

## DISRUPTING SECURED TRANSACTIONS

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*Article 9 of the Uniform Commercial Code (U.C.C.) governs secured transactions in personal property in all fifty states and has been lauded as “the most successful commercial statute ever.” But while Article 9 has facilitated commerce and economic growth, it remains complicated and inefficient in numerous respects. Its weaknesses are well known but have been considered necessary evils, accepted because no better approaches were available. The U.C.C. was motivated by the idea of streamlining the law to accommodate modern commerce—and now that goal should motivate revision of the U.C.C. itself*

*This Article proposes to remove and replace a primary structural component of Article 9 of the U.C.C.—the filing system by which secured creditors put others on notice of their interest in items of collateral. The proposal jettisons this outdated and often ineffective method of making required filings about security interests, and instead, looks to modern technologies to stake clearer and more reliable claims of security interests in collateral. It would no longer be necessary to file financing statements indexed under the name and location of the owner of collateral. Instead, the proposed regime would allow creditors to stake their claims in collateral directly—by means of online “smart” maps or by electronic tags identifying interests in particular items of collateral—and would eliminate numerous arcane, inefficient, and inequitable features of the current regime.*

*The proposal would serve the broader goals of commercial law by reducing needless legal complexity and more closely aligning legal requirements with business realities. The “disruptive” changes proposed in this Article increase certainty in commerce and allow secured transactions law to reflect developments in business and financial practices.*

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*Table of Contents*

Introduction.....	3
I. The Existing System.....	10
A. The Current Secured Transactions Regime.....	10
1. How the System Is Supposed to Work and Why.....	10
2. How the System Actually Works and Why.....	12
B. The Problem with Article 9’s Problems— and the Way to a Solution.....	18
II. Technological Alternatives.....	20
A. “Internet of Things” Technology.....	20
B. Geolocation Technology.....	29
III. The Proposed System.....	33
A. The Proposed System in Outline.....	34
B. Examples of the Proposed System’s Operation.....	42
IV. Potential Objections.....	44
A. The Costs and Benefits of Disrupting Article 9.....	45
B. “All-Asset” Lending.....	47
C. Political Resistance.....	48
D. Borderline-Tangible and Other Complicated Assets.....	50
E. Article 9’s Overlap with Related Areas of Law.....	50
F. Access and Participation by Small Businesses, Consumers, and Other Commercially Unsophisticated Parties.....	51
V. Conclusion.....	53

## INTRODUCTION

Article 9 of the Uniform Commercial Code governs secured transactions in personal property in all fifty states as well as Puerto Rico and the District of Columbia.<sup>1</sup> It has facilitated commerce, contributed to economic growth, and is widely lauded as “the most successful commercial statute ever.”<sup>2</sup>

Article 9 relies upon the central notion of a “security interest” that a creditor obtains in a debtor’s collateral by agreement.<sup>3</sup> A security interest can be obtained in almost every sort of personal property. Once it is “perfected,” the security interest gives the secured creditor rights in the collateral, not just against the debtor but also against most subsequent lenders or buyers of the property. Under Article 9, a secured creditor’s rights against collateral are generally perfected by virtue of a filing made in the state of the debtor’s location, called a “financing statement,” which is indexed under the debtor’s name and location, and which theoretically puts other creditors on notice of the security interest encumbering one or more items or classes of collateral identified in the statement.<sup>4</sup>

A security interest is a relationship between a creditor and an item of property, not a creditor and debtor; conceptually, the key feature of perfection is that it announces the creditor’s claim on that *item* to third parties. Yet Article 9’s filing system focuses on the creditor’s relationship with the *debtor*, out of perceived practical necessity. This Article argues it is necessary no longer, thanks to the availability of technologies that can permit direct identification of collateral itself.

As it stands, Article 9 remains complicated and inefficient in numerous respects,<sup>5</sup> due in no small part to the deep structural flaw of permitting financing statements announcing a security interest to be filed and discovered only when indexed under the debtor’s name and in the debtor’s state.<sup>6</sup> This structure immediately provokes questions: Which

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<sup>1</sup> Some states’ versions of Article 9 are “non-uniform,” but the deviations are relatively minor. *See, e.g.*, 4 WHITE & SUMMERS, UNIFORM COMMERCIAL CODE, § 34:17, n. 3 (6th ed. 2017) [hereinafter, WHITE & SUMMERS] (discussing nonuniform state amendments); *id.* at § 32:18, n. 3 (same); *id.* at § 31:41 (same); *id.* at § 31:32, n. 8 (same).

<sup>2</sup> Steven L. Harris & Charles W. Mooney, Jr., *A Property Based Theory of Security Interests: Taking Debtor’s Choices Seriously*, 80 VA. L. REV. 2021, 2021 (1994); *see also* Edward J. Janger, *Predicting When the Uniform Law Process Will Fail: Article 9, Capture and the Race to the Bottom*, 83 IOWA L. REV. 569 (1998) [hereinafter Janger, *Uniform Law Process*] (“Article 9 of the Uniform Commercial Code . . . is, by all accounts, the crowning achievement of the U.C.C. project . . .”).

<sup>3</sup> *See infra* notes 21-23 and accompanying text.

<sup>4</sup> *See infra* notes 25-29 and accompanying text.

<sup>5</sup> *See generally* Part I.A.2.

<sup>6</sup> *See infra* notes 38-46 and accompanying text.

forms of a debtor's name suffice for a filing to be valid? How can a party be certain of the location of a business entity doing business in state A, which might be incorporated under the same name in states B or C? What about when debtors change locations, or names, or the collateral leaves the possession of one debtor and becomes the possession of another? Article 9's rules attempt to deal with these contingencies and a multitude of others,<sup>7</sup> but in the end, the oblique structure of announcing an interest in a *thing* (the collateral) through a filing against a *person* or *business* (the debtor) brings inevitable complications.

The law has developed a number of cumbersome workarounds to make the system function. For example, secured transactions law permits security interests to stretch beyond the collateral actually described on a creditor's filings to include "proceeds" obtained upon the sale of the original collateral. Under many circumstances, the regime also permits security interests to *remain* on the original collateral after such sales—thus protecting the secured creditor at the expense of other parties dealing with the debtor or purchasing a debtor's former property. These workarounds simply allocate the losses in instances in which the theoretical goals of the system are not met—they do not provide parties with notice, help protect their interests, or set sound commercial expectations. Unsurprisingly, in light of these complications, many participants in the commercial system fail to protect their interests, either because they deem the burdens and uncertainties of the filing system not to be worth the candle, or else because they are ignorant of the law's rather arcane approach to the many difficult questions the system provokes. Either way, Article 9 imposes costly inefficiencies on commerce and finance.<sup>8</sup> Some lenders are more reluctant to lend against collateral than they would be if the system provided them with better means of attaining and protecting their perfection; some are taken advantage of by the false certainty promoted by Article 9's apparent—but not actual—coherence and reliability, and suffer needless losses.

Article 9's weaknesses are well known, but they have been considered necessary evils, accepted because no better approaches were available. This Article proposes a better approach—one that ends the filing system's detour through the debtor's name and location, and trims away the tangle of inefficient workarounds. The Article describes two disruptive technologies that can and should bring a radical shift in secured transactions: "Internet of Things" (IoT) technologies and geolocation

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<sup>7</sup> See *infra* Part I.A.1-2.

<sup>8</sup> In explaining the motivation for the U.C.C., Karl Llewellyn expressed a desire to end "the unnecessary tax on . . . business that legal uncertainty now imposes." Karl M. Llewellyn, *Why a Commercial Code?*, 22 TENN. L. REV. 779, 783 (1953).

technologies. Businesses have widely adopted these technologies, but their potential to transform commercial law has not been recognized. This Article proposes a new secured transactions filing regime based on them.

Under the proposed regime, readily available IoT and geolocation technologies would furnish the means for creditors to provide clearer notice of security interests in collateral and establish more reliable claims in that collateral. The proposed regime would require creditors to stake their claims in collateral directly—by means of public “smart” maps, or by individual electronic tags that facilitate identification of security interests in items of collateral. This simplification would eliminate the need for numerous arcane, inefficient, or inequitable features of the current regime. To be clear, the proposed changes would be almost entirely in the law and not in business practices. Secured transactions law would be accommodating the ways in which businesses already widely use these technologies—including to identify, track, and monitor their property (including their collateral)—and not embarking on some quixotic quest to convince businesses to adopt unknown new technologies. Because these technologies are widely adopted and becoming ever more pervasive, the costs of transitioning to a new legal regime would be minimal for most commercial actors.<sup>9</sup>

In general outline, the proposal is as follows: A creditor taking a security interest in a particular item<sup>10</sup> of collateral would perfect that interest by one of two mechanisms. The first mechanism involves IoT technology. The creditor (or its agent) would mark the collateral with an electronic tag or other readable label or device, containing the name and contact information of the secured creditor and an ID number generated automatically from an online interface hosted at the U.C.C. filing office of the state where the collateral was located. Once the number was assigned and the creditor’s name and contact information registered, the interest would be perfected. If the IoT-tagged collateral were moved or sold, the perfected interest would survive, because perfection is not linked to the debtor. Anywhere they encounter items, subsequent searchers (such as potential lenders) could scan them with readily available technology (such as that included on most smart phones), to ensure they are free of security interests. The later creditor would be subordinate to the prior creditor—unless the unique tag was damaged or removed from the object. In such a case, after the passage of a short grace period, the prior creditor would lose to other creditors, because it is best positioned to monitor its collateral and

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<sup>9</sup> Issues affecting commercially or technologically unsophisticated individuals and small businesses are discussed *infra*, Part IV.G.

<sup>10</sup> Intangibles are discussed *infra* notes 116-122 and accompanying text; the proposal is limited to tangible property and would leave the systems dealing with intangible property intact.

protect against such an eventuality.

Monitoring costs should be minimal, given the power of IoT technologies to provide automatic, real-time updates from afar concerning relevant characteristics of collateral, for example to monitor the location of a shipping container or the temperature or humidity of a warehouse. IoT technology is in regular use already, and use of the technology is expected to expand even more in coming years. The law would merely be looking to, and giving force to, these existing business practices.<sup>11</sup> The most familiar IoT technology is radio frequency identification (RFID), which uses electromagnetic fields (radio waves) to identify and track objects by virtue of “tags” that consist of a tiny circuit and embedded antenna and that are attached to objects. This technology is ubiquitous. Retailers use RFID to identify goods received from suppliers and then purchased by consumers, pharmacists use RFID to weed out counterfeits and verify the authenticity of medications, and employers use RFID on security badges. RFID is inexpensive and its costs are expected to diminish even further.

This mechanism of perfection mimics, in some ways, the system already in place for items such as airplanes and cars, which are assigned unique identifiers by which security interests can be perfected.<sup>12</sup> Identification by collateral has long been known to make sense in theory, but until now, it was impracticable for most pieces of collateral, which were not expensive enough to merit the treatment that valuable items such as cars or airplanes received. This proposal is a response to the development of cheap and reliable technology allowing for the tagging of individual items—technology that did not exist at the time of the U.C.C.’s drafting.

The second method of perfection would involve geolocation technology (such as that underlying GPS navigation).<sup>13</sup> A creditor would log in to a publicly maintained interactive map, navigate and click to identify the location of its collateral, and then provide its name and a basic description of the collateral. The security interest would then be perfected as to any described collateral within that location. Subsequent searchers could easily check the map and ascertain whether a geolocated interest had been claimed, inquire further if necessary, and make any other decisions accordingly. This type of identification would work well with equipment remaining in one place, as well as with warehouses, factories and stores, where there are many items of collateral that turn over frequently—and thus where a creditor might determine that tagging each item of collateral is not

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<sup>11</sup> See *infra* Part I.A (comparing need for monitoring under current Article 9 with the proposed system).

<sup>12</sup> See *infra* notes 80-83 and accompanying text (discuss motor vehicle and aircraft laws).

<sup>13</sup> On this technology, see *infra* notes 93-102 and accompanying text.

worthwhile. In all such instances, the creditor would be tasked with monitoring the collateral because if the collateral were moved outside of the protected area, the creditor would have only a short grace period to relocate the collateral and assert a claim against it. Again due to the advance of technology, such monitoring could be done with readily available, inexpensive, and automated technology.

By directly connecting creditors with their collateral, and by giving notice based on individual tagging or identification of the location of collateral, the proposal would lower Article 9 compliance costs, diminish the number of defective filings, and permit the removal of numerous problematic laws such as those protecting “proceeds.” The revised system would provide lenders more certainty and allow more precise monitoring of collateral; at the same time, it would permit debtors to carve out more precisely the property they wish to subject to security interests—all of which, in turn, would presumably improve credit markets.

In addition to these practical benefits, the proposal would put secured transactions on a sounder theoretical basis and fulfill the U.C.C.’s broader normative goals in two important ways. First, the proposed system fulfills the legal realist goals of commercial law by more closely aligning secured transactions with actual commercial practices. The U.C.C. was born out of the legal realist movement,<sup>14</sup> to shape commercial law around commercial realities and the actual practice of commerce.<sup>15</sup> This proposal moves the law away from the increasingly archaic step of filing against the debtor’s name and in the debtor’s location towards the realities of how modern commercial actors protect their interests in property.<sup>16</sup> Second, as

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<sup>14</sup> See generally WILLIAM TWINING, KARL LLEWELLYN & THE REALIST MOVEMENT 270-340 (2d ed. 2012) (discussing the “Genesis of the Uniform Commercial Code” and the “Jurisprudence of the Uniform Commercial Code” in the context of legal realism); Allen R. Kamp, *Between the Wars Social Thought: Karl Llewellyn, Legal Realism, and the Uniform Commercial Code in Context*, 59 ALBANY L. REV. 325 (1995) (outlining the intellectual and societal underpinnings of Llewellyn’s “Realist” approach).

<sup>15</sup> See, e.g., Richard Danzig, *A Comment on the Jurisprudence of The Uniform Commercial Code*, 27 STAN. L. REV. 621, 631 (1975) (surveying its history and describing the purpose of the U.C.C. as removing “statute and case law debris from the field so that commercial law could follow the natural flow of commerce”); Zipporah Batshaw Wiseman, *The Limits of Vision: Karl Llewellyn and the Merchant Rules*, 100 HARV. L. REV. 465 (1987) (noting “[U.C.C. chief architect Karl Llewellyn’s] commitment to merchant reality” as one of the two “essential themes of Llewellyn’s vision [for what became the U.C.C.]”). Wiseman notes that, “[a]s a realist, Llewellyn viewed law as a means to social ends and recognized the need to reexamine the law constantly to ensure that it fit the society it claimed to serve.” *Id.* at 493.

<sup>16</sup> As Ronald Mann has noted, “it is too simplistic to treat the codification of commercial law as a codification of the norms reflected in everyday business practices,” and yet, “policymakers who want to affect the tenor of commercial life must work to develop rules that account for the legitimate needs reflected in the reality of commercial

compared with the debtor-centered system, the proposed system makes more conceptual sense. The proposal comports with the underlying notion of a *security interest*—which is a relationship between a creditor and its collateral; as well as with the stated purpose of the requirement of *perfection*—to inform third parties that a given piece of property is encumbered with a security interest. The proposed system requires creditors to make claims on collateral directly, through identification on a tag or by location. It no longer requires the detour through the debtor’s name and identity that has been the source of much mischief in the law, and that is needless and confusing in light of the underlying legal concepts.

This Article’s proposal is also a unique contribution to the growing body of scholarly work exploring the ramifications of IoT and related technologies.<sup>17</sup> While technologically savvy commercial lawyers have floated useful proposals for revising Article 9,<sup>18</sup> none so far has looked to IoT technologies as a way of taking on the debtor-indexed filing system—even though this system is perhaps the biggest elephant in the secured transactions room. Even those who have mentioned this elephant have not found a way simply to remove it altogether.<sup>19</sup> This Article provides such a

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transactions.” Ronald J. Mann, *Verification Institutions in Financing Transactions*, 87 GEO. L.J. 1, 41-43 (1999). This Article is a call to commercial law policymakers to “develop rules that account for” new technologies and move the law away from those that those technologies have rendered unnecessarily burdensome.

<sup>17</sup> Eric Posner & E. Glen Weyl, *Property Is Another Name for Monopoly*, 19 J. LEG. ANAL. 51 (2017) (proposing a new system of property ownership, taxation, and transfer, based in part on a technologically enabled, universal registry of all property); see also Richard M. Hynes, *Posted: Notice and the Right to Exclude*, 45 ARIZ. ST. L. J. 949 (2013) (proposing for virtual “no trespassing” signs to be “posted” and accessible remotely via GPS devices and smart maps to hunters or recreationists); Ari Glogower, *Wealth and the Income Tax*, Ohio St. Public Law Working Paper No. 368 (Sept. 21, 2016) (proposing to modify tax system to force regular disclosure not just of net income but of net wealth, in part by using technological means).

<sup>18</sup> See, e.g., Carla L. Reyes, *Conceptualizing Cryptolaw*, 96 NEB. L. REV. 384, 402-03, 417-21 (2017) (proposing Article 9 revision to permit use of Blockchain technology in maintaining financing statement filing system); Lynn M. LoPucki, *Computerization of the Article 9 Filing System: Thoughts on Building the Electronic Highway*, 55 LAW & CONTEMP. PROBS. 5 (1992) [hereinafter LoPucki, *Computerization*].

<sup>19</sup> Jonathan Lipson, *Secrets and Liens: The End of Notice in Commercial Finance Law*, 21 EMORY BANKR. DEV. J. 421 (2005) [hereinafter, Lipson, *Secrets and Liens*] (identifying numerous defects with filing system under recent major round of amendments); Reyes, *supra* note 18, at 402-03 (cataloguing problems with filing system); LoPucki, *Computerization*, *supra* note 18, at 6-15 (providing detailed critique); Gerald T. McLaughlin, “*Seek But You May Not Find*”: *Non-UCC Recorded, Unrecorded and Hidden Security Interests Under Article 9 of the Uniform Commercial Code*, 53 FORDHAM L. REV. 953 (1985) (critiquing filing system). The filing system would only be removed as to *tangible* property under my proposal, although much law governing intangibles would be simplified as well. See *infra* notes 116-122 and accompanying text.

proposal.

The Article unfolds as follows. Part I outlines the problems with the existing Article 9 system. Part II provides an overview of potentially “disruptive”<sup>20</sup> advancements in two areas, in Internet of Things (IoT) technologies and in geolocation technologies. Part III considers the strengths and weaknesses of potential regimes based on each of these technologies and proposes a hybrid perfection regime that would combine the best features of each. Part IV considers potential hindrances to the proposal’s implementation and functioning. It determines that the time has come for this tectonic shift to collateral-based identification, for the benefit of all stakeholders in the secured transactions regime. Part V concludes.

