

**OVER-THE-AIR IN PERSONAM: PURPOSEFUL AVAILMENT THROUGH
OVER-THE-AIR UPDATES**

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“We’re a court . . . We really don’t know about these things. You know, these are not like the nine greatest experts on the internet.”

Associate Justice Elena Kagan.**

I. INTRODUCTION

A court must have personal jurisdiction over every party to a suit before it can pass binding judgment. And yet, personal jurisdiction law is ever more complicated by modern technology. In fact, the Supreme Court has not provided any specific guidance on how to analyze contacts made possible through modern technology in its personal jurisdiction precedent. Lower courts have been left to apply the Court’s general rules to various technologies, developing and applying different tests to help distinguish when such contacts are sufficient for jurisdiction to follow. Precedent regarding the ramifications of internet contacts is particularly unsettled. However, this paper will show that as technologies improve and become more impactful, the analysis regarding whether such technology should convey personal jurisdiction may actually become easier because such technological contacts more clearly meet the general tests laid down by the Supreme Court.

One example of such technology is over-the-air updates (OTAUs). OTAUs have been around for a few decades, but are becoming increasingly popular, powerful, and integral to product lifecycles. This technology, particularly as deployed by Tesla for its automobiles, has significant impacts on updated products and the safety of those around the product. This paper will show that OTAU usage can be a legitimate basis for *in personam* personal jurisdiction over an entity, even where it has not directed other significant activity towards a forum.

This paper proceeds in the following sections: Section II presents Supreme Court precedent necessary to understand *in personam* personal jurisdiction; Section III explains OTAUs and how they function; and Section IV applies OTAUs to personal jurisdiction precedent through a case study—Tesla’s OTAU usage in relation to South Carolina.

** Oma Seddiq, *Supreme Court Justices Aren’t ‘the 9 Greatest Experts on the Internet,’ Elena Kagan Said as They Heard a Major Tech Case*, BUS. INSIDER: POL. (Feb. 21, 2023, 5:29 PM EST), <https://www.businessinsider.com/supreme-court-google-tech-social-media-section-230-justices-internet-2023-2> [<https://perma.cc/BN29-4K5P>].

II. *IN PERSONAM* PERSONAL JURISDICTION PRECEDENT OVERVIEW

Personal jurisdiction requirements are derived almost entirely from the Due Process Clause’s requirement that defendants have an adequate ability to defend themselves through notice of litigation.¹ There are two kinds of personal jurisdiction: *in personam*, which is personal jurisdiction over a party before the court; and *in rem*, which is personal jurisdiction over a piece of property subject to litigation.² This paper deals entirely with *in personam* jurisdiction. In the seminal case for modern *in personam* personal jurisdiction law, *International Shoe Company v. Washington*, the Supreme Court made clear that the main issue in personal jurisdiction analysis is whether exercising jurisdiction comports with “traditional notions of fair play and substantial justice.”³ A secondary consideration is comity between the states, but this concern has never been determinative in Supreme Court precedent.⁴

Once a party has been properly served, state courts obtain personal jurisdiction through state legislators passing “long-arm” statutes.⁵ Federal courts also gain personal jurisdiction this way, among others, because federal courts have essentially the same jurisdiction as their state court counterparts.⁶ Such long-arm statutes properly confer personal jurisdiction on courts in the vast majority of circumstances, but, in fringe cases, such statutes are so broad that the Supreme Court invalidates them in accordance with Due Process.⁷ As a court’s jurisdiction arising from a long-arm statute must also be fairly exercised, whether a court has personal jurisdiction over a defendant is based on a two-pronged test: (1) whether the state long-arm statute provides personal jurisdiction over the defendant under the facts, and

1. See *Amdt14.S1.7.1.1 Overview of Personal Jurisdiction and Due Process*, CONST. ANNOTATED, https://constitution.congress.gov/browse/essay/amdt14-S1-7-1-1/ALDE_00000907/#essay-14 [<https://perma.cc/MCZ5-73Y2>].

