sure that licenses are available at a reasonable, nondiscriminatory price. The qualification “reasonable” has a twofold purpose: licensing fees must be neither too high (thus raising the price of the end-product to an anticompetitive level) nor too low (to reward the inventor for his investment and provide incentives for future innovations) (SIDAK 2016). However FRAND states neither the rate of royalties that patent-holders may, or have to, apply for their standard-essential patents nor the basis for calculating them.

Furthermore, SDOs do not control the declarations whereby firms state that such and such patents are essential to standards. In fact, overdeclaring patents seems to be a widespread practice. Goodman and Myers (2005) have estimated that only 21% of the patents declared to be essential for 3G are indeed essential.

Standardization and competition

During the standardization process, the patents related to the technology in question are declared essential. These standard-essential patents create a bottleneck in the process, and presumably grant more market power to patent-holders. In cases involving Motorola and Samsung, the European Commission has recognized that the holders of standard-essential patents were in a dominant position. What is, therefore, the relation between standardization and competition?

For Lemley and Shapiro (2007), a patent’s essentiality endows its holder with considerable bargaining power, thus enabling him to collect royalties above the value of the technology prior to its incorporation in the standard. This “holdup” is related to the investments made by users, investments that tend toward market closure for the users of technology based on standard-essential patents. The patent-holders take advantage of this situation and raise royalties. According to these two authors, this holdup is magnified by royalty-stacking, when several firms have patents on the technology incorporated in the standard. When setting royalties, these firms ignore the externalities thus created, in particular the fact that high royalties reduce demand downstream on the market for goods and services and thus lower the profits drawn from all licenses (what is known as the Cournot effect).

According to Williamson's (1979) "holdup" theory, the holders of standard-essential patents act opportunistically as they try to corner the economic rent that results not from their position as a monopoly but from specific investments. This theory predicts that the high level of royalties for standard-essential patents and the accumulation of economic rent will limit incentives for investing and hamper the emergence of new competitive forms of the technology in question. Furthermore, these high royalties will ultimately be paid by consumers in the form of higher prices and less purchasing power. This situation signals a market failure; it is the reason why public authorities should seek remedy. The European Commission's actions against Samsung and Motorola in 2014 were motivated by the intent to lower royalties. In both these affairs, the Commission considered that the company holding a standard-essential patent had a dominant position that it had abused for the purpose of claiming intellectual property rights even though it had accepted FRAND and even though the user of the technology had accepted to enter negotiations for a license. By limiting the possibilities of patent-holders obtaining an injunction, the Commission deprived them of the power to commit an abuse. In this way, it hoped to reduce the royalties of such patents.²

The patent holdup theory and the ensuing interventions by public authorities have aroused strong opposition. The literature questions both the arguments of the theory's supporters (LLOBET & PADILLA 2017, GALETOVIC & HABER 2017, LAROUCHE & SCHUETT 2018) and the theory's consequences (GERADIN & RATO 2007, GERADIN *et al.* 2008, MALLINSON 2015, SIDAK 2016, GALETOVIC *et al.* 2018). This theory squares poorly with reality in the telecommunications industry — often cited for its high potential of making a holdup — because technology there is evolving so fast. As a consequence, parties have repeated interactions and, too, often play several roles. They hold patents to techniques but also use standards and, therefore, patented techniques developed by others. Furthermore, empirical studies have shown that businesses in this sector tend to be competitive. Taking account of variations in quality, the price of mobile telephones has continually decreased: licenses apparently account for but 3%-5% of the product's final price — far from the 25% predicted by the holdup theory.

We thus face two diametrically opposite theses. The one, claiming that prices are too high, argues for a corrective intervention whereas the other, claiming that the market is operating properly, sees no reason for interventions to lower the price of licenses (lest incentives for innovation be lowered as well). The courts of law that have had to settle patent cases swing back and forth between these two positions, sometimes bolstering control over the setting of licensing fees but sometimes leaving more room for the market to operate.