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<sup>20</sup> On “disruptive” technologies, see Joseph L. Bower & Clayton M. Christensen, *Disruptive Technologies: Catching the Wave*, HARV. BUS. REV., Jan.–Feb. 1995. Law scholars have invoked the idea in looking for ways of regulating innovation. See, e.g., Chris Brummer, *Disruptive Technology and Securities Regulation*, 84 FORDHAM L. REV. 977 (2015) (discussing regulatory approaches to disruptive financial technologies); Wulf A. Kaal & Erik P.M. Vermeulen, *How to Regulate Disruptive Innovation—From Facts to Data*, 57 JURIMETRICS J. 169, 177 (2017) (proposing data-based regulatory model for disruptive). What has drawn less attention in the legal scholarship but is central to this Article, is how disruptive innovations may “disrupt” entire bodies of law, such as Article 9.

## I. THE EXISTING SYSTEM

A. *The Current Secured Transactions Regime*

## 1. How the System Is Supposed to Work and Why

While its details are complicated, the core features of the Article 9 system are simple, even elegant. A summary can be provided as follows. A “*security interest*” is a creditor’s legally recognized claim on some item of the property.<sup>21</sup> Once a security interest has been granted by a debtor and certain other requirements have been met, the security interest “*attaches*,” meaning it is valid and enforceable as between the debtor and creditor.<sup>22</sup> Even if the collateral remains in the debtor’s possession and the debtor keeps using it, the property legally remains collateral for the obligation owed to the creditor. The crucial, indispensable feature of an Article 9 security interest is that it allows the creditor to look to the collateral for collection, regardless of whether the debtor is uncooperative or has vanished. If the debtor fails to pay, the creditor can seize the collateral and sell it to cover the debt that is owed.<sup>23</sup>

Commonly, parties agree for a security interest to “float” over not just the “original” collateral—that is, what was collateral at the time of attachment—but also over collateral the debtor acquires subsequently.<sup>24</sup> This is convenient, for instance, for inventory, which frequently turns over. One agreement can provide for many shipments rather than forcing the parties to enter into repeated agreements for each new delivery of collateral.

Attachment is often not enough, however, because it is usually only valid as between the creditor and debtor. A debtor may have other creditors who might also have security interests in the collateral, or who might try to seize the collateral through a collections process such as garnishment or levy. For one creditor to supersede these others—to take “*priority*” over them with respect to particular collateral—usually requires the creditor take further steps, to “*perfect* that interest.<sup>25</sup> Usually, perfection is accomplished with the step of making a short, electronic filing, called a “*financing statement*,” in an office designated by the Secretary of State of the debtor’s state of residence or incorporation.<sup>26</sup> The financing statement provides the

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<sup>21</sup> U.C.C. § 1-201(b)(35).

<sup>22</sup> U.C.C. § 9-203(b) (requirements of attachment).

<sup>23</sup> See U.C.C. § 9-609 (creditor can seize collateral after default); U.C.C. § 9-610 (creditor can sell collateral); U.C.C. § 9-615 (sale proceeds used to pay off debt, and excess returned to debtor).

<sup>24</sup> U.C.C. § 9-204 (after-acquired property).

<sup>25</sup> U.C.C. § 9-308(a) (defining perfection).

<sup>26</sup> U.C.C. § 9-310(a); 4 WHITE & SUMMERS § 31.27 (“Perfection by filing is by far the

debtor's name and address, the secured creditor's name and address, and a description of the collateral, which can be as general as "all assets."<sup>27</sup> Once filed (usually electronically), the financing statement is indexed by the debtor's name, and after that point, in most states, a creditor or other inquirer can run an online search using the debtor's name to find a given financing statement.<sup>28</sup>

Usually the first creditor to file a financing statement will have priority as to collateral covered by that statement—even if, at the time of filing, the security interest has not actually attached, or if a second creditor's interest attaches first.<sup>29</sup> The theory is that the financing statement proclaims the secured creditor's interest in the collateral, thus putting later creditors on notice that they may not be first in line.

Imagine that Creditor A has a perfected security interest with priority over Creditor B's. If Debtor defaults on payments to Creditor A, Creditor A has the right to seize the collateral and auction it off to cover what it is owed by Debtor, notwithstanding Creditor B's competing interest. For this reason, Creditor A is in theory able to deal with Debtor on more favorable terms, in light of its certainty regarding the collectability of its debt given its superior interest in the collateral. By contrast, Creditor B would be left only with leftover proceeds from the auction (if any), after Creditor A has been paid in full.<sup>30</sup> Accordingly, if Creditor B searches the records and discovers a financing statement of Creditor A, it may refuse to lend to Debtor, charge Debtor a higher interest rate, or demand more collateral, in order to compensate for the increased risk that if Debtor defaults on the debt, the collateral's value to Creditor B will be diminished.

Thus, the awarding of priority to Creditor A is thought to be justified by Creditor B's opportunity to "adjust" the terms of any credit it extends to Debtor in light of its notice of Creditor A's prior interest.<sup>31</sup> Creditor B is deemed to have dealt with Debtor on terms that reflected Creditor A's prior

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most common method of perfecting a security interest under Article 9. ... We suspect that for more than 90% of the universe, perfection occurs by some form of filing of a document, which the U.C.C. calls a 'financing statement' . . . .").

<sup>27</sup> U.C.C. § 9-108.

<sup>28</sup> See, e.g., KENTUCKY SECRETARY OF STATE ONLINE SERVICES ONLINE FILING HOME PAGE, [https://app.sos.ky.gov/ftucc/\(S\(iof21xjbrgxmjlhet0k34\)\)/search.aspx](https://app.sos.ky.gov/ftucc/(S(iof21xjbrgxmjlhet0k34))/search.aspx) (last visited Feb. 18, 2018).

<sup>29</sup> Notably, it is the first creditor to *file* such a statement whose security interest will have priority, and not the first creditor to have *perfected* the interest. The filing can be (and often is) made prior to attachment and in essence preserves the creditor's "place in line," if and when it perfects.

<sup>30</sup> U.C.C. § 9-615(d).

<sup>31</sup> Some creditors have no opportunity to benefit from notice or adjust credit terms. Tort creditors, for instance. Lack of consideration of such creditors has criticized. See *supra* note 135.

interest.

That is the basic theory of the existing secured transactions system, as embodied in Article 9 of the U.C.C. It has been attacked, and defended, on normative bases,<sup>32</sup> but its rudiments have remained unchanged since the original passage of Article 9.<sup>33</sup> The notion of a security interest, and of perfection via a brief financing statement filed in a central location, were revolutionary at the time of the U.C.C.'s initial passage.<sup>34</sup>

The importance that Article 9 places on notice to creditors is connected to the notion, which has a long historical pedigree, that inequity and fraud may be perpetrated if “secret liens” are granted legal validity—in other words, if the *apparent* or *ostensible owner* of property has, without public notice, transferred property away, out of the grasp of unsuspecting creditors.<sup>35</sup> The principle dates back to at least *Twyne's Case* in 1601.<sup>36</sup> The notice aspect of the modern Article 9 system is structured to promote commerce by maximizing transferability of interests in property while assuring participants in the system that their expectations and interests will not be undermined by “secret liens” or other deceptive devices.

## 2. How the System Actually Works and Why

The core concepts and basic structure of Article 9 are sensible and coherent, as the previous section explained. Faced with a welter of convoluted, contradictory, or uncertain state laws governing the diverse array of secured transactions, the drafters of Article 9 fashioned a relatively brief and conceptually sound statute that despite several rounds of

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<sup>32</sup> See, e.g., Robert K. Rasmussen, *The Uneasy Case Against the Uniform Commercial Code*, 62 LA. L. REV. 1097 (2002) (providing a critical and scholarly overview of the substance of the U.C.C., with a focus on Article 2 and Article 9, as well as the lawmaking process); Grant Gilmore, *The Secured Transactions Article of the Uniform Commercial Code*, 16 LAW & CONTEMP. PROBS. 27 (1952) (providing an early account of Article 9 by its primary drafter).

<sup>33</sup> See generally 4 WHITE & SUMMERS, § 30:1 (summarizing history of Article 9).

<sup>34</sup> These are the primary reasons that “Article 9 was the most innovative of the original Code articles . . . .” 4 WHITE & SUMMERS, § 30:1; see also *id.* (“In pre-Code days, the lawyer had to work with a variety of security devices, each governed by its own body of law. . . . The grand innovation of Article 9 in 1962 was the introduction of a single ‘unitary’ security device.”); 4 WHITE & SUMMERS, § 31:17 (“Filing of a financing statement as to personal property was revolutionized by the initial adoption of the U.C.C., and later by the widespread use of electronic data storage. Prior to the Code’s filing system, filing was haphazard and nonuniform . . . .”).

<sup>35</sup> See generally Douglas Baird, *Notice Filing and the Problem of Ostensible Ownership*, 12 J. LEG. STUDS. 53 (1983); Lipson, *Secrets and Liens*, *supra* note 19, at 424-45.

<sup>36</sup> *In re Twyne's Case*, (1601) 76 Eng. Rep. 809 (Star Chamber); see also Baird, *Notice Filing*, *supra* note 35, at 53-54; Lipson, *Secrets and Liens*, *supra* note 19, at 437-38.

amendment remains fundamentally intact more than a half of a century after initial publication.<sup>37</sup> Their work product, Article 9, provides a logical method of organizing claims to and rights in collateral, based on the unifying notions of the “security interest” that is “attached” and then “perfected,” and takes “priority” in the collateral.

But the system is riddled with loopholes, gaps, and exceptions. As a result, creditors remain unsure of how secure their interest in collateral really is. There are two general types of problems with the operation of the current Article 9 system. The first type is the easiest to understand. This type of difficulty arises in obtaining or maintaining perfection. For instance, it might arise due to uncertainty about how to identify the debtor, about where to file the requisite forms, or about who actually has rights in the property at a given time. The second type of problem is more esoteric but highly pertinent in the actual functioning of the system. This difficulty arises from the fact that even after a debtor disposes of the collateral, the U.C.C. permits creditors to maintain certain rights both in the original collateral and in any proceeds from the sale of that collateral. For these rights to be exercised, a creditor must “trace” the collateral and the proceeds to whomever now owns or has other rights in them—who may well be surprised by the creditor’s assertion of rights.

The central theme is that the promise of certainty is not fulfilled because Article 9’s current system of debtor-based identification is cumbersome and ineffective. It includes various ornate provisions for maintaining existing interests even where they aren’t really identified and can’t put another lender on notice. This Article proposes to solve several of the major problems with the existing system. This section probes the nature and extent of those problems before the rest of the Article explains how they can be minimized or eliminated by application of new technologies.

#### a. Rights in Original Collateral

The first type of problem arises when a creditor attempts to obtain and maintain rights in an item of collateral. Despite several rounds of amendments in order to try to make Article 9’s process more simple and certain, there remain, inevitably, numerous situations in which such a

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<sup>37</sup> This might be because the fundamental structure is sound, or that the committees tasked with amendment have been “congenitally conservative.” White, *supra* note 7, at 823 (noting “members [of such committees] quickly become focused on revisions and amendments that any outsider would describe as modest”). White concludes that “[t]o the extent that the revision of any of the articles of the U.C.C. is going to be more than modest, the push must come from academics or practicing commercial lawyers outside of these committees.” *Id.* This Article attempts to “push” just such a “revision” of Article 9.

problem can arise.

The most important pieces of information in filing a financing statement, or in finding a filed statement, are the debtor's name and location.<sup>38</sup> The correct forms of debtors' names for financing statements are specified by a combination of uniform statute and state choice.<sup>39</sup> Location is defined as residence for a natural person, state of incorporation for a registered organization, principal place of business for an unregistered organization.<sup>40</sup> If a creditor enters an incorrect debtor's name in a financing statement, then the statement will not be valid (assuming the error is not considered *de minimis*).<sup>41</sup> On the other hand, if a searcher does not know the correct debtor's name, then they may fail to locate a valid financing statement. The same outcome would result if the searcher were to search the wrong set of records—for instance, searching the Delaware records for filings against “Acme, Inc.,” rather than searching for it in the Connecticut records, which, if this particular Acme is a Connecticut entity, would be the correct record to search.<sup>42</sup> In all of these situations, of course, the “notice” function of the filing system has failed.

These errors might seem easy to prevent by a knowledgeable party (although easy to make by a commercially unsophisticated party). A creditor can obtain the debtor's correct name from an authoritative document (for instance, a company's “organic corporate record” or an individual's current driver's license) at the time of a particular filing, and thus be relatively assured, at that moment, that the interest is perfected as to the particular collateral that is owned by that debtor. But in fact, such certainty is in fact more apparent than real. Even if an interest has been duly perfected, maintaining it can also be problematic under the present system. A debtor may have changed primary residence without informing the secured creditor, thus requiring the creditor to re-file in the new state in order to remain perfected.<sup>43</sup> Or a debtor may have changed names without

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<sup>38</sup> U.C.C. § 9-503(a). *See also* U.C.C. § 9-503 cmt. 2 (“The requirement that a financing statement provide the debtor's name is particularly important. Financing statements are indexed under the name of the debtor, and those who wish to find financing statements search for them under the debtor's name.”).

<sup>39</sup> U.C.C. § 9-503 (providing alternatives A and B).

<sup>40</sup> U.C.C. § 9-307(b).

<sup>41</sup> U.C.C. § 9-506; *see id.*, cmt. 2 (noting the intent of this section and § 9-503 is “to balance the interests of filers and searchers”).

<sup>42</sup> U.C.C. § 9-503; *see id.* cmt. 2 (noting that because “[f]inancing statements are indexed under the name of the debtor,” this “requirement that a financing statement provide the debtor's name is particularly important”).

<sup>43</sup> U.C.C. § 9-316(a)(2); *see* U.C.C. § 9-316 cmt. 2 (noting “a security interest perfected under the law of one jurisdiction remains perfected for a fixed period of time . . . depending on the circumstances), even though the jurisdiction whose law governs perfection changes”; arguing the time periods provided “are long enough for a secured

notifying the creditor.<sup>44</sup> Or a debtor may have transferred ownership of the collateral without notifying the creditor—perhaps to an identically named corporate entity in another state.<sup>45</sup> And all of these occurrences may be characterized differently under the U.C.C. depending on whether the debtor and collateral are still in the same state or whether they have crossed state lines.<sup>46</sup> Making an accurate filing, and maintaining it over time is not as simple as it appears.

In many ways, assuring *priority* is often as important as assuring *perfection*. Under the idealized version of the system as portrayed in the preceding section, priority is assured by a creditor checking the public records to ascertain that its desired priority is available, and then filing a financing statement to “save its place in line.” This is how the notice system is supposed to function.

In fact, assuring priority is difficult and uncertain under Article 9. For instance, Article 9 provides for perfection not only by filing but by “possession” of collateral.<sup>47</sup> The thought here is that when a creditor has actually taken possession of the collateral, such possession effectively gives notice that the creditor has an interest in the property. In other words, because the debtor does not even possess the collateral, other creditors are on inquiry notice, at least, of a competing interest. But the standard for “possession” could be met without an inquirer being on any sort of notice; the person holding the collateral could be acting as agent or as holder on behalf of the debtor, and that status need not be ascertainable by any public observation (or even communicated in answer to a formal inquiry).<sup>48</sup> Thus, even if an agent of the secured creditor arrives at a warehouse and takes an

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party to discover in most cases that the law of a different jurisdiction governs perfection and to reperfect”).

<sup>44</sup> Because there is no single authoritative form of an individual’s name, and names can change, debtor names are hard to specify correctly, and require numerous filings and regular monitoring. The same holds for unincorporated entities.

<sup>45</sup> U.C.C. § 9-316(a)(2) (“A security interest perfected [in State A] remains perfected until ... 4 months after [debtor moves].”); U.C.C. § 9-316(a)(3) (“A security interest perfected [where the debtor is located] remains perfected until . . . one year after a transfer of the collateral to a person . . . located in another jurisdiction.”). The commentary argues (without explanation) that the grace periods “are long enough for a secured party to discover [the change and] reperfect.” U.C.C. §9-316 cmt. 3; *see also id.* exs. 1-4 (providing sample exemplary fact patterns); *supra* note 43.

<sup>46</sup> U.C.C. § 9-507(c).

<sup>47</sup> U.C.C. § 9-313.

<sup>48</sup> *See* U.C.C. § 9-313(c) (secured party can take “possession” by virtue of an “acknowledgment” from the person actually in possession that they hold possession “for the secured party’s benefit”); U.C.C. § 9-313 cmt. 3 (if possessor is agent of secured creditor, that is deemed actual possession under principles of agency law, and subsection (c) is not implicated). These provisions have been sharply criticized. *See, e.g.,* Lipson, *Secrets and Liens*, *supra* note 19, at 432-35.

accounting of the property on premises, the secured creditor probably be certain of the actual “possession” of the collateral. The debtor could be merely the apparent owner of the property. If the warehouse employees have agreed to serve as a competing creditor’s agents, or even as agents of *both* the debtor and the competing creditor, the investigating party may end up unknowingly junior.

Priority can also be threatened if the goods were “consumer goods” at the time they were originally purchased.<sup>49</sup> If this is the case, another creditor’s interest might have been “automatically perfected” in them, meaning a filing would not be necessary, without notice of such interest being available to later inquirers.<sup>50</sup>

#### b. Rights After Disposition of Collateral

Article 9 currently provides that after the disposition—including a sale for fair market value—of an item of collateral, an existing security interest generally will remain on that collateral.<sup>51</sup> The statute provides a partial exception for the “buyer in ordinary course” of an item, but even this exception only provides that such a buyer takes the item free of security interests created by the party selling the item to that buyer—not any interests created by prior owners of the collateral.<sup>52</sup>

In theory, then, a would-be buyer or creditor seeking a security interest in that item must investigate the full, prior ownership history of any personal property to ensure that it is free of an existing security interest.<sup>53</sup> In practice, the burdensome nature of such a search, assuming it is even possible, is more than a rational lender or buyer would be willing to undertake except perhaps with respect to the most valuable items of collateral.

An existing security interest *also* attaches to the money (or anything else) received in exchange for original collateral. Article 9 provides rules concerning “proceeds” that permit security interests to proliferate far

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<sup>49</sup> See U.C.C. § 9-102(a)(23) (defining consumer goods); U.C.C. § 9-309(1) (purchase-money interest in consumer goods); U.C.C. § 9-320 cmt. 5 (discussing purchase-money security interests).

<sup>50</sup> See *supra* note 49.

<sup>51</sup> U.C.C. § 9-617(a)(3).

<sup>52</sup> See U.C.C. § 1-201(b)(9) (defining buyer in ordinary course); U.C.C. § 9-320(a) (sale to buyer in ordinary strips off only security interests “created by the buyer’s seller”); U.C.C. § 9-320 cmts. 3, 6 (providing examples of buyer in ordinary course exception, the exceptions to this exception, and the exceptions to the exceptions to this exception).