2. *In Personam*, CORNELL L. SCH.: LEGAL INFO. INST., https://www.law.cornell.edu/wex/in_personam [<https://perma.cc/G2Q7-TEB8>]; *In Rem*, CORNELL L. SCH.: LEGAL INFO. INST., https://www.law.cornell.edu/wex/in_rem [<https://perma.cc/2HB4-8QPG>].

3. *Int’l Shoe Co. v. Washington*, 326 U.S. 310, 316 (1945).

4. See *Mallory v. Norfolk S. Ry. Co.*, 600 U.S. 122, 144 (2023).

5. See 4 CHARLES ALAN WRIGHT & ARTHUR R. MILLER, FEDERAL PRACTICE AND PROCEDURE § 1068 (4th ed. 2023).

6. See FED. R. CIV. P. 4(k)(1)(A) (establishing federal court personal jurisdiction over any entity that is “subject to the jurisdiction of a court of general jurisdiction in the state where the district court is located”); see also FED. R. CIV. P. 4(k)(1)(B)–(C) (providing for additional circumstances where a federal court may obtain personal jurisdiction).

7. See *Mallory*, 600 U.S. at 143–46 (debating whether Pennsylvania long-arm statute, combined with registration statute, unconstitutionally permitted long-arm jurisdiction).

(2) if so, whether such provision complies with constitutional due process requirements.⁸

There are two approaches legislatures use when crafting state long-arm statutes.⁹ The first method, which is the more traditional method, is to enumerate circumstances in which the state may exercise jurisdiction. Historically, it was this kind of statute that occasionally granted jurisdiction to state courts in circumstances that would otherwise be improper under the constitutional analysis of fair play and substantial justice.¹⁰ That is why the Supreme Court developed the second prong. The second method is to craft a long-arm statute saying the state will exercise jurisdiction to the full extent allowed under the United States Constitution.¹¹ This collapses the above two prong test into just the second prong.¹² Regardless of the specifics of a long-arm statute, there are three ways to establish personal jurisdiction under the test: traditional ways, contacts-based general personal jurisdiction, and contacts-based specific personal jurisdiction.

A. *Traditional Ways to Establish Personal Jurisdiction*

There are a few traditional ways to establish personal jurisdiction over a party by meeting both prongs of the above test: (1) showing that the party is a citizen of the forum state; (2) in certain circumstances, serving the party with process in the forum state; (3) the party's waiver of any personal jurisdiction defense; and (4) the party's consent to suit.¹³

Courts have personal jurisdiction over an entity that is a "citizen" of the state in which it sits.¹⁴ An individual's place of citizenship is where the individual is domiciled.¹⁵ A corporation, on the other hand, is citizen of the state in which it is incorporated and the state that is its "principal place of business."¹⁶ A corporation's principal place of business is generally where

8. VEDDER, PRICE, KAUFMAN & KAMHOLZ, P.C., LONG-ARM STATUTES: A FIFTY-STATE SURVEY i (2003).

9. See WRIGHT & MILLER, *supra* note 5.

10. See *id.*

11. See *id.*

12. See *id.*

13. See *generally id.*, § 1064 (discussing traditional bases of personal jurisdiction).

14. See Ashleigh E. Edward, *When a Corporation Is "At Home": Personal Jurisdiction over Out-of-State Defendants*, COSGRAVE VERGEER KESTER LLP, <https://www.cosgravelaw.com/wp-content/uploads/2015/03/When-a-Corporation-Is-At-Home.pdf> [<https://perma.cc/P8BH-5MG6>].

15. See *Goodyear Dunlop Tires Operations, S. A. v. Brown*, 564 U.S. 915, 924 (2011) ("For an individual, the paradigm forum for the exercise of general jurisdiction is the individual's domicile").