The standardization of mobile technology

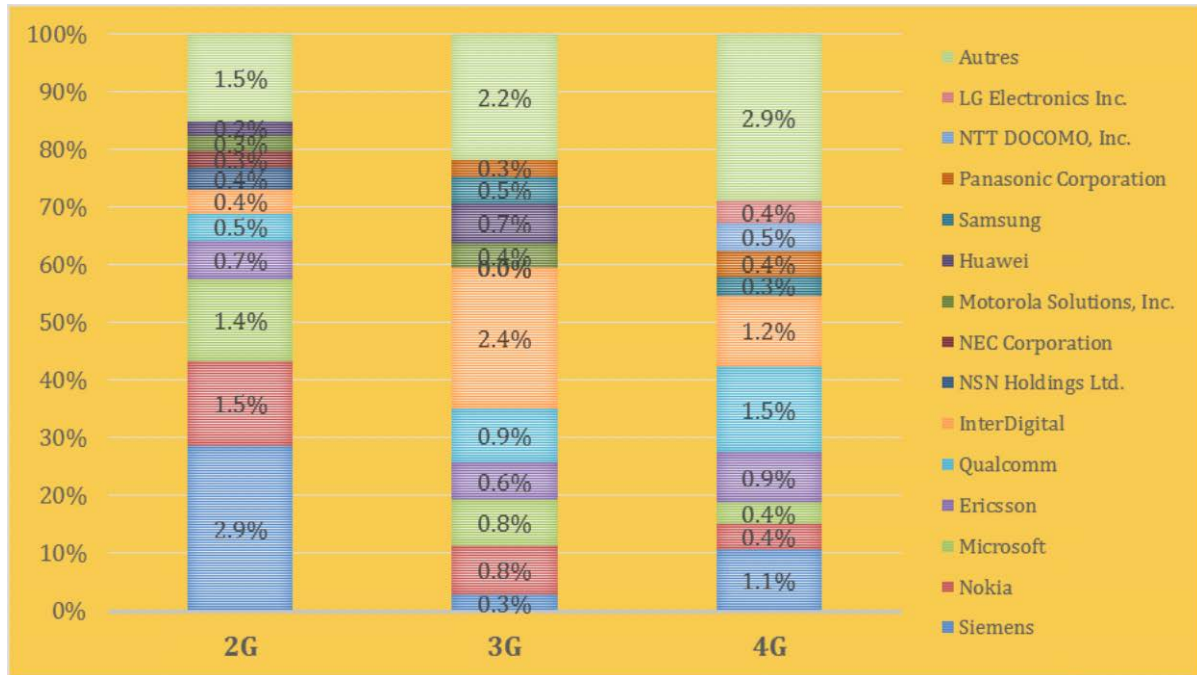
Let us conclude by citing a few statistics about the standards used in mobile telephony (2G, 3G et 4G) in order to discuss competition in the standard-setting process. As Figure 1 shows, many firms have taken part in drafting these standards. Furthermore these standards incorporate a large number of patents. This graph indicates, for each standard, the percentage of standard-essential patents concentrated in the hands of the ten biggest participants. Notice that this concentration has tended to diminish as mobile technology has evolved. The market share of the ten firms that declared the most patents fell steadily from 85% for 2G to 71% for 4G. We also notice that the market is increasingly splintered and that the market shares of big firms (*e.g.*, the giants Siemens, Nokia and Qualcomm) have varied considerably. These statistics, which should be handled with care, are evidence of a dynamic high-tech market with competition among the players in standardization.

² These cases were followed by several others. In Huawei vs. ZTE, the Court of Justice outlined the procedure for negotiating royalties under a FRAND license.

An injunction is a powerful legal procedure that can sanction the use of a patented technology without the patent-holder's agreement. An injunction may go so far as to forbid implementation of the patent, order a recall of all products violating the patent, and set damages for the patent-holder. An injunction can even exclude a competitor from the market.