<sup>53</sup> See U.C.C. § 9-507(a); U.C.C. § 9-507 cmt. 3 (noting that “any person searching the condition of the ownership of a debtor must make inquiry as to the debtor’s source of title, and must search in the name of a former owner if circumstances seem to require it.”).

beyond an original item of collateral. The rule provides that if a creditor has a security interest in one piece of collateral, the security interest will attach to any “proceeds” of that collateral.<sup>54</sup> Often, the interest not only attaches to but remains perfected in the proceeds, whether permanently or for a limited time.<sup>55</sup>

“Proceeds” are defined broadly to include any other piece of property (tangible or intangible) obtained by the sale or disposition of that collateral, and even any “rights arising out of collateral” (whatever that may mean).<sup>56</sup> The protection extends beyond any initial sale or exchange, because proceeds-of-proceeds are subject to the same protection as the original proceeds.<sup>57</sup> The process continues on and on, as long as the chain of proceeds can be traced back to the original collateral.

Under these rules, a financing statement perfecting an interest in “inventory” may in fact also have the effect of perfecting an interest in money, accounts receivable, or even equipment, if rights in such collateral were acquired upon the disposition of the original collateral (or any of its proceeds).<sup>58</sup> These additional security interests need not be disclosed anywhere on a financing statement.

There are some limitations. Under some circumstances, perfection in proceeds is limited in time, such that if a secured creditor does not act quickly to remain perfected in the proceeds by some other means (e.g., a financing statement), the perfection lapses.<sup>59</sup> Some types of proceeds—for instance those purchased by cash that is itself proceeds—do not receive the protection of automatic perfection.<sup>60</sup> But these limitations merely underscore the arbitrariness of the existing system. Why should one buyer be protected because the seller purchased an item with cash proceeds and another buyer be unprotected because the seller obtained an item by an in-kind trade involving goods that were proceeds?

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<sup>54</sup> U.C.C. § 9-315(a).

<sup>55</sup> U.C.C. § 9-315(a).

<sup>56</sup> U.C.C. § 9-102(a)(64).

<sup>57</sup> U.C.C. § 9-102(a)(12) (defining “collateral” as including proceeds of original collateral); U.C.C. § 9-102(a)(64) cmt. 13(c) (clarifying that subsection (a)(12) means that proceeds-of-proceeds are protected as proceeds).

<sup>58</sup> See U.C.C. § 9-102(a)(64) (definition of proceeds); U.C.C. § 9-203(f) (providing that a security interest in collateral extends to proceeds of that collateral); U.C.C. § 9-315 (establishing rules regarding preservation of perfection of security interests). The definition of proceeds expanded under the 2001 revisions. See LYNN M. LOPUCKI, ELIZABETH WARREN & ROBERT M. LAWLESS, *SECURED TRANSACTIONS: A SYSTEMS APPROACH* 163-64 (8th ed. 2016).

<sup>59</sup> U.C.C. § 9-315(c)-(e) (providing for continuation, and lapse, of perfection of security interests in proceeds, under various circumstances); U.C.C. § 9-515(e) (providing for lapse of effectiveness of financing statements).

<sup>60</sup> U.C.C. § 9-315(c)-(e).

*B. The Problem with Article 9's Problems—and the Way to a Solution*

Article 9 is rife with opportunities for what appear to be well-founded interests to be undermined by events or circumstances that are unknown to a creditor, or that transpire after the creditor believes it has secured its own rights in the collateral. These opportunities may be exploited in bad faith, as when a debtor deceives a creditor as to its rights in particular collateral. More often, problems arise innocently, as when a creditor's collateral is disposed of without that creditor's knowledge or consent, leaving the creditor to seek protection in the rules concerning proceeds.

The steps that would be required to obtain extra certainty under the existing Article 9 are burdensome, and for all but the most valuable items, the costs of certainty are unlikely to be worth the marginal benefits to any individual creditor. As a result, numerous U.C.C. rules amount more to loss-allocation mechanisms than guides to actual or potential practice of creditors.<sup>61</sup>

The fact that Article 9 often operates as a loss-allocation regime rather than a functional guideline for compliance has several negative consequences for the entire commercial law framework. First, it subjects the Article 9 system to criticism on substantive grounds. The law provides less certainty *ex ante* than supposed, its results *ex post* are often questionable (and subject to uncertainty and splits in legal authority), and compliance is unwieldy at best.

Second, in addition to substantive criticism, Article 9 has also been attacked on grounds that, procedurally, the uniform law process by which it has been developed is inequitable, or simply biased and captured.<sup>62</sup> The process by which Article 9 is annotated and amended has been viewed as

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<sup>61</sup> See LOPUCKI ET AL., *supra* note 58, at 339, 394 (“In circumstances where potential losses are not worth the effort necessary to avoid them, the [U.C.C. Art. 9] rules simply allocate those losses to the filers or searchers.”); LoPucki, *Computerization*, *supra* note 18, at 15 (same idea).

<sup>62</sup> Scholarship on the uniform law process, including Article 9's drafting and amendment, is extensive. See, e.g., Steven L. Harris & Charles W. Mooney, Jr., *How Successful Was the Revision of UCC Article 9? Reflections of the Reporters*, 74 CHI.-KENT L. REV. 1357 (1999) (describing process from inside perspective); Robert E. Scott, *The Politics of Article 9*, 80 VA. L. REV. 1783 (1994) (providing public choice analysis); David Frisch & Peter A. Alces, *On the U.C.C. Revision Process: A Reply to Dean Scott*, 37 WM. & MARY L. REV. 1217 (1996); Janger, *Uniform Law Process*, *supra* note 2 (identifying problematic aspects of revision process). For this Article, the key point is that if rather than providing loss-allocation rules in a zero-sum game, Article 9 provides feasible and reliable means of fulfilling commercial expectations, the stakes of the amendment process may be lower.

political rather than technical, dominated by powerful interests, and Article 9's legitimacy as law suffers as a result.<sup>63</sup> Technocrats and legal scholars may be entrusted with the power to develop efficient and equitable rules, but they begin to lack legitimacy when they are delegated the power simply to determine how losses should be allocated. Thus, criticisms of the uniform law process, by which amendments to Article 9 are proposed and by which its text is formally annotated, have bite precisely because the distributive impact of Article is so pronounced, much more than might be supposed from its posture as a neutral source of mere "rules of the game."

All of this would be merely academic, however, without changes in technology providing the hope of another way to do things. Hitherto, there was little that could be done, even by those who saw this situation clearly. Now, technologies have changed the means by which commercial actors actually transfer and monitor interests in collateral, allowing them to directly monitor the location and status of the property to which they have claims. As a result, the step of filing a financing statement against the debtor's name and in the debtor's location seems a bureaucratic hassle using an archaic tool of limited effectiveness. The U.C.C. emerged from legal realism, with a commitment to shape commercial law around the actual practice of commerce. Particularly in light of that underlying commitment, Article 9's legal rules are ripe for the same technological disruption that has been working its way through the world of business and finance.

Article 9's rules were defensible based on the limitations of the world in which it was drafted. The Article 9 regime is a historical artifact of a world where both collateral-specific identification and cheap, automated, ongoing monitoring of collateral were not feasible. In light of technological change, which has largely removed those limitations, its rules are needlessly cumbersome and ripe for substantial revision. The following Part explores the new technologies that can and should support this change. The changes ultimately proposed would benefit commercial law in two major ways: They would align Article 9 more closely with modern commercial practices and rebuild its legitimacy by making it less a set of distributively consequential loss-allocation rules and more a feasible and functional guide to commercial certainty.

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<sup>63</sup> This erosion of legitimacy could lead to more states passing non-uniform amendments to the law or to more judges or lawmakers putting their "thumbs on the scale" in favor of consumer, bankruptcy, or real estate law when they conflict with the U.C.C.

## II. TECHNOLOGICAL ALTERNATIVES

There are at least two areas in which technology has developed substantially in recent decades in ways that could revamp the secured transactions system. The two areas are technologies related to the “Internet of Things,” and technologies related to geolocation. Each area of technology is considered below with respect to its potential for transforming the secured transactions system.

Ultimately, the conclusion with respect to each technology is that it faces limits that would likely prevent it—at least on its own—for serving as the basis of a new system. However, as shown in this Part, a hybrid regime combining the strengths of both technologies, and eliminating most of their weak points, is possible.

### A. “Internet of Things” Technology

A security interest is a relationship between a creditor and an item of collateral.<sup>64</sup> A fundamental problem with the secured transactions system is that notice of the interest is provided not directly by reference to the item itself, but rather indirectly, through reference to the debtor. As shown in the previous section, Article 9’s means of working around this indirectness have led to problems.

Technology now permits a relationship to be established directly with items of collateral. Even on a mass scale, items can be inexpensively identified as being subject to a security interest, and be remotely monitored from afar. The relevant technologies are generally discussed under the rubric of the “Internet of Things” (IoT).<sup>65</sup> The IoT is the incorporation of

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<sup>64</sup> See Part I.A.1.

<sup>65</sup> See, e.g., Vinod Kumar Tiwari & Vijay Singh, *Study of the Internet of Things: A Vision, Architectural Elements, and Future Directions*, 7 INT’L J. ADV. RES. COMP. SCI. 65 (2016) (summarizing technical factors and applications of IoT); In Lee & Kyoochun Lee, *The Internet of Things (IoT): Applications, Investments, and Challenges for Enterprises*, 58 BUS. HORIZONS 431, 431 (2015) (“The IoT is recognized as one of the most important areas of future technology ....”); Felix Wortmann & Kristina Fluechter, *Internet of Things: Technology & Value Added*, 57 BUS. INF. SYS. ENG’G. 221, 221 (2015) (“[E]stimates currently suggest that the IoT could grow into a market worth \$7.1 trillion by 2020.”); Eleanora Borgia, *The Internet of Things Vision: Key Features, Applications and Open Issues*, 54 COMP. COMM’NS 1, 1 (2014) (“IoT refers to an emerging paradigm consisting of a continuum of uniquely addressable things communicating one another to form a worldwide dynamic network.”); Luigi Atzori et al., *The Internet of Things: A Survey*, 54 COMPUTER NETWORKS 2787, 2787 (2010) (“The basic idea of this concept is the pervasive presence around us of a variety of things or objects—such as Radio-Frequency IDentification (RFID) tags, sensors, actuators, mobile phones, etc.—which, through unique addressing schemes, are able to interact with each other and cooperate with their neighbors

items from vacuum cleaners to shipping crates into computer networks via technologically enabled sensors, tags, and devices.<sup>66</sup> Innovations have made technologies for detecting and monitoring goods, payments, and places much cheaper and more accurate, and these innovations have transformed commerce—even if that change is not yet reflected in the law.

High-profile examples of the IoT are in-home devices such as Amazon’s Echo and Google’s Home, which require a user only to speak appropriate commands in order to monitor and control IoT-enabled devices throughout the home: to adjust the thermostat, lock the doors, print an email, order more dish soap, play music, or converse with someone ringing the doorbell.<sup>67</sup>

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to reach common goals.”).

<sup>66</sup> See, e.g., Matthew Lacey et al., *Shipping Smarter: IoT Opportunities in Transport and Logistics*, DELOITTE INSIGHTS, Sept. 15, 2015 (noting that “[c]ompanies in this sector have embraced the suite of data-driven technologies dubbed the Internet of Things (IoT) in diverse settings, from maritime and aviation freight to warehousing to package delivery”), <https://www2.deloitte.com/insights/us/en/focus/internet-of-things/iot-in-shipping-industry.html>. Powerful devices are readily available on an off-the-rack basis. See, e.g., AT&T Business, Container and Trailer Tracking and Monitoring, <https://www.business.att.com/solutions/Service/internet-of-things/asset-management/iot-shipping-containers/> (last visited Feb. 18, 2018) (offering “[m]onitoring devices attached to your containers or trailers gather data from an array of sensors that track the condition of the container and contents over the duration of its trip,” and noting that “[t]he collected data is sent to the cloud for viewing from an application that provides alerts and notifications, customizable to support the needs of your business”); *The Internet of Things: The Future of Consumer Adoption*, ACCENTURE INTERACTIVE: POINT OF VIEW SERIES 3 (2014), [https://www.accenture.com/t20150624T211456\\_\\_w\\_/us-en/\\_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Technology\\_9/Accenture-Internet-Things.pdf](https://www.accenture.com/t20150624T211456__w_/us-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Technology_9/Accenture-Internet-Things.pdf) (predicting eventual “smart vacuum cleaner” market share of 40%).

<sup>67</sup> See Grant Clauser, *Amazon Echo vs. Google Home: Which Voice Controlled Speaker Is Best for You?*, THE WIRECUTTER (Feb. 1, 2018), <https://thewirecutter.com/reviews/amazon-echo-vs-google-home/> (describing capabilities of the devices and the “digital assistants” by which they control “smart home” devices such as thermostats, speakers, doorbells, and lights); On various consumer functionalities of IoT devices, see, e.g., Richard Beguley & Colin McDonald, *Appliance Science: The Internet of Toasters (and Other Things)*, CNET NEWS (March 2, 2015), <https://www.cnet.com/news/appliance-science-the-internet-of-toasters-and-other-things/> (noting that existing technologies already include “washing machines and dryers from Whirlpool and others that ping your cell phone when they are done and also know when electricity is cheapest (to keep down the cost of the wash).”); Nick Wingfield, *With Meld, Another Step Toward the Internet of Tasty Things*, N.Y. TIMES BITS (Apr. 7, 2015), <https://bits.blogs.nytimes.com/2015/04/07/with-meld-another-step-toward-the-internet-of-tasty-things/> (describing device and application that aids food preparation by giving real-time sensor-based monitoring of dishes, and automated control of stove); Parija Kavilanz, *“Connected” Babies = More Sleep for You*, CNN MONEY (Apr. 17, 2015), <http://money.cnn.com/2015/04/16/smallbusiness/mimo-wearable-baby-monitor/index.html> (describing baby monitoring technologies such as sensor-embedded onsies that transmit

Business applications of the IoT are more ubiquitous and important than consumer applications, although they garner less media attention.<sup>68</sup> Merchants have adopted technologies such as RFID to track millions of objects shipped great distances (and moved around stores and warehouses)<sup>69</sup>; the IoT generates vast amounts of everyday data allowing firms to tailor goods and services (and advertising) to newly revealed consumer behaviors; businesses are integrating blockchain and “smart contract” technologies with the Internet of Things to ease the administrative risks and costs of large-volume, long-distance shipping. To offer concrete examples: John Deere’s farm equipment is now embedded with IoT technology to aid automation, generate data for the manufacturer and for users, and permit more efficiently tailored processes, for instance, of planting seeds or spreading fertilizer.<sup>70</sup> The movement of freight across borders, over land and seas, and through ports is monitored remotely by both government authorities and private companies to diminish paperwork burdens and increase security.<sup>71</sup> Airlines and plane manufacturers use sensors to speedily and reliably log airplane parts, tools, and safety devices at airport construction and maintenance facilities and on airplanes themselves.<sup>72</sup> Fleets of work vehicles are remotely tracked and the data

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information to a smartphone application)..

<sup>68</sup> James Manyika et al., *Unlocking the potential of the Internet of Things*, MCKINSEY GLOBAL INSTITUTE (June 2015), <https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world> (“Business-to-business applications [of the IoT] will probably capture more value—nearly 70 percent of it—than consumer uses, although consumer applications, such as fitness monitors and self-driving cars, attract the most attention . . .”).

<sup>69</sup> See *infra* notes 76-78 and accompanying text (describing RFID technology and applications).

<sup>70</sup> See, e.g., Alex Fitzpatrick, *Hand Me That Wrench: Farmers and Apple Fight over the Toolbox*, TIME (June 22, 2017), <http://time.com/4828099/farmers-and-apple-fight-over-the-toolbox/> (discussing, inter alia, Deere’s technology permitting equipment to be steered along most efficient routes using global position technology). This has led to a battle over farmers’ right to repair or modify their equipment. See, e.g., Grant Gerlock, *Farmers Look for Ways to Circumvent Tractor Software Locks*, NATIONAL PUBLIC RADIO (Apr. 9, 2017), <http://www.npr.org/sections/alltechconsidered/2017/04/09/523024776/farmers-look-for-ways-to-circumvent-tractor-software-locks>. I am grateful to my former student Nicholas Oleson for bringing this to my attention.

<sup>71</sup> See *supra* note 66.

<sup>72</sup> See, e.g., International Air Transport Association, *Guidance on Introducing Radio Frequency Identification (RFID) Into Airline Maintenance Operations* (May 2013), <http://www.iata.org/whatwedo/ops-infra/Documents/RFID%20Guidelines%20May2013.pdf> (describing technology and uses in airline industry); Martha C. White, *Investing in Tech to Tackle an Awful Annoyance: Lost Luggage*, N.Y. TIMES (May 15, 2017), <https://www.nytimes.com/2017/05/15/business/investing-in-tech-to-tackle-an-awful-annoyance-lost-luggage.html> (noting “new bag tags are embedded with RFID chips . . . which means the location of bags is tracked and electronically crosschecked against a

analyzed, to encourage cautious and lawful driving, keep workers on task, and prevent theft.<sup>73</sup> Supply chain management has been transformed by IoT technologies, with more change on the horizon.<sup>74</sup> Amazon's vast warehouses are reliant upon algorithms to maximize efficient and accurate movement of both people and items.<sup>75</sup> In fact, decades before, Walmart's rise was enabled by superior efficiency in supply chain and inventory management; and this superiority was itself in part a product of Walmart's extensive adoption of what now would be thought of IoT-type technologies, such as barcodes and RFID tags.<sup>76</sup> RFID tags consist of microchips attached

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database to make sure that they are in the right place at the right time," and explaining convenience and security rationales).

<sup>73</sup> The technology is generally termed "telematics." See *Fleet Leasing & Management in North America: Key Enabler for the Future of Mobility*, DELOITTE 36 (Jan. 2018), [https://www2.deloitte.com/content/dam/Deloitte/de/Documents/consumer-industrial-products/Deloitte\\_Fleet-leasing-and-management-in-North-America.pdf](https://www2.deloitte.com/content/dam/Deloitte/de/Documents/consumer-industrial-products/Deloitte_Fleet-leasing-and-management-in-North-America.pdf) ("Today about 40-45 percent of all US fleet vehicles are already equipped with a telematics device . . . ."); Intelligent Fleet Management, Intel Technical White Paper (2015), <https://www.intel.com/content/dam/www/public/us/en/documents/white-papers/atom-e3800-intelligent-fleet-management-paper.pdf> (explaining fleet management system structure and providing results of case studies showing significantly safer and more fuel-efficient driving after system implementation); Andy Lundin, *Telematics Evolution Pushes Forward for Fleets*, AUTOMOTIVE FLEET (Feb. 2018), <http://www.automotive-fleet.com/channel/fuel-management/article/story/2018/02/fleet-tech-today-and-beyond-telematics.aspx> (predicting continued steep growth in adoption of monitoring technologies for commercial automobile fleets).

