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Hardly a day goes by without mention of 5G in the news. What is 5G and why is it so important? This article—the first of three articles in a series addressing legal issues surrounding 5G— answers those questions. It also explains how this new technology will foster the creation and development of new applications for wireless technology that were not feasible or practical with even the fastest-existing 4G technology. Also, it will identify intellectual property challenges that will result from these new uses, including exploring some of the conflicts that are expected to emerge as new competitive relationships develop. Finally, this article explains how lessons learned from the licensing and litigation of 4G technology can be applied to issues that will inevitably arise as 5G becomes the next dominant communications standard.

What Is 5G and How Will It Be Used?

The fifth-generation network (or 5G) is the next-generation cellular network platform and will transform the way people use their connected devices. This powerful new technology builds upon previous generations of cellular technology, including analog voice (1G), digital voice (2G), mobile data (3G), and high-speed mobile internet access (4G Long-Term Evolution, or LTE) to provide users with a cellular network that is better than 4G in nearly every way.

In particular, once fully deployed, 5G will be more reliable, much faster, and more responsive, and offer substantial bandwidth improvements over 4G. 5G, for example, reportedly will be 10 times faster (or more) than LTE, while providing an estimated 100 times (or more) the traffic capacity of LTE. This superior speed and capacity will enhance existing uses of cellular technology, like Internet-of-Things, entertainment, productivity, and connectivity. But the real impact of 5G and its decreased latency, increased capacity, and flexible network arrangements will be in the enablement of a wide array of new applications, including virtual and augmented reality, machine-to-machine communications, and edge computing. Indeed, industries such as automotive, aerospace, health care, energy, wearables, retail, and agriculture are already realizing novel uses for 5G.

The use of virtual and augmented reality in 4G mobile devices, for example, is limited to novelty features in a handful of navigation and entertainment applications. But 5G's dramatic decrease in latency will stabilize the slow, jittery, and unstable experience that currently plagues the technology and unlock practical, real-world applications. These include 3D interactive holograms in video games, real-time remote assistance for first responders, and vehicle heads-up displays that superimpose real-time navigation, hazards, and other information.

Machine-to-machine communications in a 4G cellular network are slow and require a hierarchical routing of information through the backbone of the telecommunication network. This method introduces compounding latency issues and makes the timely delivery of critical information unreliable. New classes of products, such as autonomous vehicles, however, are circumventing the hierarchical structure and taking advantage of 5G's ability to support machine-to-machine communications. 5G's decreased latency also makes the direct communication of critical, time-sensitive information between machines practical and safe. For example, in-car media content streaming and real-time monitoring of diagnostic information will make full use of 5G's increased speeds. And, widespread deployment of self-driving cars requires large-scale accident and congestion avoidance systems that can only be supported by 5G's sub-millisecond latencies and machine-to-machine communication.

5G's flexible network structure also allows for edge computing, which like cloud computing, offloads data processing to faster and more powerful computers. Edge computing, however, improves upon the speed and latency of cloud computing by processing data as close to the source as possible rather than at centrally located servers.

These are just a few examples of the incredible number of new potential applications of 5G technology. Indeed, 5G is so improved over 4G that its impact may mirror that of the internet in the late 1990s, when its increased speed, reliability, and accessibility allowed it to permeate nearly all aspects of everyday life.

Important, Increasing Role of Standards

As the examples above demonstrate, the possible use cases for 5G technology are diverse and exciting. But its new applications will rely heavily on other technologies, especially as 5G applications expand into unchartered territories. In fact, the success of these anticipated use cases will depend upon other technical standards covering network, software, and hardware implementations to ensure critical systems are interconnected and interoperable.

Technology standards, including 5G, are generally established by standards setting organizations involving members from both private and public sectors. SSOs and their members generally seek to include the best possible technology in a given standard. In exchange for including a member's technology in the standard, SSOs require the member to disclose and grant licenses to patents and applications covering this technology. These patents are deemed "standard-essential patents" (or SEPs) and must be licensed under "fair, reasonable, and non-discriminatory" terms (or FRAND terms).

The 3rd Generation Partnership Project is the SSO that has developed numerous communications standards including Global System for Mobile (GSM), Universal Mobile Telecommunications System (UMTS), 4G-LTE, and now 5G. 3GPP technical specifications are defined with input from its members, which, for 5G, includes hundreds of leading technology companies representing various industries. Among other things, 3GPP's 5G specifications define the system's overall architecture, security, and capabilities.