16. *Hertz Corp. v. Friend*, 559 U.S. 77, 80 (2010) (quoting 28 U.S.C. § 1332(e)(1)).

its “nerve center” (i.e., its headquarters) is located.¹⁷ Furthermore, in unique circumstances, properly serving an individual with process, known as “tagging” can establish personal jurisdiction in that forum.¹⁸ Additionally, all personal jurisdiction arguments are also waivable by failing to object to a court’s adjudication of a claim against a defendant.¹⁹

In a similar vein as waiver, parties may consent to personal jurisdiction.²⁰ That is why personal jurisdiction arguments are usually only an issue for defendants—plaintiffs necessarily consent to suit by filing a claim.²¹ Recently, business registration statutes have been central to the discussion of consenting to personal jurisdiction. In *Mallory v. Norfolk Southern*, the Supreme Court held that Pennsylvania’s foreign business registration statute conferred personal jurisdiction over a corporation doing business in the state under the traditional consent theory.²² In *Mallory*, there were two Pennsylvania statutes at issue, 15 Pa. Cons. Stat. § 411 and 42 Pa. Cons. Stat. § 5301(a)(2)(i), (b).²³ Per § 411, any non-Pennsylvania based corporation must register with the Pennsylvania Secretary of State to do business within its borders.²⁴ Further, § 5301(a)(2)(i) explicitly said that, by registering under § 411, the foreign corporation consented to “any cause of action” levied against it in the state.²⁵ Despite the defendant’s argument that such sweeping jurisdiction would be unfair and would improperly take too many cases away from other states, the Court held that, because the defendant had “taken full advantage of its opportunity to do business in

17. *Id.* at 81. The *Hertz* Court left open the possibility that telecommuting or other internet uses may disrupt the efficacy of the “nerve center” test. *Id.* at 95–96.

18. See *Burnham v. Superior Ct. of Cal.*, 495 U.S. 604, 627–28 (1990); Cody J. Jacobs, *If Corporations Are People, Why Can’t They Play Tag?*, 46 N.M. L. REV. 1, 1 (2016).

19. See FED. R. CIV. P. 12(h) (providing that failure to raise personal jurisdiction argument in preliminary motions or in any pleading constitutes waiver of such argument). *But see Collateral Attack*, CORNELL L. SCH.: LEGAL INFO. INST., https://www.law.cornell.edu/wex/collateral_attack [<https://perma.cc/TK5D-QCNW>] (explaining exception to the aforementioned rule regarding waiver).

20. See generally Scott Dodson, *Plaintiff Personal Jurisdiction and Venue Transfer*, 117 MICH. L. REV. 1463 (2019) (discussing contours of a plaintiff’s ability to consent to personal jurisdiction).

21. *Id.* at 1466 (“[P]laintiffs arguably have similar entitlements to the protections of personal jurisdiction. In most cases, consent obviates any protections: the plaintiff’s act of filing a complaint in a court manifests the plaintiff’s consent to the personal jurisdiction of that court for purposes of resolving the claims asserted in that complaint.”).

22. See *Mallory v. Norfolk S. Ry. Co.*, 600 U.S. 122, 144–46 (2023).

23. *Id.* at 127.

24. *Id.* at 134. (citing 15 PA. CONS. STAT. § 411 (2014)).

25. *Id.* at 127. (citing 42 PA. CONS. STAT. § 5301(a)(2)(i), (b) (2019)).

[Pennsylvania]” and had followed the statutes to a tee, exercising jurisdiction in this way was fair.²⁶

The final and most complicated way to establish personal jurisdiction is through contacts analysis.²⁷ Such analysis tallies up all the ways that a defendant has interacted with the forum, and then asks whether such interaction makes it fair for the defendant to be haled into litigation there.²⁸ There are two kinds of contacts-based personal jurisdiction, general and specific. General personal jurisdiction allows a court to hear any type of litigation against a party, but specific personal jurisdiction only allows a court to hear claims that “arise out of or relate to” the state specific contacts that created such specific personal jurisdiction.²⁹ Both of these arise from the Court’s language in *International Shoe*, stating that a state’s courts may be properly authorized to assert personal jurisdiction so long as such assertion comports with “traditional notions of fair play and substantial justice” guaranteed by the due process clause.³⁰