<sup>74</sup> Joe Mariani et al., *Forging Links Into Loops: the Internet of Things' Potential to Recast Supply Chain Management*, 17 DELOITTE REV. (July 27, 2015), <https://www2.deloitte.com/insights/us/en/deloitte-review/issue-17/internet-of-things-supply-chain-management.html> (noting ways IoT is transforming principles of supply chain management).

<sup>75</sup> See, e.g., Marcus Wohlsen, *A Rare Peek Inside Amazon's Massive Wish-Fulfilling Machine*, WIRED (June 16, 2014), <https://www.wired.com/2014/06/inside-amazon-warehouse/> (describing Amazon fulfillment center (i.e., inventory warehouse) as "a uniquely 21st-century creation, a vast, networked, intelligent engine for sating consumer desire," noting that "[e]ach shelf [in the warehouse] is divided into small cubbies, and each cubby gets a barcode and an alphanumeric ID, much like the Dewey Decimal System"); Chris Baraniuk, *How Algorithms Run Amazon's Warehouses*, BBC FUTURE (Aug. 18, 2015), <http://www.bbc.com/future/story/20150818-how-algorithms-run-amazons-warehouses> (describing use of both workers and computer algorithms to locate, track, and package inventory in warehouses), <http://www.bbc.com/future/story/20150818-how-algorithms-run-amazons-warehouses>; Will Knight, *Inside Amazon's Warehouse, Human-Robot Symbiosis*, MIT TECH. REV. (July 7, 2015), <https://www.technologyreview.com/s/538601/inside-amazons-warehouse-human-robot-symbiosis/> (describing "robotic shelves" and other innovations for making Amazon's order fulfillment more efficient).

<sup>76</sup> See, e.g., MICHAEL H. HUGOS, *ESSENTIALS OF SUPPLY CHAIN MANAGEMENT* 18-20 (3d ed. 2011) ("Wal-Mart is a company shaped by its supply chain . . . ."); *id.* at 125 ("Large companies . . . such as Wal-Mart, are mandating that their suppliers start using

to antennas, which can receive “queries” and transmit a “response” to them:

Tags are characterized by a unique identifier and are applied to objects (even persons or animals). Readers trigger the tag transmission by generating an appropriate signal, which represents a query for the possible presence of tags in the surrounding area and for the reception of their IDs. Accordingly, RFID systems can be used to monitor objects in real-time, without the need of being in line-of-sight; this allows for mapping the real world into the virtual world.<sup>77</sup>

RFID tags allow for objects to “speak” for themselves (and among themselves), and to be communicated with remotely. As might be expected, RFID tags range widely in terms of functionality (e.g., range of transmission, amount of data stored, etc.), size (as small as half a millimeter along each dimension), and price (as little as 7¢ per tag, currently).<sup>78</sup> As with other forms of microtechnology, the pace of improvement along all of these dimensions is likely to continue, making new uses feasible.

Because it permits a direct relationship to be established between any user and an IoT-enabled object, the IoT could serve as the basis of a secured transactions system. The basic idea would be that when a secured creditor evaluates collateral in anticipation of lending, rather than having to investigate a chain of title, interrogate control of the warehouse, or otherwise accept the risk of having an interest later overturned, the creditor would merely use a smart phone to search for security-interest tags on any devices within range. Each tag would transmit a U.C.C. registration number unique to that object—which could allow the creditor to instantaneously pull up the record on the state’s U.C.C. “app”—along with contact information for the creditor claiming an interest. Thus alerted, the potential new creditor could contact that earlier creditor (or have the debtor do so) in order to establish the nature of its claim, which would then affect whether the new creditor would proceed with the transaction or not. If no such tags

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passive RFID tags on the products that they ship.”); Nicholar Varchaver, *Scanning the Glod: The Humble Bar Code Began as an Object of Suspicion: Today It’s Deep in the Heart of the FORTUNE 500*, *FORTUNE* (May 31, 2004), [http://archive.fortune.com/magazines/fortune/fortune\\_archive/2004/05/31/370719/index.htm](http://archive.fortune.com/magazines/fortune/fortune_archive/2004/05/31/370719/index.htm) (“A key element of Wal-Mart’s rise has been its hyperefficient supply chain and inventory management, which have allowed it to keep costs—and prices—down”).

<sup>77</sup> Atzori et al., *supra* note 65, at 8790; see also Claudia Loebbecke, *RFID in the Supply Chain*, in *ENCYCLOPEDIA OF E-COMMERCE, E-GOVERNMENT, AND MOBILE COMMERCE* 948-53 (2006) (describing technological features and business uses of RFID).

<sup>78</sup> See RFID Frequently Asked Questions, *RFID JOURNAL*, <https://www.rfidjournal.com/faq/show?85> Page (noting prices can range from as low as seven cents and up to \$25 or more depending on technology and other features desired); Atzori et al., *supra* note 65, at 8790.

were detected, the creditor could rely on that fact to tag the objects and extend credit on a secured basis. The creditor would bear a burden to monitor the collateral, for instance against manipulation or malfunction of the tags, but this could often be automated, for instance via a central node that maintained wireless Internet connections with any tagged objects, and even, if warranted, via a video-feed (or any other type of sensor) as further insurance.<sup>79</sup> Such automated monitoring would serve as proof in any potential dispute over the collateral. This roughly sketched system could bring a dramatic shift, and radical simplification, to Article 9, by allowing creditors to establish, and to put others on notice of, a direct relationship with the relevant collateral.

The fact that a debtor—as opposed to collateral—centered filing structure such as Article 9’s is far from the only possible arrangement can be demonstrated by reference to various systems that already use direct identification of collateral as the basis for providing notice of a claim in collateral and for protecting rights therein (in other words, for the non-U.C.C. analogies to the U.C.C. concept of “perfection”). Claims on cars, once they have been sold, are made on title documents, which are easily linked directly to the relevant automobiles by virtue of standardized and mandatory vehicle identification numbers (VINs).<sup>80</sup> A similar system exists for certain airplanes and airplane parts, which in the United States, pursuant to federal law and to international treaty, must be registered by standardized identification number with federal authorities and with an international registry.<sup>81</sup> Both systems obviously bear strong parallels to the proposed

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<sup>79</sup> See, e.g., Andrew Slaughter et al., *Connected barrels: Transforming oil and gas strategies with the Internet of Things*, DELOITTE INSIGHTS (Aug. 14, 2015), <https://www2.deloitte.com/insights/us/en/focus/internet-of-things/iot-in-oil-and-gas-industry.html> (noting “companies are joining forces in developing a data-enabled monitoring infrastructure,” to protect against oil spills and pump breakdowns).

<sup>80</sup> U.C.C. § 9-316(d)-(e); *id.*, cmt. 5; Larry N. Miller, *A Proposal for Modernization of the Vehicle Certificate of Title System*, 49 CONSUMER FIN. L.Q. REP. 400 (1995); Memorandum from Professor Stephen L. Sepinuck to Ed Smith, Chair of Joint Review Committee for Article 9 (Feb. 13, 2009), [http://www.uniformlaws.org/shared/docs/ucc9/ucc9\\_sepinuckmemo\\_021309.pdf](http://www.uniformlaws.org/shared/docs/ucc9/ucc9_sepinuckmemo_021309.pdf) (surveying state motor vehicle certificate of title laws).

<sup>81</sup> The contours of this legal regime remain somewhat unclear. So far as the federal law (now supplemented with an international treaty) stretches, it pre-empts the U.C.C. See U.C.C. 9-316(d)-(e); Steven L. Harris, *The Convention on International Interests in Mobile Equipment (Capetown Convention)*, in 10B HAWKLAND U.C.C. SERIES § 9.55 (2017) (summarizing current law); Nettie Downs, *Comment: Taking Flight from Cape Town: Increasing Access to Aircraft Financing*, 35 U. PA. J. INT’L L. 863 (2014) (summarizing law); Kaitlyn Schrick, *Does Anyone Have "Actual Knowledge" of What Effects the Cape Town Treaty Has Had on the Application of Philko Aviation, Inc. v. Shackel?*, 67 OKLA. L. REV. 867 (2015) (summarizing law and identifying potential conflict of treaty regime with Supreme Court jurisprudence).

IoT-based method of perfecting security interests. It is easy to see why, for practical reasons, the personal property system developed as it did: It was feasible, given 20th century technology, to provide a unique, standardized mark on airplane engines and cars but not to do the same for many thousands of items of personal property.<sup>82</sup> Thus the debtor-centered personal property structure seemed inevitable. Now, technology permits a different alternative.

The car and the airplane registration systems were not developed primarily to protect security interests. Rather, the car system developed to prevent theft and protect the integrity of car manufacturing, and the airplane parts system is in large part an initiative to build safety and reliability in the airplane manufacture and repair business as well as to address theft.<sup>83</sup> These systems are, in a way, similar to the system proposed here, because it, like they, would piggyback on technology and practices already developed for other reasons to develop the legal regime. In this case, secured transactions law can take advantage of technologies developed in large part for business reasons such as supply chain management, inventory monitoring, factory automation, and so on.

The proposed IoT-based system would also resemble the real estate title recording system, which is ultimately based on information tied directly to the particular property at issue; for centuries, public authorities have developed and maintained records of ownership, mortgages, and other claims upon real property, often for reasons relating to taxation, estate preservation, and the facilitation of reliable transactions.<sup>84</sup> But the proposed Article 9 system would be reliant on much more advanced technology than the antiquated<sup>85</sup> and highly fragmented<sup>86</sup> real estate recording systems of the United States. In fact, real estate records are much criticized by legal scholars, including because many of them index land records primarily by names rather than by tract numbers, and thus suffer from similar problems to those characterizing the current Article 9 system.<sup>87</sup> Proposals for

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<sup>82</sup> Interactive “smart” maps, as required by the proposed geolocation method of perfection, were of course also not readily available in the 20th century either.

<sup>83</sup> See *supra* notes 80 (motor vehicle law), 81 (aircraft and parts law).

<sup>84</sup> On real estate recording, see GRANT S. NELSON ET AL., *REAL ESTATE TRANSFER, FINANCE, AND DEVELOPMENT: CASES AND MATERIALS* 201-38 (8th ed. 2009); Lipson, *Secrets and Liens*, *supra* note 19, at 435-39 (describing early recordation systems and collecting sources).

<sup>85</sup> Dale A. Whitman, *Digital Recording of Real Estate Conveyances*, 32 J. MARSHALL L. REV. 227, 227 (1999) (“During the past 350 years, little has changed in the way real estate conveyances are recorded in America.”).

<sup>86</sup> Sam Stonefield, *Electronic Real Estate Records: Context, Unresolved Cost-Benefit Issues, and a Recommended Decisional Process*, 24 W. NEW ENG. L. REV. 205 (2002) (“There are 3524 recording jurisdictions nationwide.”).

<sup>87</sup> NELSON ET AL., *supra* note 84, at 232 (“[C]hain-of-title problems illustrate vividly

technologically driven reforms in real estate recording have been offered but have not yet gained much traction.<sup>88</sup> For this reason, if the proposed system takes hold in the U.C.C. context, something like it may also be appealing in the real estate context. In any case, the examples of cars, airplane parts, and real estate recording show that perfection by direct reference to collateral without indexing through the debtor's name has been done elsewhere, and under analogous circumstances.

Several concerns about the IoT-based system sketched above can be easily addressed. First, there might be a concern over expense. This idea might work for large pieces of equipment, but what about, say, an inventory of cases of wine? The expense should not be overestimated. As mentioned, currently RFID cost as little as 7¢ per tag, depending on the technology included in the tag itself—such factors as how much data is stored, how far away the information is transmitted, and what security features are included. Active, wireless-enabled sensors—that is, those that can directly

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the deficiencies of name-index recording systems.”). Non-specialists seem sometimes to assume the existing real estate recording system is more manageable and coherent than it is. Compare Rasmussen, *supra* note 32, at 1143 (“With real estate, the answer of where to look is relatively easy. The location of the land is fixed, and the searcher merely has to learn at which level, state or local, the records are kept.”) with NELSON ET AL., *supra* note 84, at 212 (“In addition to interests which need not be recorded at all (like adverse possession) and those which need be recorded only after the fact (like mechanics’ liens), problems are raised by those which are allowed to be . . . recorded in places other than the county recorder’s office. . . . One compilation for Cleveland, Ohio listed 76 types of records in 16 different public offices which might contain land title data.”).

<sup>88</sup> See, e.g., Whitman, *supra* note 85, at 228 (“We can make recording much easier, faster and less costly. . . . All of this can be done with the use of digital computing technology that is virtually ‘on the shelf’ today.”); Tanya Marsh, *Foreclosures and the Failure of the American Land Title Recording System*, 111 COLUM. L. REV. SIDEBAR 19 (2011) (lamenting failure of real estate recording system to respond to prior calls for modernization, and urging solutions based on updated technologies); Emily Bayer-Pacht, *The Computerization of Land Records: How Advances in Recording Systems Affect the Rationale Behind Some Existing Chain of Title Doctrine*, 32 CARDOZO L. REV. 337 (2010) (suggesting areas where doctrine should be revisited as technological changes take hold in some real estate recording systems); Stonefield, *supra* note 86 (evaluating costs and benefits of transition); Donald J. Kochan, *Dealing with Dirty Deeds: Matching Nemo Dat Preferences With Property Law Pragmatism*, 64 U. KAN. L. REV. 1, 52-60 (2015) (proposing technologically driven amendments to recording). The proposed simplification of the real estate recording system is all the more feasible given advancements in technology. Controllers of private, for-profit “title plants” that have come to dominate real estate title searching might complicate such efforts. See Whitman, *supra* note 85, at 230 (explaining title plants); NELSON, *supra* note 84, at 204 (noting that entrenched interests may be a reason real estate recording has not been reformed); Dale A. Whitman, *Are We There Yet? The Case for a Uniform Electronic Recording Act*, 24 W. NEW ENG. L. REV. 245 (2002) (outlining practical and political difficulties with shifts to higher technology recording).

connect with a wireless router without even the requirement of another central node—are a few dollars each, at most, and the most expensive technology is also often reusable. As electronics become ever smaller, more reliable, more capable of storing data and of performing analytical and communicative tasks, the expense would become even more negligible. Also, many items are already tagged, for shipment and supply chain purchases: For such items, meeting the Article 9 requirements would add little expense and would merely require one extra, automated step. It would simply reflect the already existing reality that the IoT is deeply integrated into the practices of commerce.

Second, there might be a concern over the tags being stripped off, or losing power over time. The burden of proving that tags were operational at a given time (for instance in a dispute with a future creditor or buyer) would fall on the creditor claiming an interest: The system is not “tag and forget about it,” but rather “tag and monitor.” But the monitoring could be easily automated, and with technology that is already widely available “off the rack” at minimal cost.<sup>89</sup> Thus, tag degradation, in addition to being rare, would be easily monitored and corrected when it did occur.

Third, there might a concern over transportation of collateral. When collateral leaves a monitored space (say, a warehouse) and is transported somewhere else (say, a delivery truck), the connection of the item to the IoT network might well be severed, thus preventing monitoring. But it is not at all clear that such a severance is required. Many vehicles can be or already are equipped with wireless Internet connections; and for more valuable devices, a transmitter capable of transmitting to cellular networks is also possible where wireless Internet is lacking. In any case, even where a temporary severance of connection is anticipated by a creditor, the creditor could take appropriate steps to maintain the connection, employ an agent to protect the collateral in transit, or to release the security interest (for instance, in favor of a new shipment into the warehouse) as appropriate. The risk of forfeiting an interest due to failure to monitor in transit would not seem to be much of a problem.

In fact it is an advantage of the IoT approach that it permits not just for increased certainty but relatively easy maintenance of a claim over collateral that is likely to be mobile. Consider what a creditor must do under the current system to maintain a claim over a piece of collateral that is

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<sup>89</sup> Releasing or transferring interests could also be easily automated. For instance, RFID technology routinely allows for information to be securely re-written by a possessor of the password for a given tag. FREQUENTLY ASKED QUESTIONS, RFID JOURNAL, <http://www.rfidjournal.com/site/faqs> (last visited Feb 18, 2018) (“With read-write [RFID] chips, you can add information to the tag or write over existing information when the tag is within range of a reader . . .”).

mobile: File an accurate financing statement and then either (a) trust the debtor and hope for the best, or (b) monitor the data and be able to trace it back to the debtor's ownership at the relevant time frame. The addition of the requirement of tagging is likely to be a substantial additional burden only on a creditor relying on (a) alone; the creditor who has chosen course (b) will likely find that tagging adds little burden, if any, because the monitoring it is already doing will likely match that required under the new system. Also, the IoT approach would remove the initial burden of filing a financing statement as well as all the uncertainties of the current system in instances of change of ownership and location.<sup>90</sup>

Thus, these potential concerns can be assuaged, at least in large part. There are other detailed questions and concerns that would arise from any full-scale modification of the Article 9 system.<sup>91</sup> But because this Article's actual proposal is a hybrid one, based not just on IoT but also on geolocation technologies, consideration of these is deferred to Parts III, which lays out this Article's proposed system in more detail, and Part IV, which answers several other objections to it.

Despite its many advantages, there are two major limitations to any system based solely on the IoT, at least with current technology. The two problems are difficult-to-tag items, and items with a high turnover rate.

First, certain collateral may simply be difficult to tag. Consider corn in a silo or oil in a tank. While tech-enabled monitoring such collateral is certainly possible, tagging seems much less so. It is possible to conceive of a sensor-equipped tag that would keep track of each new addition to the tank or silo and proclaim the interest to any inquirers, but such a system seems to shift too much of the burden to a searcher for such interest. In other words, the tag in such a case seems like it would be insufficiently clear to those investigating the status of goods for existing encumbrances. There is no obvious way to solve this at present.

A second problem involves high-turnover items such as goods held as inventory. Tagging and registering the security in each item before it leaves inventory might be overly burdensome in some contexts. Interestingly, many items are already RFID-tagged—such as clothing in the inventory of some retailers<sup>92</sup>—thus showing that the task is not impossible. Nonetheless, because of the vast number of objects involved, and given the

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<sup>90</sup> Concerning the laws for collateral or debtors crossing state lines see Part I.A.2.

<sup>91</sup> For instance, concerns over implementation difficulties, weighing of costs and benefits, and overlap with other bodies of law, all of which (in addition to numerous others) are addressed *infra* Part IV.

<sup>92</sup> See, e.g., Lauren Indvik, *Why Luxury Brands Are Putting Microchips in Your Clothes and Accessories*, FASHIONISTA.COM (Apr. 14, 2016), <https://fashionista.com/2016/04/moncler-ferragamo-rfid-counterfeiting> (noting security and prestige benefits of tagging to ascertain authenticity of luxury products).

current state of technology, it must be conceded that the IoT system may not yet be up to the task.