With the integration of mobile communications in atypical industries, such as automotive and aviation, a surge of new members have joined 3GPP. Of course, 5G will not operate in a vacuum and other standards, such as other communications protocols, signal protocols, encoding and decoding methods, will play an important role in the exemplary use cases discussed above. And each SSO's rules, policies, and procedures will impact the potential implementation of these technologies, as well as frame future issues regarding licensing and enforcement.

Lessons Learned from 4G Licensing and Litigation

The wide applicability of 5G is expected to produce a complicated licensing and litigation landscape. There are, however, several lessons that can be learned from a review of past licensing and litigation activities of earlier cellular standards—4G in particular.

Historically, 1G/2G/3G licenses were typically negotiated between telecommunications companies that developed wireless technology and produced cellular products, such that both had SEP portfolios and product lines that practiced those SEPs. As direct competitors (or as customers/suppliers), these telecommunications companies were often able to simplify negotiations by cross-licensing their patent portfolios, sometimes on a royalty-free basis, or by including a smaller balancing payment to one party.

With the transition to mobile broadband communication of 4G LTE, however, non-telecommunications companies began integrating cellular technology into a wide range of IoT products, causing them to become licensing targets for SEP holders. The cellular industry's traditional licensing model did not work well in this situation. First, these companies were mis-aligned, in that they did not have similar SEP portfolios and corresponding product lines.

Consider, for example, a historical telecommunications company with a large, established cellular SEP portfolio that is attempting to license an appliance manufacturer selling a very successful IoT-enabled refrigerator that does not have its own cellular SEP portfolio. Here, the traditional approach of cross-licensing with a balancing payment will not work, as the payment from the appliance manufacturer to the cellular SEP holder may be viewed as being too significant. And the conventional method of valuing the cellular SEPs in the context of, for example, an end-product like a smartphone, may be inapplicable (or at least a less-ideal match) to the value provided to a product like a refrigerator whose primary function of cooling food is unrelated to cellular technology.

Many cellular SEP portfolios, moreover, had been licensed as a percentage of the end-product price. This made sense, as most cellular devices were devices dedicated to cellular communication, so the value to that device was easier to isolate and quantify. But when considering the value cellular technology might provide for a refrigerator, the historical calculus is less applicable, and could produce an inaccurate measure of those SEP's value to that new type of end product. This was an issue faced in 4G licensing and, with an even greater variety of 5G-enabled devices, that problem will likely grow in 5G licensing as well.

Further complicating modern cellular licensing is the fact that cellular components have become commoditized and are often nested into other increasingly complicated, multifunctional devices. One ongoing case, *Continental Automotive v. Avanci* (Case No. 5:19-cv-02520), pending in the Northern District of California, exemplifies how parties have struggled with the challenges inherent in valuing SEPs in modern, complex devices. This case involves licensing discussions surrounding communications SEPs between a patent pool administrator (Avanci) and car manufacturers. The automobiles at issue included telematics control units (TCUs) that act as the car's "black box" and report collision and other data to remote servers using an onboard network access device (NAD) that itself includes an integrated baseband chip.

Rather than license the portfolio to the manufacturers of the integrated baseband chip (which provides the communication functionality arguably covered by the patents), or the NADs (which include the baseband chip), or the TCUs (which include the NAD), Avanci allegedly has chosen to license only end-product manufacturers (i.e., the automobile manufacturer, whose device is the one that benefits from all these embedded systems). When Avanci's demanded royalty is applied to the total cost of the automobile, it appears small. But when compared to the price of the baseband chip, it is roughly two-thirds the cost of the chip. As 5G expands further into new markets, this type of valuation challenge is likely to persist and will underscore the need for comprehensive and effective indemnification provisions.

So, how does an implementer considering incorporating 5G technology into a new device learn from these past challenges? Perhaps most importantly, an implementer needs to consider the value proposition of 5G for this new device. Specifically, how does adding 5G functionality add value to the product? And is this a product that will require 5G in all modes of operation, or will this be more of an add-on benefit that only some customers would be interested in using? The answer to questions like these will help an implementer determine how best to design their product (and how best to prepare for incoming licensing demands).

Depending on the specific end-product, certain strategies may be employed to minimize the costs of implementing certain standards. For example, while avoiding cellular communications standards would be impossible in developing a mobile phone, there are design options an implementer should consider when developing a 5G-enabled IoT product. For example, consider a consumer product company producing a hobbyist drone that is designed to use 5G. If certain aspects of 5G, like machine-to-machine communication capabilities for collision avoidance, will not be required for certain users, the manufacturer may have the option of setting certain hardware or software switches to enable/disable the offending feature.

Or, they may be able to design their product such that the 5G functionality can be added by installing a 5G module, or by requiring the user to download certain software necessary for use. Switches, add-ons, and downloads of this nature may be able to reduce the number of potentially infringing devices sold, such that any royalty paid can be more closely tied to the select customers who choose to pay for the feature (and would actually benefit from its inclusion in the device at issue).