B. Contacts-Based General Personal Jurisdiction Precedent: The “At Home” Test

Contacts establish general personal jurisdiction for any cause of action against a corporation in a forum where its contacts make it “at home” in the forum. The first iteration of general personal jurisdiction by consequence of contacts analysis was created by the Supreme Court in *Perkins v. Benguet Consolidated Mining Co.* when it held that a court can constitutionally exercise jurisdiction over a defendant if the defendant had “continuous and systematic” contacts in the state at the time of service.³¹

In *Perkins*, the Court held that the defendant had continuous and systematic contacts with Ohio where the defendant mining company’s president returned to Ohio to run the company from home but the company had no mining operations in Ohio.³² The plaintiff sued the defendant for losses related to the mining company’s alleged improper dividend reimbursement and failure to issue additional shares.³³ The company at no point ran any mining operation in Ohio, but had to temporarily halt all

26. *Id.* at 141.

27. *See generally* *Int’l Shoe Co. v. Washington*, 326 U.S. 310 (1945) (providing explanation, justification, and application of contacts analysis).

28. *See id.* at 316–17.

29. *See* WRIGHT & MILLER, *supra* note 5, § 1067.1; *Int’l Shoe*, 326 U.S. at 316–17.

30. *Int’l Shoe*, 326 U.S. at 316 (quoting *Milliken v. Meyer*, 311 U.S. 457, 463 (1940)).

31. *See Perkins v. Benguet Consol. Mining Co.*, 342 U.S. 437, 445–46 (1952).

32. *Id.* at 447–48.

33. *Id.* at 438–39.

mining operations elsewhere due to the Second World War.³⁴ However, the president's activities in Ohio included operating bank accounts, sending employee salary checks, rehabilitating closed mining operations overseas, exchanging business related correspondence, and housing of company files.³⁵ The president was served by the plaintiff as these interim operations were ongoing.³⁶ The Court reasoned that the president's activities, despite the fact that no mining operations were conducted in Ohio, were sufficient to give the defendant fair notice of potential litigation in all forms because such contacts constituted "continuous and systematic supervision of the necessarily limited wartime activities of the company."³⁷ Therefore, the Court held that the Ohio courts could exercise general personal jurisdiction over the defendant, even for the unrelated claim regarding share and dividend dispersal.³⁸

While the continuous and systematic test was never overruled, the Court clarified in *Daimler AG v. Bauman* that the test requires continuous and systematic contact such that the company can be rightly considered "at home" in that state.³⁹ In *Daimler*, the Court held that general personal jurisdiction was improper where the defendant was sued in California District Court based on the contacts of one of the defendant's subsidiary companies.⁴⁰ The defendant in *Daimler* was "a German public stock company, headquartered in Stuttgart, that manufacture[d] Mercedes-Benz vehicles in Germany."⁴¹ One of its subsidiaries operated in the United States to distribute the defendant's vehicles to dealers, including dealers in California.⁴² However, the subsidiary was incorporated in Delaware and its principal place of business was New Jersey.⁴³ The plaintiffs, citizens of Argentina, brought a claim under the Alien Tort Statute.⁴⁴ The plaintiff argued that California could exercise personal jurisdiction over the defendant in this unrelated suit because its subsidiary's contacts with

34. *See id.* at 447–48.

35. *Id.*

36. *Id.* at 448.

37. *Id.*

38. *See id.* at 447–49.

39. *Daimler AG v. Bauman*, 571 U.S. 117, 127–33 (2014) (explaining that the *Daimler* Court was not overruling *Perkins* by adding the explicit language of being "at home," because the *Perkins* defendant had its activities limited to the forum in a way that made it at home—even if the Court did not use that language in the *Perkins* decision.).

40. *See id.* at 134–42.

41. *Id.* at 121.

42. *Id.*

43. *Id.*

44. *Id.* at 117.