It is far from a stretch to imagine that technological advancement would render these problems manageable in the future. Yet for now, they suggest that the IoT approach on its own might not be feasible at the present time.

### B. Geolocation Technology

A second area of promising technology for replacing the current filing system is in the area of geolocation. Geolocation technologies permit the pinpointing of precise locations anywhere in the United States (and most of the world), as well as the overlaying of other information on top of location data.<sup>93</sup> A point or area, plotted with longitude and latitude data (or identified by clicks on an interactive map),<sup>94</sup> can be overlaid with street names, tract numbers, elevations, crime records, and so on. All that is required is a database document containing (1) a list of the location information to map an area, and (2) whatever additional information is to be associated with that area. There are widely available, high-quality, and often free tools to convert such a list into a viewable “smart map,” which displays all the information visually.<sup>95</sup> These technologies are used regularly by

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<sup>93</sup> See generally Jeremy Speich, *Comment: The Legal Implications Of Geographical Information Systems (GIS)*, 11 ALB. L.J. SCI. & TECH. 359, 360-62 (2001) (summarizing features of global information system); Harlan J. Onsrud & Robert I. Reis, *Law and Information Policy for Spatial Databases: A Research Agenda*, 35 JURIMETRICS 377 (1995) (providing overview of basic concepts and areas of legal concern); Ann M. Burkhart, *Real Estate Practice in the Twenty-First Century*, 72 MO. L. REV. 1031, 1070-71 (2007) (outlining innovations to real estate law and practice permitted by accuracy and low expense of global position system technologies).

<sup>94</sup> NASA runs a free, easy-to-use website that permits a searcher to enter (or mouse-click on) any address, which is instantly transformed into latitude and longitude coordinates. It plots the University of Kentucky College of Law at latitude 38.036556, longitude -84.507308 and shows an area map constructed of satellite imagery and including features such as street labels. The searcher can then hover the mouse over any spot on the map and the page generates latitude and longitude coordinates for each spot the mouse passes. See LATITUDE/LONGITUDE FINDER-MY NASA DATA, NASA, <https://myasadata.larc.nasa.gov/latitudelongitude-finder/> (last visited Feb 18, 2018).

<sup>95</sup> Margaret Rhodes, *A Dead-Simple Tool that Lets Anyone Create Interactive Maps*, WIRED, July 15, 2014 (describing several tools). The software company Tableau, for instance, makes several powerful, easy-to-use, free tools. See Tableau, Resources, <https://public.tableau.com/en-us/s/resources>. Google provides tools for use with its Google Maps platform. See Google Earth Outreach, *Visualize Your Data on a Custom Map Using Google My Maps*, <https://www.google.com/earth/outreach/learn/visualize-your-data-on-a-custom-map-using-google-my-maps/> (providing sample database file and step-by-step instructions for producing a custom map). Creative uses of such tools abound. See, e.g.,

individuals, businesses, and governments.<sup>96</sup> State and local authorities maintain various databases linking area maps to information about individual properties, for instance for taxing purposes,<sup>97</sup> or for restaurant inspections.<sup>98</sup> Journalists have constructed their own smart maps.<sup>99</sup> An academic recently proposed to ease the burden on landowners by permitting them to “post” a “no trespassing” sign virtually on such maps, which would be available remotely on smart devices and GPS locaters to recreating hikers and hunters.<sup>100</sup> Geolocation technologies, when combined with other related developments—the extensive availability of mobile devices, reliable mobile payment capabilities, and speedy background and license checks—have permitted the rise of ride-sharing services such as Uber.<sup>101</sup> Smart maps can also be made to be interactive, such that anyone with rights to add to a map can simply click on one or more points in order to designate a new location, and then enter additional information to be overlaid on that point.<sup>102</sup>

It is possible to imagine a filing system based on geolocation technology. The filing system could work like this: Each state filing office would maintain a smart map available for free on an Internet site. The map would show all existing claims of security interests within any particular geographic area in the state. A creditor desiring to add a claim of its own could obtain a username and password. Then, by clicking an area on a map and filling in basic information about the claimed interest, the creditor

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Nell Casey, *Interactive Map Shows What NYC Neighborhoods Have the Most Rat-Infested Restaurants*, GOTHAMIST (June 10, 2015), [http://gothamist.com/2015/06/10/rat\\_map\\_2015.php](http://gothamist.com/2015/06/10/rat_map_2015.php).

<sup>96</sup> See, e.g., Spieth, *supra* note 93 (outlining existing and potential uses).

<sup>97</sup> Travis County, Texas, where the city of Austin is located, maintains such a map and database. See Travis CAD Map Search, HARRIS GOVERN MAP SEARCH, <http://propaccess.traviscad.org/mapSearch/> (last visited Feb 18, 2018).

<sup>98</sup> See NEW YORK CITY DEPARTMENT OF HEALTH AND MENTAL HYGIENE, <http://a816-restaurantinspection.nyc.gov/RestaurantInspection/SearchBrowse.do> (last visited Feb 18, 2018) (providing an interactive map but requiring specification of numerous search criteria before returning results). Private parties can then create their own interfaces for the same data. See Jeremy White, *New York Health Department Restaurant Ratings Map*, N.Y. TIMES, <http://www.nytimes.com/interactive/dining/new-york-health-department-restaurant-ratings-map.html> (last visited Feb 18, 2018).

<sup>99</sup> See, e.g., White, *supra* note 98 (New York City restaurants); Casey, *supra* note 95 (rats in New York City restaurants).

<sup>100</sup> See Hynes, *supra* note 17. Hynes imagines that the system would be organized through the property tax system, but an interactive map would be possible.

<sup>101</sup> See, e.g., John Patrick Pullen, *Everything You Need to Know About Uber*, TIME (Nov. 4, 2014), <http://time.com/3556741/uber/> (describing the basic aspects of Uber’s operations).

<sup>102</sup> See, e.g., Smart Mapping, ARCGIS MAPPING MADE EASY, <http://www.esri.com/software/arcgis/smart-mapping> (last visited Feb 18, 2018).

would be able to stake its claim to collateral within a given area. The creditor would have to provide its contact information, and describe the collateral claimed (“all assets,” “inventory,” “backhoe with serial number #xxx,” etc.). Nothing more would be required. The secured party would have thereby perfected its security interests on any collateral matching the provided description within the denoted area.<sup>103</sup> If a debtor had multiple locations, a secured party could go through this process for each of the debtor’s locations, which would require little extra work.

Under this imagined system, any party interested in claiming collateral located within an area would be able to easily pull up the map and check to see if there was a competitor. Obviously, if a party had staked a valid claim in a particular area, the new creditor would have to negotiate with the prior creditor to narrow that interest, proceed with staking the claim while accepting a lower-priority spot in line, or simply decline to lend. On the other hand, if the claim on a particular area was not valid—for instance because the prior creditor had selected too large an area, or had left the interest in place even though the debt was no longer owed—the system would be similar to the current system, in that the prior creditor would be obligated to narrow the claimed area or delete the claim, as appropriate (or risk liability).<sup>104</sup>

One objection to the imagined system might be that it would not deal well with a situation in which multiple debtors granted security interests in items within a given area. For instance, imagine there were two debtors sharing a warehouse. The system as described does not require a creditor to specify the debtor’s name. Even if Creditor A’s dealings are only with Debtor A and not Debtor B, a new creditor would be reluctant to lend against Debtor B’s property in that warehouse. Even though it is true that Creditor A’s security interest would attach (and be perfected) only against Debtor A’s property, the notice could theoretically permit Creditor A to lend to Debtor B at a later point and have higher priority than any later claims.<sup>105</sup>

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<sup>103</sup> As with the current system, the secured party would only have perfected its interest to the extent its interest had attached—it would not have thereby encumbered property, for instance of parties other than the debtor.

<sup>104</sup> U.C.C. § 9-513 (creditor must file statement indicating termination of security interest when appropriate); U.C.C. § 9-625(e) (creditor will owe damages if it files an unauthorized financing statement or refuses to file termination statement when appropriate). Arguably, any amended system should strengthen, or at least clarify, these provisions to make clear the creditor’s obligations.

<sup>105</sup> This would be similar to the effect now of lending to a debtor when there is an existing financing statement, even if the security interest to which that statement relates has not yet become enforceable. *See* 4 WHITE & SUMMERS § 33.3 (discussing this “first to file or perfect” rule of U.C.C. § 9-322). Essentially, these rules oblige the debtor and new

This challenge seems surmountable. One obvious solution might be for the law to require Creditor A to amend its claim to attach an addendum upon request of Debtor B (as the owner of other property within the claimed area). The addendum would be a binding declaration as to which debtor the security interest attached; in other words, it would limit the creditor's claim to the property of Debtor A, thus providing the new creditor with some assurance that its interest would not be threatened. This solution might seem burdensome, but consider this same situation under the current system. It is difficult to conceive that many creditors would lend against the second debtor's supposedly unencumbered assets stored in the same warehouse as another debtor's encumbered assets, without having a subordination agreement or some other form of assurance in place with respect to the prior creditor.

The more substantial objection to the geolocation system is the more obvious one—that interests are only perfected within the specified area. Under this imagined system, there is no clear way of maintaining an interest when items are removed from the designated area. That might often be sufficient; an inventory lender might be content to know that the current content of the warehouse will remain its collateral, and might be comfortable with its interest being released when the items are removed. But other lenders might wish to maintain their interests beyond a specific location.

Solutions to this problem are conceivable; for instance, a security interest perfected by geolocation could remain perfected for a short grace period while the creditor had the opportunity to investigate the situation and notify the holder of the asset (wherever now located) of its claim.<sup>106</sup> Just as “tag and monitor” was the requirement of the imagined IoT system, so “claim and monitor” would be required by a geolocation-based system. Again, such monitoring might be inexpensive thanks to modern technology. In addition, it is far from clear that the monitoring requirements of the system as described would be substantially more burdensome than the current system. Under the current system, it is true that a valid claim could be asserted further in the future than in the imagined system—creditors are not limited by some legally imposed “grace period.” But realistically, once property of a debtor is moved to another location upon purchase, theft, or otherwise, it is hard to imagine that many creditors can later locate and assert claims against that property. A creditor who cares about collateral must monitor that collateral—whatever the law technically permits or requires. Nonetheless, in a system based entirely on geolocation technology,

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creditor to reach an agreement with the old creditor, U.C.C. § 9-339, if the new creditor wishes to be ensured of priority.

<sup>106</sup> Indeed, this is the solution proposed below, see Part III.A.

this objection has some validity.

A geolocation-based secured transactions system would have the appeal of simplicity and of increased certainty. The interface could be easily and intuitively navigated and could provide parties with considerable certainty under most of the real-world circumstances in which security interests are claimed, including inventory warehousing. The capacity of parties to specify the scope of their interests in an objective, easily searchable visible format on a map holds great appeal. But geolocation's inability to deal with mobile objects represents a significant weakness. Accordingly, this Article proposes that the new secured transactions perfection system be a hybrid one, drawing on the strengths of both geolocation and IoT technologies and avoiding the weaknesses of each.

### III. THE PROPOSED SYSTEM

As explained in the previous Part, both geolocation and IoT technologies hold great promise as potential substitutes for the current secured transactions regime. However, under the current state of technology, there would be significant weaknesses in a system based exclusively on one or the other. While IoT technology is inexpensive and provides the most direct way of establishing and providing notice of the security-interest connection between creditor and collateral, IoT technology is not yet so easy to automate and so cheap to deploy that it can be imagined as a way of dealing with all collateral in all situations—for instance, it might be cumbersome to use it for large warehouses or large stores containing many small, individually packaged items. By contrast, geolocation technologies excel when property is going to be held in one place for most or all of its useful life as collateral, thus filling the gap left by IoT technology. Geolocated claims could be made cheaply and easily, and the claims would be highly transparent to any searchers after records. The weakness of this approach, however, is that if a creditor desires to maintain a security interest over collateral as it moves from place to place, geolocation provides no obvious means to do so. An IoT approach, of course, does. As is readily apparent, then, the two technologies have complementary strengths.

This Part proposes a reformed secured transactions system, a hybrid involving the use of both IoT and geolocation technologies. In rough outline, the proposed system would permit notice of claims of security interests in tangible collateral to be claimed either through an IoT tagging approach or through geolocation. (Interests in intangible collateral would be

left as-is.<sup>107</sup>) Once claimed, and provided that certain monitoring requirements are complied with, the proposed system would provide significant commercial certainty. Numerous existing provisions, most notably those regarding proceeds, would be jettisoned or greatly simplified, and numerous exceptions would be eliminated.

Section A describes how the hybrid system would work in broad outline. Section B works through several examples of its proposed operation. These sections explain in broad terms how the system would work as a whole, how the proposed law would assign rights and responsibilities to participants in secured transactions, and what would change or be eliminated from the current law. The next Part provides a discussion of several specific concerns that the proposal might provoke.

#### *A. The Proposed System in Outline*

The proposed system is easily described and is, from a legal perspective and compared with current regime, very simple.

*Tagging.* First, collateral could be tagged with a RFID or other transmitting beacon containing basic information about the claimed security interest and contact information for the party claiming the interest, along with a unique alphanumeric code uniquely identifying that object.<sup>108</sup> Once the tag is affixed and registered with the Secretary of State, the security interest would be perfected within that state's boundaries. There is no reason that creditors could not register the same collateral in all fifty states, the District of Columbia, and Puerto Rico, if they were concerned about collateral "walking" across state lines without consent, and paid to register the interest in those places. Collateral in a box or other container could be tagged on an entire-container basis, although once the individual items were separated from the container, perfection would cease.

*Geolocation.* Second, a security interest could be perfected by designating an area using coordinates registered on a map maintained by the Secretary of State of each state, providing contact information, and describing the collateral claimed within that area.<sup>109</sup> The process of claiming a geolocated interest would be simple. A creditor would first

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<sup>107</sup> See *infra* notes 116-122 and accompanying text.

<sup>108</sup> It is unlikely that there would be a limit to the unique collateral codes available. The underlying architecture of the Internet has been adjusted to permit much larger numbers of uniquely identified participants: Internet Protocol v6, the transition to which began in 2012, permits up to  $3.4 \times 10^{38}$  unique addresses. See *generally* Overview, Google IPv6, <https://www.google.com/intl/en/ipv6/index.html>. More simply, consider that there are over 2.176 billion (i.e.,  $36^6$ ) unique combinations of alphanumeric characters if each combination uses only 6 characters.

<sup>109</sup> On geolocation technologies, see *supra* notes 93-102 and accompanying text.

obtain a username and password in order to log in to the system and provide a credit or bank card number. Thus, only “known” parties would be able to add entries to the interactive map, which would serve as protection against fraudulent or frivolous claims.<sup>110</sup> Next, the creditor would navigate on the map to the desired spot, identify the relevant area by clicking on its four corners (or if the map was linked to an existing tract map, simply click on the desired tract or tract(s)). The creditor would identify the collateral that it claimed an interest in within that area (“all collateral,” “crane with serial # \_\_\_\_,” etc.), and fill in its name and contact information. With no further steps needed, the claim would be made at that point. Any searcher could easily pull up the map, navigate to an area of interest, receive notice of the claim, and take appropriate steps.

As with the current system, there is of course some possibility of abuse, because a creditor could easily encumber more than intended by simply submitting a filing covering more than strictly necessary, and claiming “all assets” as collateral. Thus, there would need to be a clearing mechanism available for parties covered by a too-broad filing (perhaps together with penalties for carelessly or intentionally overbroad filings). In addition, the law would need to limit the size of each area covered, to prevent creditors from inadvertently seeking to encumber assets from a broader area than intended.<sup>111</sup>

For the foreseeable future, the geolocation route to perfection remains important, as it may be the only feasible way of perfecting in certain collateral, the tagging of which would be too difficult or too expensive with current technology. However, if tags such as RFID tags move from being common (as they are now), to being ubiquitous, then the

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<sup>110</sup> There is no reason to think the proposed system would be any more plagued by false filings than the current system, which is not particularly effective at dealing with this problem. See NATIONAL ASS’N OF SECRETARIES OF STATE, STATE STRATEGIES TO SUBVERT FRAUDULENT UNIFORM COMMERCIAL CODE (U.C.C.) FILINGS (2014), <http://www.nass.org/sites/default/files/surveys/2017-08/final-nass-report-bogus-filings-040914.pdf> (describing fraudulent filings problem, state and federal law-based remedies, and potential solutions). A technologically streamlined system could provide for more effective policing of abusive filings. A similar system has been implemented elsewhere. See Todd J. Janzen, *Note: Nationalize the Revised Article 9 Filing System: Comparison of the Old Article 9 and Canadian Personal Property Filing Systems*, 11 IND. INT’L & COMP. L. REV. 389, 401 (2001) (“Ontario protects debtors by limiting who can file a financing statement electronically. ... [A] filing party must register with ... the central filing office, in order to obtain an account. This account allows the filing party ... to submit financing statements electronically.”).

<sup>111</sup> Upper limits of areas to be claimed could even be adjusted to the average density in an area. In urban areas, perhaps only a block or fraction of a block could be covered per claim, whereas in vast open places such as West Texas, upper limits of filings could be much larger, for instance to permit coverage of cattle.

perfection process could, for instance, simply become part of the inventory intake process, with registration of the creditor's interest accomplished automatically as each shipment is scanned into a warehouse or store, and monitored thereafter by IoT security mechanisms that are themselves already common. In such an instance, geolocation might or might not remain necessary as a parallel system.

*Priority.* If an item were both tagged and located within a geolocated claim, the *first* interest to be claimed *over that item* would generally prevail. The *over that item* proviso is important: if an already tagged item were later brought within a geolocated area, the tagged interest would prevail (even if the geolocated claim over the area was made before the item was tagged; as long as the tagging was done prior to the item entering the area, it would prevail). On the other hand, if an item within a geolocationally claimed area were then tagged, the geolocated interest would prevail—of course, only so long as the item remained within that area.

As under current law,<sup>112</sup> a party could remain perfected (i.e., have perfection “credited back” to the original date of a claim) over an item by overlapping one method of perfection with the other: in other words, it could remain continuously perfected in an item even after it was removed from a perfected-by-geolocation area by perfecting-by-tagging the item before it left that area. Insofar as proving the time of a claim might be difficult for a particular geolocated item increased monitoring systems could help—most obviously, a video display of the object upon arrival or construction in a space would be a useful form of proof. Such proof would usually be no more complicated, and might often be simpler, than proving possession or ownership at a given time by a given debtor under the existing legal regime.<sup>113</sup> Proving a time of tagging should usually be easy, although similar proof could easily be produced.