Figure 1: Distribution of standard-essential patents for 2G, 3G and 4G.

Source: Authors' calculations based on the Searle Center Database on Technology Standards & Standard-Setting Organizations (BARON & POHLMANN 2018).



This article seeks to draw attention to this dynamic competition in a “standard-driven” sector of the economy. In the digital era, rules, regulations and standards contribute to the well-being of consumers. The needs for more interoperability and communications are making standards more important in our societies. This discussion, while pointing out the consequences that competition might have on consumers in a highly “standardized” market, also suggests that competition comes into play in the standardization process itself.

References

- BARON J. & POHLMANN T.C. (2018) "Mapping standards to patents using declarations of standard-essential patents", *Journal of Economics and Management Strategy*, 27(3), pp. 504-534.
- CONTRERAS J.L. (2018) "Essentiality and standards-essential patents" in J.L. CONTRERAS, *Cambridge Handbook of Technical Standardization Law: Antitrust, Competition and Patent Law*. Cf. <http://www.papamike.ca/book-id/the-cambridge-handbook-of-technical-standardization-law-competition-antitrust-and-patents>.
- GALETOVIC A. & HABER S. (2017) "The fallacies of patent holdup theory", *Journal of Competition Law and Economics*, 13(1), pp. 1-44.
- GALETOVIC A., HABER S. & ZARETZKI L. (2018) "An estimate of the average cumulative royalty yield in the world mobile phone industry: Theory, measurement and results", *Telecommunications Policy*, 42(3), pp. 263-276.
- GERADIN D. & RATO M. (2007) "Can standard-setting lead to exploitative abuse? A dissonant view on patent holdup, royalty stacking and the meaning of FRAND", *European Competition Journal*, 3(1), pp. 101-161.
- GERADIN D., LAYNE-FARRAR A. & PADILLA A.J. (2008) "The complements problem within standard setting: Assessing the evidence on royalty stacking", *Boston University Journal of Science and Technology Law*, 14, 35p.
- GOODMAN D.J. & MYERS R.A. (2005) "3G cellular standards and patents", paper submitted at the 2005 International Conference on Wireless Networks, Communications and Mobile Computing, 13-16 June. Available at <https://ieeexplore.ieee.org/document/1549445>.
- LAROUCHE P. & SCHUETT F. (2018) "Repeated interaction in standard-setting", *Journal of Economics & Management Strategy*, 5 October. Available at <https://onlinelibrary.wiley.com/doi/abs/10.1111/jems.12287>.
- LAYNE-FARRAR A. (2018) "Standards development organizations as two-sided markets", June. Available via <https://www.competitionpolicyinternational.com/wp-content/uploads/2018/06/CPI-Layne-Farrar.pdf>.
- LEMLEY M.A. & SHAPIRO C. (2007) "Patent holdup and royalty stacking", *Texas Law Review*, 85, 59p.. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=923468.
- LLOBET G. & PADILLA J. (2017) "The inverse Cournot effect in royalty negotiations with complementary patents", 28 February, 50p. Available at <https://ssrn.com/abstract=2866389>.
- MALLINSON K. (2015) "Cumulative mobile-SEP royalty payments no more than around 5% of mobile handset revenues", *WISEHARBOR*, 19 August, 13p. Available via <http://www.ipladership.org/publications/wisearbor>.
- SIDAK J.G. (2016) "What aggregate royalties do manufacturers of mobile phones pay to license standard-essential patents", *Criterion Journal of Innovation*, 1, pp. 701-719. Available at <https://www.criterioneconomics.com/aggregate-royalty-to-license-standard-essential-patents.html>.
- STITZING R., SÄÄSKILAHTI P., ROYER J. & AUDENRODE M.V. (2017) "Overdeclaration of standard essential patents and determinants of essentiality" available via <https://ssrn.com/abstract=2951617>.
- WILLIAMSON O. (1979) "Transaction-cost economics: The governance of contractual relations", *Journal of Law and Economics*, 22(2), pp. 233-261.