California were continuous and systematic in nature, thus justifying general personal jurisdiction under the reasoning of *Perkins*.⁴⁵

The Court rejected the plaintiff's argument as an expansive and "unacceptably grasping" standard.⁴⁶ The Court reasoned that general personal jurisdiction, while not exclusively available over a corporation in its state of incorporation or its principal place of business, should only be available in instances where the contacts are similarly extensive.⁴⁷ The Court said the defendant, even assuming the contacts of its subsidiary were transferable to it, had only a small part of its business conducted in California and could not fairly be expected to defend all potential suits in that forum.⁴⁸ Thus, the Court held that a corporation must essentially be "at home" in a forum to be subject to general personal jurisdiction.⁴⁹

This additional language greatly restricted prevailing notions of when general personal jurisdiction was proper. However, the Court maintains that the *Daimler* decision did not overrule, or even conflict with, the *Perkins* decision; stating that *Perkins* was an unusual circumstance where the corporation's principal place of business temporarily became Ohio, thus making the defendant essentially at home in Ohio even if the Court did not use that language to describe it in the decision.⁵⁰

The Court applied this rule again in *BNSF Ry. Co. v. Tyrrell* where it held that the defendant corporation was not "at home" in Montana because it was not incorporated or headquartered there, and its approximately 2,000 employees and 2,000 miles of railroad track in the state were insufficient because the company had contact with many other states in a similar fashion.⁵¹ The Court cited the reasoning from *Daimler* that "the general jurisdiction inquiry does not focus solely on the magnitude of the defendant's in-state contacts. . . . [a] corporation that operates in many places can scarcely be deemed at home in all of them."⁵² This means that to be "at home" a corporation's contacts in a state must be (1) continuous and systematic, (2) uniquely larger than its contacts in other states of which it is

45. *See id.*

46. *Id.* at 138, 141.

47. *See id.* at 137–39.

48. *See id.* at 136–37.

49. *Id.* at 119.

50. *See id.* at 129–30 ("We held that the Ohio courts could exercise general jurisdiction over [the defendant in *Perkins*] without offending due process. That was so, we later noted, because 'Ohio was the corporation's principal, if temporary, place of business.'") (quoting *Keeton v. Hustler Mag., Inc.*, 465 U.S. 770, 780 n.11 (1984)).

51. *BNSF Ry. Co. v. Tyrrell*, 581 U.S. 402, 414 (2017).

52. *Id.* (quoting *Daimler AG*, 571 U.S. at 139–40 n.20).

not a citizen, and (3) of similar or greater magnitude than its contacts within its state(s) of citizenship.

C. Contacts-Based Specific Personal Jurisdiction Precedent: Purposeful Availment

Specific personal jurisdiction arises from “minimum contacts” analysis.⁵³ Minimum contacts exist where a party “purposefully avails itself of the privilege of conducting activities within the forum State.”⁵⁴ Courts break that down into the following three elements: (1) whether the defendant purposefully availed itself of conducting business in the forum, (2) whether the claim sufficiently arises from or relates to such availment, and (3) if both are true, whether exercising jurisdiction would be fair and reasonable.⁵⁵ The second and third elements are dependent on the first element and include highly fact-specific inquiries. Consequently, courts have described purposeful availment as the “*sine qua non* for *in personam* jurisdiction.”⁵⁶

As the remainder of this Section demonstrates, the Supreme Court has found purposeful availment in the following three general categories of cases that are distinguishable by the type of contacts in each: direct and/or targeted effects contacts, stream-of-commerce contacts, and expected relationships contacts. Some cases within these categories include contacts that fit under the logic of another category, but each case will be discussed within the type of reasoning that seemingly provided the most force for the decision.

1. Direct and/or Targeted Effects Contacts

Direct contact cases are the simplest and include the kinds of contacts that are rarely debated like physical presence. One of many examples is *Keeton v. Hustler Magazine, Inc.*, in which the Court held that the defendant magazine had sufficiently availed itself of the forum’s laws by circulating its magazines such that it should anticipate being sued for any libelous content in those magazines.⁵⁷ The defendant magazine company in *Keeton* was a

53. See WRIGHT & MILLER, *supra* note 5, § 1067.1; see also *Int’l Shoe Co. v. Washington*, 326 U.S. 310, 316 (1945).

54. *Ford Motor Co. v. Mont. Eighth Jud. Dist. Ct.*, 592 U.S. 351, 352 (2021) (quoting *Hanson v. Denckla*, 357 U.S. 235, 253 (1958)).