Although predicting technological development is a perilous task, the IoT is likely to continue to develop by allowing smoother and fuller integration of numerous types of technology. Already, the IoT involves inputs not just from RFID-type tags but also visual contacts, temperature and other sensors, even monitoring by drone. Geolocation technologies are a part of the panoply of inter-related technologies that augment the IoT. It is

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<sup>112</sup> See U.C.C. § 9-308(c).

<sup>113</sup> Imagine a creditor with a second-filed financing statement claims to have been earlier perfected by virtue of having possession nine years before, prior to the first financing statement having been filed. LOPUCKI ET AL, *supra* note 58, at 390 (Problem 22.3). This illustrates the difficulty under current law of *disproving* such matters as possession, when possession can be established by anyone who has agreed to act on the secured creditor's behalf. *Id.*; see also *supra* note 48 and accompanying text.

not hard to imagine that the two aspects of the proposed system could be linked, such that IoT interests could be continuously plotted on maps as well, providing two forms of notice (one remote, one short-range) of a security interest, and allowing ever easier and more automated monitoring.

*Proceeds.* Under current law, a perfected security interests is often maintained even after the sale or exchange of an item, both in the original item (now sold) and in whatever has been obtained through the sale (money, an account receivable, etc.).<sup>114</sup> While there are important exceptions to this principle, most importantly for “buyers in the ordinary course of business,” there are exceptions-to-the-exceptions as well. The law is full of traps for the unwary, and is at best imperfect—an area where given its complications, the current regime probably operates more as a loss-allocation regime than as an actual guide to conduct.

In the proposed system, the entire proceeds regime would be eliminated. Perfected security interests in the original collateral would generally be unaffected by sale or disposition of the collateral. With the exception of the rules concerning buyers in ordinary course and sales to which a creditor has consented, the sale or disposition would simply not affect the perfection of a security interest. As long as collateral remained within the geolocated area it would remain encumbered, although when it was removed, an assertion of the security interest would be required within seven days. As for tagged collateral, the security interest would remain as long as the tag remained operative, and again, there would be a short challenge window once it was no longer operative. In other words, absent the narrow but important exceptions already mentioned, the rule would be that once attached and perfected, a security interest stays so as long as the tagging or geolocation covers the property; as soon as one of those means of perfection has lapsed, the creditor would have a very short amount of time to re-establish or assert the interest.

In order to assert a security interest in what was acquired by the sale or disposition (what is currently know as proceeds), the secured creditor would have to perfect some other way. If the new property of the debtor fell within an already demarcated geolocated area, then it would be included as soon as it arrived on premises. The same principle would apply to tagged items; upon the arrival of new inventory, for instance, tags on cases of wine or other collateral could be immediately electronically activated when scanned, on an automated basis. Technically speaking, the security interest could (by agreement) extend to proceeds but would not do so as a matter of course, and perfection in the original collateral would not automatically follow in the proceeds.

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<sup>114</sup> See *supra* note 58 and accompanying text.

Numerous other details concerning the proposed system would have to be considered before implementation,<sup>115</sup> but this description suffices as to the basic features of the system and the ways in which it can be distinguished from the existing system.

*Intangibles.* Article 9 provides for security interests to be perfected in a range of intangible types of property, such as trade secrets, copyrights, accounts receivable, and so on.<sup>116</sup> Because intangibles are not “things” that can be tagged and tracked, nor are they geolocatable, the proposed system would not apply to them. The proposed system would largely leave the current system in place with respect to intangibles. For instance, accounts are probably best identified by means of the party to whom payment is initially owing—i.e., the owner of the account. A similar principle is true of the party who owns a trade secret, an unregistered copyright, and so on.

It might seem burdensome to have three parallel systems—the geolocation system, the tagging system, and the legacy system that would be left in place for intangibles. But the burden is actually light because there would be very little overlap among the different systems. Intangibles under the current system are frequently generated from the sale of tangible assets—for instance, accounts receivable—with the new intangible being treated as “proceeds” of the tangible collateral.<sup>117</sup> That would no longer be the case under the proposed system. Hidden liens on accounts in favor of one creditor arising from the sale of that creditor’s tangible collateral would no longer have any power. In other words, perfection in the tangible systems would not significantly affect the intangible system, and vice-versa. Thus, ascertaining who had a claim to the intangibles would be easier under the proposed system.

The secured transactions regime governing intangibles is already complicated by a confusing overlap of federal and state law, particularly with respect to intellectual property, and is in grave need of reform.<sup>118</sup> With respect to copyrights, for instance, legal authorities are divided on when

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<sup>115</sup> For instance, the maximum length of effectiveness of a registered claim.

<sup>116</sup> U.C.C. § 9-102(a)(2). Depending on the precise form they take, what are colloquially referred to as accounts receivable can fall, sometimes, within the scope of other U.C.C. terms, such as payment intangible, U.C.C. § 9-102(a)(61), or even instrument, see U.C.C. § 9-102(a)(47), but the analysis here would not be changed substantially in either case.

<sup>117</sup> See U.C.C. § 9-102(a)(64) (defining proceeds); see *supra* notes 54-60 and accompanying text.

<sup>118</sup> See, e.g., Juliet M. Moringiello, *False Categories in Commercial Law: The (Ir)Relevance of (In)Tangibility*, 35 FLA. ST. U. L. REV. 119 (2007) (arguing the distinction of tangible/intangible property should be abandoned); Jonathan C. Lipson, *Financing Information Technologies: Fairness and Function*, 2001 WIS. L. REV. 1067 (critiquing Article 9 regime on intangibles).

security interests must be filed in the federal Copyright Office and when in the U.C.C. filing offices.<sup>119</sup> This has initiated considerable uncertainty, misleading creditors, splitting courts, and inciting criticism from academics.<sup>120</sup> By contrast, patents, another important category of intangibles, are currently perfected in the U.C.C. filing system, while ownership interests in them are made by reference to their federal patent office identifiers.<sup>121</sup> This bifurcation is confusing and seems inefficient; where there is a centralized system for granting or protecting property interests in such assets, it makes most sense to permit claims perfecting security interests to be made in the same place as ownership claims. Such an alternative system is not always practicable, but where it is, it provides a direct link between creditor and collateral comparable to that proposed in this Article for other forms of property, and it should be implemented.

Thus, while the regime for perfecting interests in intangibles will remain confusing until broader reform is initiated, there are several important ways in which the proposed system would simplify the current system.

*Possession.* Another alternative that lawmakers could consider is to provide yet another route to perfection, which could be termed “notorious possession,” that is, possession that is clearly marked and clear to any observer.<sup>122</sup> Notorious possession would be unlike the type that is permitted under Article 9, where possession is easily obtained, or falsified without true notice to any other party having been provided.<sup>123</sup> A creditor could claim this form of possession simply by clearly and unmistakably possessing an item.

In most cases geolocation could accomplish much the same end, because a creditor could simply claim the location where the creditor was holding the collateral on the U.C.C. map. But under some circumstances—for instance if a debtor is transporting collateral from place to place and has not yet been able to tag it—possession could be another, sensible supplement to the proposed system. As with the other proposed means of protection, the creditor would bear the burden of monitoring the collateral

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<sup>119</sup> 4 WHITE & SUMMERS § 30:30 (noting divisions in law concerning copyrights).

<sup>120</sup> *Id.*; see also Molly Shaffer Van Houweling, *Land Recording and Copyright Reform*, 28 BERKELEY TECH. L.J. 1497 (2013) (analogizing defects in the copyright system to those of the land recording system).

<sup>121</sup> See, e.g., 4 WHITE & SUMMERS § 30:30 (summarizing relevant law). For a proposal to allow virtual rather than physical “marking” of patented devices, see Corey McCaffrey, *The Virtues of Virtual Marking in Patent Reform*, 105 NW. U. L. REV. 367 (2011).

<sup>122</sup> The possession rules could also require the name and contact information of the possession creditor (or its agent) to be clearly observable as well, in order to facilitate inquiry.

<sup>123</sup> See *supra* notes 47-48 and accompanying text.

and maintaining sufficient records to demonstrate its possession at the relevant times.

*Implementation.* The proposed regime is radically different from the present one. Its implementation, however, need not be radically disruptive.<sup>124</sup> The old debtor name-based register could be maintained and the validity of perfection obtained under it left in place long enough to provide parties a chance to adjust and re-perfect as necessary. Consent granted for the initial financing statement (which can be implied from the consent granted in a security agreement), could cover an amendment sufficiently limited to the scope of the original agreement.<sup>125</sup> If a creditor re-perfected under the new system during the transition period, perfection would be deemed to have been continuous from the time of the original filing under the prior regime. At some point, perfection obtained by the new system would begin to be given priority over perfection obtained the prior way. Either at that same time or at a later point, perfection under the old system would be deemed to have lapsed as to lien creditors and other potential claimants on the collateral.

It is conceivable that automation could help with the transition to the new system, particularly if state authorities take the initiative. The name and address of both creditor and debtor are supposed to be included on the U.C.C.-1 forms currently on file.<sup>126</sup> A state filing office could notify the creditor at the address given on the current form and could provide the creditor with the opportunity, for a fee, to instruct the office to re-perfect the interest by identifying it on the map using the debtor's address.<sup>127</sup>

*Fees and funding.* The current Article 9 regime generates funds for the filing offices, usually the Secretaries of State of each state. The proposed system would as well, particularly after implementation and transition costs have been paid. The transition to the new system would require some amount of initial investment, but much of the required costs could be covered by a fee structure designed generally to approximate the current structure. As noted, much or all of the proposed software could be partially obtained on an off-the-rack basis, and the experience of the first states to transition to the new regime could benefit the later states to transition.

The fee structure for filings would require some adjustment. One

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<sup>124</sup> Concerning the transition from the major 2001 revision, see Caroline N. Brown, *U.C.C. Revised Article 9: The Transition Rules*, 79 N.C. L. REV. 993 (2001).

<sup>125</sup> See U.C.C. § 9-509(b) (consent to security agreement implicitly includes consent to all necessary financing statements and other filings).

<sup>126</sup> See U.C.C. § 9-502(a) (noting requirements of financing statements); U.C.C. § 9-516(b) (same); U.C.C. § 9-521(a) (model U.C.C.-1 form, sections 1 and 3).

<sup>127</sup> Because filings would be at the location of collateral and not state of incorporation, this solution would require coordination between states.

solution would be to permit users of the IoT-based service to pay a regular (biannual, annual, monthly, etc.) fixed fee covering as many filings as they wish. In any case, the per-filing fee for IoT registrations will have to be low, to allow for the many thousands of filings that the system contemplates. As for claims based on geolocation, one option would be to require users to pay a small fee for each claim made, perhaps with fees increasing by the size of the claimed area, to discourage overbreadth. Another alternative would again be to charge a user fee that includes the right to make a number of claims.

In terms of how long filings would remain valid, one alternative is to adopt a system akin to that of some Canadian provinces, where users can choose the length of time of effectiveness, with fees rising on a sliding scale based on the length of time claimed.<sup>128</sup> With tagged claims, because IoT hardware generally has a lifetime of years not decades, there may be a natural limit to how long parties will pay to register the interests. In the current system there is some incentive to clear out old registrations in order to decrease the number of outdated search results, but the IoT system, because each registration would have its own specific alphanumeric identifier, and so parties will not need to sift through multiple search results to find the relevant information about a given piece of collateral.<sup>129</sup>

There is of course a tension between allowing sufficient fees to be charged that filing offices can maintain well-functioning and secure infrastructure and qualified staff, and charging so much that it deters parties from using the system. As under the current system, the proposed system would allow for states to strike this balance, on the reasonable assumption that users of the system will have sufficient incentive to advocate against filing offices seeking to charge exorbitant fees. There have been proposals to induce competition among state filing offices, or even to eliminate them in favor of national filing. Of course, if these proposals gain steam, they might help lesson concerns over inconsistencies or inequities in state fee structures. The uniform law commissioners could also have a role if states are perceived to abuse their rights to set their own fees.<sup>130</sup>

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<sup>128</sup> This appears to be the Canadian approach. See Ronald C.C. Cuming, *Article 9 North of 49: The Canadian PPS Acts and the Quebec Civil Code*, 29 LOY. L.A. L. REV. 971, 981 (1996) (“When registering a financing statement, the registering party can choose the period of registration between one and twenty-five years or the party can choose infinity registration. The registration fees in Saskatchewan are five dollars per year or \$400 for infinity registration.”).

<sup>129</sup> On the availability of identifiers, see *supra* note 108.

<sup>130</sup> See U.C.C. § 9-535 (permitting states to set fee structure); U.C.C. §§ 9-519, 9-520 (providing for rights and responsibilities of filing offices).

*B. Examples of the Proposed System's Operation*

The previous section provided an overview of the proposed legal regime for secured transactions. To illustrate how the proposed regime would work, this section provides examples of the new law's affect on several typical types of secured financing arrangements.

Consider the example of a restaurant, with revolving inventory and existing equipment in place, all of it collateral for a loan from Acme Bank. The equipment could include ovens as well as plates, glasses, and flatware for service. The restaurant's inventory could include food and drink to fill the plates and glasses with.

Equipment such as an oven would be easy to tag, with an RFID tag or WiFi-transmitting device would operate like a "beacon" to any nearby readers, including a wireless router. The tag would include data to the effect of "Oven is Collateral of Acme Bank," with contact information for the secured party, and would be registered with that information in the relevant filing office (i.e., the state Secretary of State). The tag could be read by any party with a device capable of reading such tags (including most smartphones). If the security interest is lifted (for instance, the obligation is satisfied), then the tag could be removed or reprogrammed to be blank or to specify a new secured creditor. If the oven is moved, the secured creditor should be able to ascertain that fact very quickly either by cheap, regular monitoring by hand-held devices (which could be wielded by the debtor's employees, with updates then uploaded and transmitted to the secured creditor's collateral management program), or by virtue of a direct connection of the oven to a wireless network. The tag would be difficult or impossible to remove from the oven without breaking and thus no longer transmitting as designed, setting off alarms for the creditor.

Legally speaking, the burden would be on the secured creditor to monitor its collateral and pursue remedies—locating the oven, calling the debt, taking whatever other steps are permitted by the contract. With an automated system established, the creditor should be able to prove the location of the collateral and the existence of its tag at any given time. Thus, if any competing creditor tried to tag the oven and claim priority, the original creditor would be able to refute such a claim easily. In fact the same monitoring system that allows it to maintain contact with its own tag would also detect such a competing interest as soon as its establishment was attempted, since the competing tag would be read. If a creditor sought to maintain the tag longer than was permissible, then of course a debtor could bring a legal challenge to have the creditor's claim (and its corresponding tag) lawfully removed; if a creditor's tag was wrongfully removed, the law would permit a short window or grace period in which it could vindicate its

interest in the oven, otherwise its interest would be forfeit as to a good-faith buyer or to another creditor who loaned money on the collateral in good faith and otherwise took steps to perfect its interest. Challenges to the subsequent buyer or lender (after a short initial period in which the original claim could be vindicated) would be limited to lack of good faith.

More to the point, there would be no need for the elaborate panoply of U.C.C. rules concerning proceeds and after-acquired property; if the lender wished to obtain more collateral as it came it, it could simply have the debtor's employees tag and scan such collateral, and thus add it to the monitoring system smoothly. Otherwise, a perfected security interest would *not* extend beyond the particular tagged item, thus vastly reducing the risk to competing creditors of being ambushed by a "secret lien" obtained by virtue of the proceeds rules.

As for the inventory, we can picture boxes of frozen or refrigerated meat, pallets of vegetables, bottles of alcohol, and so on. The proposal would permit security interests in these goods to be perfected by two different means. One is now familiar: individually tagging the items as they arrive. This might not be as cumbersome as it sounds. Consider a box of frozen salmon fillets, or a bottle of bourbon. The box or bottle could be tagged cheaply, and as long as it was intact would retain significant value as collateral. To be sure, neither one empty bottle nor box would be worth much, and a creditor might have a hard time detecting from afar whether bottles were full or not. On the other hand, as discussed above, WiFi-enabled camera technology is readily available, and it is easy to imagine that a creditor could ascertain whether the hundred bottles of bourbon or boxes of frozen salmon in a supply pantry or refrigerator were empty, or whether they were unopened and full of their valuable contents. As bottles or boxes were taken out of storage and used, the creditor could monitor the replenishment of its collateral or the payments made with respect to the consumption of such inventory.

If the creditor deemed tagging to be infeasible, a second option would be available: a geolocated claim for a specified type of collateral on premises. To obtain such an interest, all that would be required would be the registration of latitude and longitude coordinates with the Secretary of State, along with a statement of the type of collateral claimed ("all assets," as under the current regime, could be an option). Again, any claimant would have the right to challenge such a claim at any time. But for the indexing by location rather than debtor name, this option largely resembles the existing system. There are several significant ramifications of this distinction. Because claims are limited to that location, they are thus more transparent to third parties, more certain for the claimant (who does not have to worry about "hidden liens" encumbering property in that location), as well as

more fragile, since the security interest will be lost as to property taken off those premises. The limitation encourages monitoring/diligence on behalf of secured parties, although again, in light of the availability of remote, automated monitoring technology such as WiFi enabled cameras and sensors, the burden would be relatively light. What is gained is certainty concerning legal rights.

To take another example, consider a factory producing goods for sale out of raw materials. Tagging goods that are being warehoused would certainly seem possible in many cases, for instance of large pieces of timber or commodities being stored for later shipment. In other cases tagging raw materials might not be feasible, particularly if they are in the process of being transformed. So, a geolocated claim could be preferred. As with the salmon and bourbon examples above, WiFi-enabled sensors could readily and automatically transmit real-time information concerning the collateral present in a given warehouse, silo, tank, or other space (moisture levels, weight/volume/density, would all be possible). Once the raw materials change form, they would either have to be tagged again (presumably the original tag(s) would have been compromised or destroyed in the manufacturing process) or otherwise described (including as part of an all-assets claim) in the geolocation-based filing.

This Part has explained the substance and function of the proposed new system, and clarified how the new law could plausibly provide for increased certainty in several typical secured financing arrangements, without adding significant expense, and, in fact, with largely giving legal force to commercial practices that are already increasingly being adopted. The next Part provides more in-depth discussion of several potential objections to the proposed law, which allows the weighing of its costs and benefits more clearly.

#### IV. POTENTIAL OBJECTIONS

This Part considers several objections that might be made to the proposed system, ranging from the practical to the more philosophical. Section A considers whether the benefits of the proposed system outweigh the costs of it (including the costs of transitioning). Section B examines the relationship of the proposed system to the currently common practice of all-asset lending. Section C discusses whether particular political constituencies would oppose the amendments. Section D explains how the proposed system would deal with certain unusual classes of assets, such as deposit accounts. Section E answers objections about the overlap of the proposed regime with other bodies of law, such as real estate law. Section F discusses privacy concerns that the proposed system might present. Section G outlines

potential problems of access to, and participation in, the proposed system that might be faced by small businesses, consumers, and other commercially unsophisticated parties, and suggests some ways of easing those difficulties. Finally, section H explores the discomfort that the proposed system might provoke as an apparent step toward a world of total technological control that could reach down the level of each individual object and area on or near the entire earth.