This type of "activation" system, or one in which functionality is added in a modular manner, provides protection against a potential injunction, as an adjudicated infringer would have the option of simply disabling or removing the feature, rather than pulling the products from the market. Traditionally, at least within the U.S., the risk of an injunction by an SEP owner was viewed to be quite low, as injunctions were not believed to be in the public interest, at least by the U.S. Department of Justice and Federal Trade Commission.

But some observers noted this policy upset the delicate balance between implementers and innovators in terms of SEP enforcement. Specifically, without the ability to seek an injunction, those implementing the standards could potentially "hold-out" during negotiations, because courts could, at most, impose the very same FRAND rates that the implementer could obtain through negotiation. Addressing these tactics, the DOJ recently withdrew from its prior approach, signaling greater freedom for courts to impose injunctions against SEP infringers in appropriate circumstances. It will remain to be seen how the DOJ ultimately expresses its new policy, and if others follow the DOJ in making injunctions more available (as they have been in other countries).

As 5G expansion continues, SEP holders should be mindful of potentially negative consequences, including the emergence of "hold up," in which the threat of excluding a product from market is used to extract an above-FRAND royalty. Time will tell whether equipping SEP holders with injunctive remedies will bring potential 5G licensees to the table, or whether it will deter them from using 5G entirely.

Patent Pools

With the rise in the number of SEPs and standards, patent pools have become an increasingly important source of SEP licenses. Patent pools, ubiquitous in the field of consumer electronics, are organizations that operate on behalf of their members to manage licensing of their patents (almost always patents essential to a particular standard). Ideally, these organizations provide a single avenue to license patents essential for implementing a particular standard in order to avoid royalty stacking (where individual licenses for a given standard are added together, often reaching unreasonable total sums).

When properly organized, patent pools increase the predictability of licensing costs, reduce transaction costs, and help avoid expensive litigations. Patent pools may also extend the relevant life of patents by bundling patents essential to both legacy and emerging standards, thus promoting backwards compatibility. Past, successful patent pools have generated substantial income for their members, as the barrier to entry was reduced and the standard-at-issue was widely adopted by implementers.

But patent pool success is not guaranteed. To be successful, members of the patent pool must agree on a unified licensing strategy. For a patent pool, defining the appropriate royalty requires a balance between monetizing the intellectual property and ensuring its deployment. Setting the royalty rate too high may hinder its chance of widespread adoption and may risk triggering development of a competing standard or pool.

For example, in the context of 5G, if royalties for streaming devices are set too high, consumers could decide that 4G LTE is sufficient for their needs, as streaming will not benefit as significantly from 5G's more exceptional advantages. And pools are not immune from the challenges of patent valuation in disparate end products. Avanci is one example of a pool who has targeted a particular industry segment (automotive) in the hope that valuation will be easier, but as 5G will apply to an even greater range of products and use cases, valuation challenges will remain for 5G pools and they will need to adapt to the increasingly tangled patent landscape.

The video compression field and the challenges that industry has faced in licensing SEPs shows how patent pool policy can negatively impact a standard's adoption rate, and may provide a warning to prospective 5G pools. As video compression standard H.265 was first being deployed, there was a lack of consensus on the target royalty rates, products, and potential caps. The result was a fractured pool environment, with members joining different pools, or remaining entirely independent. At present, a prospective H.265 implementer must deal with three different patent pools (e.g., MPEG LA, HEVC Advance, and Velos Media), each of which charge their own royalty, some capped, some not. And still other large SEP holders have decided to remain independent (e.g., Broadcom, Cisco, and Disney).

This fracturing has reintroduced the very real threat of royalty stacking and has increased the potential cost faced by integrating the standard into consumer electronics quite dramatically. The result of this situation is that competitor standards are under development and many companies have chosen not to take licenses or have removed features from their products.

Ultimately, even when patent pools do adhere to FRAND terms, royalty stacking remains a serious concern and will continue to influence 5G adoption, particularly because emerging 5G-enabled products and systems will need to support an even greater number of diverse standards—implicating SEPs owned by a variety of patent pools and independent licensors.

Conclusion

The deployment of 5G will bring with it exciting new technical developments but will also usher in a new round of licensing disputes and potential litigation. While the substantial technical benefit of 5G will mean that it will be adopted in the traditional core cellular market, the true realization of its potential will be its use in non-traditional markets in new ways. The success of 5G will depend on whether these markets can identify and respond to the licensing and enforcement challenges presented by 5G SEPs.