The Part concludes that even in light of its costs and some of the concerns about it, the proposal seems likely to represent a considerable improvement over the existing system.

#### *A. The Costs and Benefits of Disrupting the Status Quo*

One obvious challenge to the proposal is the purely practical one. There are costs to the proposal: Costs to changes in the legal system, and costs to creditors for updated technological and monitoring requirements. Do the promised benefits of the proposal exceed its costs?

In terms of legal change, the costs are in fact limited. The language of the amendments would have to be drafted and pass through the appropriate political channels, with uniform law bodies and in the various states. Lawyers and their clients would have to transition to the new system. Disputes would arise as to the interpretation of numerous sections, and courts and law drafters would be busy filling gaps and clarifying ambiguities for some period of time after passage. On the other hand, the body of law would be dramatically simplified by the proposals. Numerous complicated provisions of the current law that strive to balance the interests of present and potential creditors would be largely cut in favor of more certainty and simplicity. In sum, the costs of legal change would be concentrated in the transition period and would likely be balanced by the benefits after that period.

In terms of practical changes, the proposal might seem to require significant more vigilance from creditors in order to maintain their interests in collateral. As a matter of the text of the new rules, to be sure, this is so: The new proposal explicitly contemplates that if a creditor fails to detect the movement of collateral outside of a geolocated zone, after a grace period passes, perfection over that property lapses; if an IoT monitor or tag is removed such that another interest holder cannot perceive the interest, after a similar grace period, the interest again lapses. These rules require continuous monitoring in order to maintain full protection, whereas under the current system, interests usually remain perfected, even if property is moved around or altered—or even disposed of in exchange for other property.

On the other hand, in terms of actual creditor practices, the differences may be more illusory than real. Although the current system does not, on its face, require the same level of vigilance, a creditor that is not monitoring its collateral can hardly expect to maintain its interest in that collateral. Under the current regime, without a secured creditor carefully monitoring collateral, it seems impossible to believe that its legal rights, while technically protected, are in fact worth much. The original drafter of Article 9, Grant Gilmore, put it like this:

Article 9 does make it possible for a lender to take a security interest in all of a debtor's present and future property, advance his money, sit back and take no further interest in what goes on. He will not be well advised to do this. This hypothetical course of action makes little or no sense from a business or banking point of view.<sup>131</sup>

This insight would remain true under the new regime as under the old. Whatever its legal rights may be, an inattentive creditor risks significant loss of personal property collateral, which is after all usually relatively moveable and not difficult to spirit away. If the creditor has not found the collateral worth monitoring in any meaningful way under the current system, they are unlikely to do so under the new system, and apparently do not anticipate any resultant losses being particularly severe. Of course, insofar as the creditor *is* monitoring collateral, the proposed system would represent little additional imposition. In other words, there is a general principle, which holds just true under both the current and the proposed regimes: If collateral is worth having, it is worth monitoring.

Indeed, the practical need for monitoring, even under the current system, is one reason that monitoring technologies have come into widespread use. As discussed above, the technology is continuing to improve and is neither particularly expensive nor complicated to use, so there are few barriers to wider adoption.

In other words, without better data concerning the pervasiveness of such technologies in commercial practice, it is difficult to assess what the *actual* costs will be. It seems entirely possible be that over the five to ten years required to bring the proposed system fully into force, most or all secured creditors would have already availed themselves of the requisite technologies—whether for monitoring of collateral or for the numerous other purposes such technology serves, such as supply chain management, regulatory compliance, security, and so on.

If that turns out to be the case, then the actual additional costs to creditors would approach zero. The corresponding benefit would be, of

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<sup>131</sup> Gilmore, *What It Does for the Past*, *supra* note 34, at 299.

course, the curtailment of the existing Article 9 requirements and their attendant uncertainties.

### B. “All-Asset” Lending

A related concern arises from the current practice of “all-asset” or “blanket” lending. The current practice of secured lending is a grant of security interests in all assets of the debtor is a default. Many, perhaps most, secured transactions grant security on this basis, and this has been the case for at least several decades.<sup>132</sup> The result of this practice is that the most common type of security interest is what is known colloquially as a blanket lien—a lien on all of the debtor’s property. As explained in this Section, all-asset lenders should be reassured that the proposed system need not disrupt their current practice in any significant way.<sup>133</sup>

Under the proposal, all assets could be claimed with only slightly more work than the current system. A claim on intangible assets would be made largely as under the current system (although neither these nor other claims would benefit from the current system’s expansive proceeds protection). A claim on tangible assets in a given location could be made easily by a geolocation claim. The security interests thus perfected could “float” over future intangibles and tangible assets brought on premises. With a few clicks and keystrokes, a security interest over much of a

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<sup>132</sup> See, e.g., Morris Shanker, *A Proposal for a Simplified All-Embracing Security Interest*, 14 U.C.C. L.J. 23, 26-27 (1981) (noting that “an all-embracing lien, that is, a security interest in all the debtor’s property,” is “what most secured parties want, and that is what most of them are now getting”).

<sup>133</sup> There are fierce debates about such liens from efficiency and equity standpoints. While Shanker takes no view on the desirability of the “all-embracing lien,” he suggests that if the law is to permit such liens, it should not complicate the process of claiming them without reason. See *id.* at 26 (“If the law intends that security over all of the debtor’s assets can be obtained . . . by simply copying from a boiler-plate list of words found in Article 9, then why even require it? At best, continuing to require this boiler-plate list can serve only as a trap for those who, by reason of inadvertence or lack of proper advice, fail to copy it precisely. And that seems a poor reason to penalize these unfortunate souls.”). This proposal was almost entirely implemented in later versions of the U.C.C., although “unfortunate souls” are still occasionally caught in the few traps that remain. See, e.g., *In re Lexington Hospitality Grp., LLC*, No. 17-51568, 2017 WL 5035081, at \*6 (Bankr. E.D. Ky. Nov. 1, 2017) (denying creditor relief because financing statement failed to list the necessary collateral and therefore security interest was unperfected).

Even under existing law, there may be personal property interests that even an “all-asset” lien does not encompass—and that some argue it should not encompass. See, e.g., Edward J. Janger, *The Logic & Limits of Liens*, 2015 UNIV. ILL. L. REV. 589, 595 (“[I]nvestors often speak of ‘blanket liens’ as if there is such a thing”). Janger notes that there are “holes” in the “blanket” such that parts of the a debtor’s property. *Id.* at 596; *id.* at 596-97 (citing examples).

debtor's property could be perfected remotely and quickly. The new system would be inconvenient only when debtors have a very large number of locations or many items of collateral constantly on the move, and even then the proposed IoT and geolocation technologies are unlikely to require significant adjustments.

Similarly, the additional monitoring requirements of the new system upon such a creditor should not be substantial. As mentioned above, if the creditor actually cares about the collateral, it monitors those materials anyway. Finally, because the proposed system reduces "secret lien" possibilities, the proposed system would often help protect the hypothetical, "lazy" all-assets creditor. The proposed system would also facilitate easy and certain means of carving out *exceptions* to an "all-assets" lien. This would provide a sort of natural experiment to shed light on when and why the all-asset approach remains appealing, by providing other easy and reliable options for "slicing" a debtor's property more finely among different security interests.

If, despite the above argument, proponents of the all-asset practice were to stand implacably opposed to the proposed system, it would be possible to modify the proposed system to appease them. The existing filing system could be left in place and permit for all-asset filings on the basis of the debtor's identity only to perfect as to all of the debtor's assets. Such perfection would be limited to original and after-acquired collateral and would not extend to proceeds. It would lose priority to valid geolocated or IoT-based claims; in other words, it would *not* defeat parties who had perfected through one of these other means, even after the "all-assets" filing was made. Essentially, it would only trump unsecured creditors and creditors who have attempted to levy on collateral of the debtor pursuant to a judicial lien.<sup>134</sup> This proposed modification would protect the current all-assets practice while allowing for the implementation of the proposed system, although it might have troubling distributive consequences.<sup>135</sup>

In sum, the proposed system would not represent a major burden or disruption to current all-asset practice—although that practice might ultimately diminish if creditors find that the proposed system provides a sufficient increase in certainty that more limited security interests will allow

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<sup>134</sup> This would include the trustee in bankruptcy standing in the shoes of a lien creditor. 11 U.S.C. § 544(a).

<sup>135</sup> It might be seen to further disadvantage "involuntary" or "non-adjusting" creditors, who are already disfavored without clear normative justification. *See, e.g.*, Elizabeth Warren, *Making Policy with Imperfect Information: The Article 9 Full Priority Debates*, 82 CORNELL L. REV. 1373 (1997); Lucian A. Bebchuk & Jesse M. Fried, *The Uneasy Case for the Priority of Secured Claims in Bankruptcy*, 105 YALE L.J. 857, 869 (1996); Alan Schwartz, *Security Interests and Bankruptcy Priorities: A Review of Current Theories*, 10 J. LEGAL STUD. 1 (1981).

them to meet their financing needs without resorting to “all assets.”

### C. Political Resistance

Proposed amendments to law commonly run into difficulties because of opposition by entrenched interests. For instance, there have been credible proposals to use technology to consolidate and simplify existing real estate recording systems, but they have encountered resistance and made only sporadic progress.<sup>136</sup> Proposals concerning the U.C.C., such as proposals to nationalize the U.C.C. filing system, have failed to take hold.<sup>137</sup> The uniform law process, by which Article 9 is amended, has been subject to extensive analysis and critique.<sup>138</sup>

A similar fate should not await this Article’s proposal, because there are not any obvious, major constituencies against it. Filing officers have an interest in maintaining a status quo that generates fees and employment. But they would see their role, if anything, enhanced by a system that would require creditors to have frequent recourse to IoT and geolocation systems maintained by filing offices. Some officers might resist the transition, which would entail start-up investments in infrastructure and training. However, these costs could be rapidly recovered in filing fees; there would be a likely spike in such fees upon implementation of the proposed system.

By shifting filings away from debtors’ states of incorporation and to the location of collateral, the proposal would divert business from filing offices of common states of incorporation like Delaware. This could conceivably leave them opposed. However, the move to state of incorporation is itself a relatively recent phenomenon, and thus undoing it not very jarring. In addition, there is a larger number of states to whom business will be diverted, and their interests should weigh heavily even against concentrated resistance of major incorporation states.

Another potential opponent might be firms that gather credit-related information about firms and sells access to the public. Conceivably, such firms (often termed “information intermediaries”<sup>139</sup>) might resist change because they are reluctant to adjust to a new regime, or they fear that making information too easily available will “democratize away” the very need for their firms. But the former concern would arise only if companies thought the transition costs or barriers to entry to the new system would

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<sup>136</sup> See *supra* notes 84-88.

<sup>137</sup> See, e.g., Janzen, *supra* note 110; LoPucki, *Computerization*, *supra* note 18.

<sup>138</sup> See *supra* note 62 and accompanying text.

<sup>139</sup> See Lynn M. LoPucki, *The Unsecured Creditor’s Bargain*, 80 VA. L. REV. 1887, 1941 (1994); Mann, *Verification Institutions*, *supra* note 16, at 41-43; Lipson, *Secrets and Liens*, *supra* note 19, at 452.

disadvantage them versus their competition; in fact, specialty firms likely could transition quickly due to their expertise, and thus maintain their advantages. A similar dynamic would likely answer the second concern. When the information-dissemination possibilities of the Internet were newly discovered, some companies in the information business had concerns that the value of their expertise would diminish. But the opposite has proven true: With such a vast quantity and wide range of data available, both data-gathering and data-analysis have become more difficult and more necessary, which has made them even bigger business than before.<sup>140</sup> In addition, such companies' interests are aligned with the broader purpose of this Article's proposal, namely the facilitation of commerce through increased certainty and decreased costs. Their business grows along with growth of commercial and financial activities and benefits from changes that bring growth.

For these reasons, it seems unlikely that the proposal would run into insurmountable political obstacles.

#### *D. Borderline-Tangible and Other Complicated Assets*

The proposal described above provides for claims on intangible assets to be made roughly along their current lines.<sup>141</sup> Another difficult category of assets is those that are tangible but present unusual features compared to most tangible assets—such as negotiable instruments, cash, and some investment properties such as certificated securities. Certain of these assets in fact most resemble intangible assets and should probably be perfected by the same means as they are—that is, by debtor name as under the present system. Securities, for instance, are typically held by repositories such as the Depository Trust Company and indexed under the name of the owner of the security, and thus the use of debtor's name as means of perfection is unlikely to mislead.

By contrast, assets susceptible to geolocating—cash in a register, for instance—could be perfected as under the proposed system. Negotiable instruments, on the other hand, may be sufficiently tangible to simply apply the proposed system, requiring a creditor either to stake a geolocated claim or to tag the individual instruments (which could be done without damaging them).

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<sup>140</sup> One firm incorporates 1.3 billion updates to skip-tracing records per month. *What Makes Experian's Skip Tracing Tools Better?*, EXPERIAN, <http://www.experian.com/small-business/skip-tracing-tools-software.jsp>. Dun & Bradstreet offers its own data for business credit monitoring and the data of a dozen partners, across a range of industries. *Data Exchange Partners, DUN & BRADSTREET*, <https://developer.dnb.com/marketplace/dataexchange/partners> (last visited Feb. 18, 2018).

<sup>141</sup> See *supra* notes 116-122 and accompanying text.

Some further line-drawing would be required by these complicated asset classes, but they do not present any serious threat to the current system. The proposed system offers several ways in which they could be dealt with.

#### *E. Article 9's Overlap with Related Areas of Law*

Another objection might be that the proposed regime would complicate the interface between Article 9 and other bodies of law, most notably real estate laws. This interface comes into play, for instance, when personal property is transformed into part of real property. Imagine a heater being installed into a house, or a sound system into a music venue. There are inevitable tensions and gray areas between real and personal property laws in such cases, as would be expected.

The proposal does not change the balance between the real estate and U.C.C. systems. The proposal affects perfection (and lapse of perfection) in interests in personal property. Where the current system awards priority to interests in real property over those in personal property, or to those in personal property over real property, there is no need to change such rules.

That said, as noted above, the real estate system could perhaps be improved by with similar disruptions—specifically the use of geolocation technologies for the recording of land lending and purchase documents. If such improvements were made to the real estate system, then it seems plausible that greater integration of the real estate and personal property systems would be possible, benefitting both bodies of law by decreasing uncertainties, requiring fewer steps to claim or to search out security interests in personal property, in real property, or in the contested, in-between categories.

#### *F. Privacy*

Another objection that the proposed system might provoke is that information concerning exact scopes of property holdings would be more readily available and might intrude on legitimate trade secrecy interests or simple privacy interests. IoT technologies have raised these concerns in numerous areas of law.<sup>142</sup>

As noted, however, what would be disclosed would be minimal information. As under the current system, the goal would be for the filing to provide inquiry notice only, and enough of a trail for reliable inquiry to be

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<sup>142</sup> See, e.g., Scott R. Peppet, *Regulating the Internet of Things: First Steps Toward Managing Discrimination, Privacy, Security, and Consent*, 93 TEX. L. REV. 85 (2014).

made. For an IoT-based claim, a registration number and the secured creditor name and contact information is all that would be publicly available. For a geolocated claim, all that is needed aside from the location would be the name and contact information for the secured party or its agent. In the rare case that even the location information would reveal some information that is personally or commercially sensitive, then a move to the IoT system should usually be possible.

Arguments could potentially be made for the U.C.C. filing system to include more encompassing information about transactions, whether based on public-good rationales or contract rationales; the Article 9 filing system could serve as a location for all relevant transaction information, as the real estate records at least theoretically are.<sup>143</sup> The system proposed here could accommodate such a change, but an analysis of whether such a change is worthwhile is beyond the scope of this Article.

Because all that would be required under the proposal is enough for searchers to be put on inquiry notice and given sufficient information to enquire as to the source of a potentially conflicting claim (and debtors would be given sufficient chance to challenge claims clouding the title of their collateral), the intrusion on privacy should be minimal.

*G. Access and Participation by Small Businesses,  
Consumers, and Other Commercially Unsophisticated Parties*

Another concern might be that use of new, more technologically sophisticated requirements for filing and monitoring collateral puts too much of an onus on parties with little commercial sophistication. The proposed regime might impose new barriers on parties' access to markets and access to justice—on access to the legal protections of the secured transaction system.

It is not clear that access would be any more difficult under the proposed system. Perfecting and maintaining a security interest in the current system requires accuracy and diligence beyond the means of many small-time players and leaves uncertainty even for those who take reasonable precautions.<sup>144</sup> The proposed system strips away various complicated legal provisions that represent traps for the unwary.

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<sup>143</sup> One rationale for requiring more transaction information to be disclosed, for instance, could be that the availability of the records of underlying transactions could allow subsequent creditors to gain, more easily than now, a more thoroughgoing view of a debtor's finances. There are of course many counterarguments, such as the administrative costs, the potential disclosure of trade secrets, and so on. The question of the optimal amount of disclosure for a filing system to require is not a simple one.

<sup>144</sup> See *supra* Part I.A.2.

There is no reason to think that cost would be prohibitive. While technologically sophisticated, the tools required to claim and maintain an interest in the new system are widely available off the rack. As technology develops, the costs of claiming an interest and monitoring collateral should drop even more. Finally, by adding certainty, the proposal should make financing cheaper and more available under standard economic assumptions, benefitting marginal borrowers whose access to credit might otherwise be prohibitive.

Consumers are accorded special treatment in some parts of Article 9, and they might be entitled to continued special treatment under the proposed changes. Historically, consumers, the goods they buy, and the transactions they enter were thought to require exemptions because of consumers' presumed lack of sophistication in secured transactions law and because it is more desirable to foster easy commerce in consumer goods than to subject such commerce to the usual rules of secured transactions. A fuller explanation of the rationales for such treatment are elusive in part because the exceptions granted to consumers, consumer transactions, and consumer goods are spotty and inconsistent at best, and probably not coherent under any single rationale. A full treatment of potential new approaches to security interests in consumer goods would require more consideration than is possible here. If desired, the status quo could be maintained: it would be possible to except consumers, consumer goods, and consumer transactions from the proposed system by granting them priority despite an otherwise perfected interest, or by leaving other special provisions in place, such as the automatic perfection of certain security interests in consumer goods.<sup>145</sup> Such exceptions would be no more disruptive than they are now.

More to the point, under the proposed system, consumers would have less to worry about. The geolocation approach would likely be preferred for many consumer goods, and once those goods left the designated area upon purchase (and the grace period passed), the interest would lapse and the consumer would have nothing to worry about. If the IoT approach has been taken with respect to a particular item, then there is potentially more concern, and the consumer might have to look to either the protections for "buyers in the ordinary course," which should in most cases be sufficient.<sup>146</sup>

The most that would be required, if a consumer desired to hold an item free of any security interest, would be to require her to scan an item to make sure it was not tagged with a continuing security interest before the purchase. This could be done by an application on a smart phone; or it could

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<sup>145</sup> See *supra* note 49.

<sup>146</sup> See *supra* note 52 and accompanying text.

be done by virtue of a tool provided by the seller at time of sale, as a demonstration that no IoT-perfected interest is being claimed. A scan for IoT tags could even be integrated into the checkout scanning process, and then integrated with existing credit card payment processing systems or new payment platforms such as Apple Pay. Thus, a consumer could make a one-time selection only to approve payments for items that have scanned as “free-and-clear” at time of purchase, and never think about it again. Alternatively, as a policy matter, it might not be thought feasible to require a consumer to make such an inquiry, and thus a policy decision could be made for consumers to automatically take free and clear. Such an exception could of course be included in the amended Article 9 text.

*H. Universal Property Registers and Maps of Everything:  
A Prelude to Dystopia?*

A final objection is the general sense of unease that the proposal might provoke. The world imagined in the proposal may seem futuristic—in some ways utopian and ideal, and in others dystopian and nightmarish. The proposal might seem inadequately to account for the societal implications of the technological changes it relies upon.

Technological change has always brought change to law. Technologies have a way of upending assumptions about what is feasible or reasonable, and accordingly, disrupting bodies of law developed based on those assumptions. On-the-ground realities shift such that once-sensible legal rules rapidly come to become ineffective or counter-productive. Vast swathes of law, both public and private, may need to be remade. Examples from the rapid development of technology in recent decades are easy to come by. The rise of ad-hoc workers and independent contracting in the “gig economy” will remake employment law and other bodies of law as well.<sup>147</sup> The deployment of AI to make decisions and provide services will challenge notions of responsibility and agency.<sup>148</sup> Technologically-enabled and automated forms of exchange and corporate enterprise will require development of new commercial and corporate laws.<sup>149</sup> Data gathering and

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<sup>147</sup> See, e.g., Veena Dubal, *Winning the Battle, Losing the War?: Assessing the Impact of Misclassification Litigation on Workers in the Gig Economy*, 2017 WIS. L. REV. 739, 740-58 (2017) (explaining gig economy and assessing its relationship to existing law). Related is the rise of the “sharing economy,” which also presents challenges across numerous bodies of regulation at every level of government. See, e.g., Abbey Stemler, *Between & Between: Regulating the Sharing Economy*, 43 FORDHAM URBAN L.J. 31 (2016).

<sup>148</sup> See, e.g., Matthew A. Bruckner, *The Promise and Perils of Algorithmic Lenders’ Use of Big*

*Data*, 93 CHI.-KENT L. REV. 3 (2017).

<sup>149</sup> See, e.g., Anthony J. Casey & Anthony Niblett, *The Death of Rules & Standards*,

analytics will challenge notions of privacy and property in personal information.<sup>150</sup> Human body augmentations and prosthetics that may stretch notions of personhood and identity. The continued development of remote warfare capabilities, like remote-controlled drones and “smart” missiles, will continue to challenge the laws of war and humanitarianism.<sup>151</sup> There are even more exotic examples of bodies of law that will have to be developed—for instance, the law that will govern activities undertaken in “virtual worlds,” that is, in online social spaces inhabited only by computer-generated “avatars.”<sup>152</sup>

The IoT and geolocation technologies at the heart of the proposal in this Article are working similar, uncertain changes in both law and society. Making full use of these technologies’ capabilities, the proposal amounts to a plan for precisely identifying, mapping, tracking, monitoring potentially millions or billions of individual items throughout their entire useful life. It imagines interactive, publicly available maps, accurate to within a few feet at most, which parties can rely upon to structure their financial dealings and to adjudicate property disputes. It assumes the longstanding, continuous availability of a vast amount of computing power and storage capacity, as well as widespread, high-capacity communication networks. It is premised on users who will integrate all of these technological capabilities thoroughly into their everyday business activities.

No doubt, this interconnected and sensor-laden world still seems futuristic. As a result, it is not wonder that the proposed system seems a step toward a sort of electronic panopticon, a world of total technological tracking and control that could reach down the level of each individual object and space on the globe.<sup>153</sup> And, while it still seems futuristic, the

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92 INDIANA L.J. 1401 (2017) (analyzing some likely ramification of technologies for “gap-filling” contracts); Carla Reyes, *If Rockefeller Were a Coder* (Dec. 7, 2017), available at [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3082915](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3082915) (discussing appropriate legal structures under business organizations law for “decentralized autonomous organizations” and similar new forms of technologically enabled ventures).

<sup>150</sup> See, e.g., Peppet, *supra* note 142; Harry Surden, *Structural Rights in Privacy*, 60 S.M.U. L. REV. 1605 (2007) (discussing effects of emerging technologies on effective rights including right to privacy).

<sup>151</sup> See, e.g., Veronica Ma, *The Ethics and Implications of Modern Warfare, Robotic Systems, and Human Optimization*, HARV. INT’L REV. (Jan. 16, 2017), <http://hir.harvard.edu/article/?a=14494> (providing overview of emerging legal and ethical issues of warfare technology).

<sup>152</sup> See, e.g., Joshua Fairfield, *Escape Into the Panopticon: Virtual Worlds and the Surveillance Society*, 118 YALE L.J. POCKET PART 131 (2009).

<sup>153</sup> For canonical discussions of the notion of a panopticon, see JEREMY BENTHAM, *THE PANOPTICON WRITINGS* (Miran Bozovic ed., 1995); MICHEL FOUCAULT, *DISCIPLINE & PUNISH: THE BIRTH OF THE PRISON 195-30* (Alan Sheridan trans., Vintage Books 2d ed. 1995); see also Jeffrey H. Reiman, *Driving to the Panopticon: A Philosophical Exploration*

proposal is not quixotic—this is not a situation in which law would far outstrip facts. To the contrary, the practice of commercial and even governmental actors already mirrors, in many ways, what is proposed here. The proposed system for perfecting security interests in personal property would integrate easily with other systems involving extensive geolocation and IoT that already pervade the business world and increasingly, technologically connected (“smart”) homes.

Thus, the time is ripe for scholarship both to consider the ways in which this technology should affect law, as well as the broader concerns about policy and society that it may provoke. These two strands of work cannot be undertaken in isolation; they must inform one another.

This Article falls in the first category of work. It deals with a set of normative questions concerning how existing or anticipated technological developments can help to develop, supplant, or be integrated into existing bodies of law. Others have begun to explore similar questions in analogous areas of law. For instance, in fascinating recent work, Eric Posner and Glen Weyl have recently proposed a system to reallocate property rights based on a publicly available, continually updated registry of ownership of essentially all property. Essentially, the way the Posner-Weyl system would work is that owners would provide a self-assessed valuation of all of their property, pay regular taxes based upon that valuation, and be continually at risk of losing any asset they place too low a value on, because anyone could purchase their assets for the announced valuation (plus some small amount) at any time. Implementation of the Posner-Weyl universal property registry—which they term the *cadaster*—would require heavy reliance on IoT and geolocation technologies.<sup>154</sup> Obviously, the Posner-Weyl cadaster bears a certain strong resemblance to the proposed secured transactions system explored in this Article.

In terms of work on broader policy concerns, scholars have begun to explore the ramifications of technologies discussed here and proposed ways

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*of the Risks to Privacy Posed by the Highway Technology of the Future*, 11 SANTA CLARA COMPUTER & HIGH TECH. L.J. 27, 28 (1995) (“The Panopticon was Jeremy Bentham's plan for a prison in which large numbers of convicts could be kept under surveillance by very few guards. . . . The French philosopher Michel Foucault used Bentham's Panopticon as an ominous metaphor for the mechanisms of large-scale social control that characterize the modern world.”).

<sup>154</sup> Eric Posner & E. Glen Weyl, *Property Is Another Name for Monopoly*, 19 J. LEG. ANAL. 51 (2017); see also Ari Glogower, *Wealth and the Income Tax*, Ohio St. Public Law Working Paper No. 368 (Sept. 21, 2016) (proposing to modify tax system to force regular disclosure not of net income but of net wealth, in part by using technological means). Posner and Weyl have a forthcoming book on these topics, *RADICAL MARKETS: UPROOTING CAPITALISM AND DEMOCRACY FOR A JUST SOCIETY* (forthcoming 2018).

of addressing them.<sup>155</sup> It seems increasingly likely that human society is facing a major shift as a result of the advance of communications, processing, and network technologies. In the same way that the Domesday Book dramatically increased the legibility of real property in medieval England and exemplified a paradigm shift in record-keeping and in legal consciousness with respect to property rights,<sup>156</sup> the Internet of Things seems likely to transform numerous of our society's fundamental notions (including that of property itself) in quite sweeping and profound ways.<sup>157</sup>

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<sup>155</sup> Numerous law articles have considered the rise of IoT and related technologies as potential panopticons in various legal and societal realms. *See, e.g.*, Neil M. Richards, *The Dangers of Surveillance*, 126 HARV. L. REV. 1934, 1936, 1940 (2013) (explaining concerns that the rise of government and corporate surveillance “menaces our intellectual privacy and threatens the development of individual beliefs in ways that are inconsistent with the basic commitments of democratic societies,” and citing “software, RFID chips, GPS trackers, cameras, and other cheap sensors” as “the technologies of surveillance”); Sean C. Helms, *Translating Privacy Values with Technology*, 7 B.U. J. SCI. & TECH. L. 288, 290 (2001) (exploring ways of preserving user anonymity online in light of pervasive surveillance technologies that are “moving us toward a ‘Cyber-Panopticon’”); Jerry Kang & Dana Cuff, *Pervasive Computing: Embedding the Public Sphere*, 62 WASH. & LEE L. REV. 93, 94 (2005) (“[T]he Internet will soon invade real space as networked computing elements become embedded into physical objects and environments. ... [T]he physical world will gain digital qualities, such as computer-addressability through unique identification codes. ... If the line between cyberspace and real space has grown increasingly difficult to draw, it may soon become impossible.”); Marcy Peek, *The Observer and the Observed: Re-Imagining Privacy Dichotomies in Information Privacy Law*, 8 NW. J. TECH. & INTELL. PROP. 51 (2009) (exploring implications of technological and related social changes on areas of legal doctrine in the areas of privacy); Timothy Zick, *Clouds, Cameras, and Computers: The First Amendment and Networked Public Places*, 59 FLA. L. REV. 1, 3 (2007) (assessing the First Amendment implications of the “networking of public places” including by IoT technologies); Bert-Jaap Koops & Ronald Leenes, “Code” and the Slow Erosion of Privacy, 12 MICH. TELECOMM. TECH. L. REV. 115, 116 (2005) (concluding that in numerous areas of law, including “law enforcement, national security, E-government, and commerce,” technology has generally eroded privacy); Kevin Werbach, *Sensors & Sensibilities*, 28 CARDOZO L. REV. 2321, 2322 (2007) (“The sensor revolution will challenge hidden assumptions in a bewildering array of doctrinal fields, including contracts, evidence, trade secrets, patents, criminal law, securities regulation, and many others. The initial legal impacts of pervasive sensors will be both diffuse and unsettling.”); Rebecca Rubin, *Note: Smart Dust: Just A Speck Goes A Long Way In The Erosion Of Fundamental Privacy Rights*, 15 J. HIGH TECH. L. 329, 330 (2015) (describing the nanotechnology of “[s]mart dust, miniature sensors proposed to be smaller than what the naked eye can see,” and noting its potential to erode privacy and surveillance norms).

<sup>156</sup> *See generally* M.T. CLANCHY, FROM MEMORY TO WRITTEN RECORD: ENGLAND 1066-1307 (2d ed. 1993).

<sup>157</sup> The beginning of this shift predates the Internet of Things, because it goes back at least to the innovation of the bar code, the importance and unlikely success of which remains remarkable. *See generally* STEPHEN A. BROWN, REVOLUTION AT THE CHECKOUT COUNTER: THE EXPLOSION OF THE BAR CODE (providing an institutional history of the bar code, written by an insider in the process); Margalit Fox, *Alan Haberman, Who Ushered In*

As scholars have pointed out, there are elements of technological development, both from the perspective of law and of society more generally, that can be alternatively worrisome and promising. This work is valuable and necessary. But it would be unwise to leave aside the work of this Article, or that of Posner and Weyl, which probes ways in which the law can begin to be adapted to these emerging technologies.

Thus, the approach taken in this Article is a way of informing future work on broader policy implications, on the threats and possibilities opened by new technologies,<sup>158</sup> but it is also a necessary concession to reality, to the technological facts on the ground. An amended Article 9 may not take the form imagined in this Article, or even rely upon the technologies outlined here.<sup>159</sup> But there is no doubt that the current Article 9 filing system technology is already outdated and will only become more so in coming years. Without being brought closer into accord with actual commercial practices, it will recede in all likelihood toward irrelevance. If amendment does not occur, then that will represent not a victory for our secured transactions system, but a defeat.

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*the Bar Code, Dies at 81*, N.Y. Times, June 15, 2011 (quoting Haberman as discussing the importance of the invention of the UPC (the universal product code, the central feature of bar codes) in the most grandiose terms imaginable: “Go back to Genesis and read about the Creation” ... “God says, ‘I will call the night “night”; I will call the heavens “heaven.”’ Naming was important. Then the Tower of Babel came along and messed everything up. In effect, the U.P.C. has put everything back into one language, a kind of Esperanto, that works for everyone.”); Varchaver, *supra* note 76 (discussing history of the bar code and the IoT as its successor).

<sup>158</sup> See, e.g., Werbach, *supra* note 155, at 2323 (“The best response to the coming sensor revolution, therefore, is not to panic. Anticipating and appreciating the impacts of pervasive sensors is the best way to shepherd the law through a challenging transition process.”).

<sup>159</sup> There have, for instance, been moves toward trying to use the blockchain or other distributed ledger technologies for simplifying and improving some aspects of the filing system. See, e.g., Reyes, *supra* note 18, at 402-03, 417-21 (proposing use of distributed ledger technologies like blockchain for U.C.C.-1 filings); Andrea Tinianow et al., *Delaware’s 2017 Resolution: Making Blockchain a Reality*, COINDESK (Jan. 4, 2017), <https://www.coindesk.com/what-expect-delaware-blockchain-initiative-2017/> (article by then-director of Delaware Blockchain Initiative and others discussing Delaware’s initiatives, including the initiatives to give U.C.C. filers “the opportunity to use smart-contract versions of U.C.C. documents on a distributed ledger”); Andrea Tinianow & Caitlin Long, *Delaware Blockchain Initiative: Transforming the Foundational Infrastructure of Corporate Finance*, HARV. L. SCH. FORUM ON CORP. GOV. & FIN. REG. (Mar. 16, 2017), <https://corpgov.law.harvard.edu/2017/03/16/delaware-blockchain-initiative-transforming-the-foundational-infrastructure-of-corporate-finance/> (explaining and predicting adoption of distributed ledger-based ““smart U.C.C.’ filings” to improve the filing system, “which is still surprisingly paper-based, slow and error-prone”).

## V. CONCLUSION

There have been numerous sensible proposals for streamlining the secured transactions system in light of advances in technology.<sup>160</sup> This proposal goes much further than other proposals, because under it, the underlying structure of the Article 9 filing system would change, from debtor-based indexing to collateral-based identification. The proposal removes a detour through the debtor's name and location and allows collateral to "speak for itself," using newly feasible technological means.

The proposal has two main benefits. First, the proposal better accords with the notion of a security interest as a direct relationship between a creditor and item of collateral, as well as with the theory of notice that underlies the concept of perfection. Numerous provisions of Article 9 could be simplified or eliminated thanks to the proposed shift.

As new realms of information technology become ever more pervasive, this type of rethinking of fundamental legal structures should be expected. Technological shifts challenge existing notions about property; about social rights, responsibilities, and duties; and about the role of law itself in a world increasingly governed not just by law but, as Larry Lessig has put it, by "code."<sup>161</sup> In many cases, technology will render existing laws unnecessary, as in the case of the Article 9 filing regime. In other cases, it will necessitate the formation of new legal frameworks and new bodies of law.

Second, the proposed shift helps Article 9 better reflect commercial reality, which is a worthy, historical goal of the U.C.C. From manufacture through sale, businesses have changed and will continue to change their

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<sup>160</sup> See *supra* note 18.

<sup>161</sup> Lessig argued that computer code functions as a substitute for, or a parallel governance regime to, law. LAWRENCE LESSIG, CODE AND OTHER LAWS OF CYBERSPACE (1999). Joshua Fairfield has explored aspects of this idea in the realm of property and commercial law. Law has not taken proper account of the power of information technologies, in part because legal thinkers have failed to recognize that much of law is about the *facilitation of a flow of information*. For instance, Fairfield states that "[p]roperty is the law of lists and ledgers. County land records, stock certificate entries, mortgage registries, Uniform Commercial Code filings on personal property . . . are all merely entries in a list, determining who owns what." Joshua A.T. Fairfield, *Bitproperty*, 88 S. CAL. L. REV. 805, 805 (2015). He argues "[p]roperty has not benefitted from the scaling effect of drastically reduced information costs because property law has been traditionally understood as being concerned with tangible objects, rather than information." *Id.* at 811. His view aligns with this Article, which proposes to give legal force to new forms of object-based communication, and discard information (the debtor's identity) that has frustrated the flow of relevant information. In essence, this Article proposes to simplify the "code" of the U.C.C. filing system.

practices to reflect technological advancements, including those that permit simplified identification, tracking, and monitoring of property from place to place and owner to owner. Chief among the advancements that have already revolutionized business are the technologies underlying geolocation and the Internet of Things. The proposal would use technology that is already being widely adopted by businesses, and in doing so, would permit notice of security interests to be more confidently and cheaply. As the statute emerged most closely and most triumphantly from the leaders of the “Legal Realist” movement, it is appropriate that the U.C.C. remains a frontier where evolving business practices and technological capacity would lead to reassessment and legal change—even if such changes make lawyers invested in the current system’s ornate doctrinal structure uncomfortable.

To lawyers, the disruption of U.C.C. Article 9 proposed here might seem dramatic and unsettling. To clients, the changes would have the opposite effect. For them, the changes would merely cut away a layer of artificial paperwork and replace it with a simpler and more predictable system. The new law of security interests would be more reflective of commercial reality and more reliable in protecting the reasonable expectations of lenders, buyers, and debtors. This proposal’s simplicity, its consistency with the underlying notions of our secured transactions doctrine, its reliance on existing technologies, and its capacity to evolve alongside further developments in technology and in commercial practice, suggest that its time has arrived.