55. WRIGHT & MILLER, *supra* note 5, § 1069.

56. *Compuserve, Inc. v. Patterson*, 89 F.3d 1257, 1263 (6th Cir. 1996) (quoting *S. Mach. Co. v. Mohasco Indus., Inc.*, 401 F.2d 374, 381–82 (6th Cir. 1968)).

57. See *Keeton v. Hustler Mag., Inc.*, 465 U.S. 770, 781 (1984).

citizen of Ohio and California.⁵⁸ The plaintiff made five libel allegations in a suit in New Hampshire, despite being a resident of New York.⁵⁹ Those libel allegations were combined claims for all nationwide publications, not just the New Hampshire ones.⁶⁰ The defendant consistently circulated between 10,000 and 15,000 magazines in New Hampshire.⁶¹

The Court held that the defendant could foresee being sued in New Hampshire based on the content of its magazines because it circulated magazines in the state, saying that such circulation constituted purposeful availment that looks entirely different from “random, isolated, or fortuitous” contacts.⁶² Furthermore, despite the lower court’s reasoning that New Hampshire was not a sufficiently interested forum to have jurisdiction over the libel that arose from nationwide publications, the Court held that states have a heightened interest in adjudicating torts that occur within their territory.⁶³ It then stated that such heightened interest extends to non-residents bringing related claims originating outside the state, thereby justifying New Hampshire in hearing all the libel claims.⁶⁴

Furthermore, the Court treats targeted effects similarly to direct contacts through a test established in *Calder v. Jones*.⁶⁵ In *Calder*, two Floridian writers were sued in California for an intentionally libelous article they wrote in Florida.⁶⁶ The plaintiff in *Calder* was a Californian professional entertainer.⁶⁷ The writers’ physical contacts with California were limited to some phone calls, business trips, and occasional personal trips.⁶⁸ They wrote an article libeling the plaintiff that relied upon California sources and was then heavily circulated in California.⁶⁹ The Court reasoned that, as “California is the focal point both of the story and of the harm suffered,” the writers’ contacts were sufficient “based on the ‘effects’ of their Florida conduct in California.”⁷⁰ It further stated, “[a]n individual injured in California need not go to Florida to seek redress from persons who, though

58. *See id.* at 772.

59. *Id.*

60. *Id.* at 775.

61. *Id.* at 772.

62. *Id.* at 774.

63. *Id.* at 776.

64. *Id.*

65. *Calder v. Jones*, 465 U.S. 783 (1984).

66. *Id.* at 783.

67. *Id.*

68. *Id.* at 785–86.

69. *Id.*

70. *Id.* at 789 (citing *World-Wide Volkswagen Corp. v. Woodson*, 444 U.S. 286, 297–98 (1980); RESTATEMENT (SECOND) OF CONFLICTS OF LAW § 37 (AM. L. INST. 1971)).

remaining in Florida, knowingly cause the injury in California.”⁷¹ Thus, despite such wrongs not constituting physical presence or contact in the traditional sense of the word, such targeted effects were contacts sufficient to establish specific personal jurisdiction.

This effects test was the subject of litigation in many lower courts and of academic writing because it was unclear how targeted conduct must be, how wrongful it must be, or how unique the effects must be to a forum.⁷² The Court provided some clarity, but not much, in *Walden v. Fiore*, where it deemed the *Calder* effects test unmet and that personal jurisdiction would be improper.⁷³ The plaintiffs in *Walden* were Nevada citizens.⁷⁴ The plaintiffs were about to leave Puerto Rico by plane with a substantial amount of cash won through gambling when TSA agents searched their persons, followed by defendant DEA agents arriving and questioning the plaintiffs.⁷⁵ The DEA agents learned of the plaintiffs’ citizenships, let them board the plane, but then filed a misleading report in Georgia that Atlanta DEA agents then used to confiscate the plaintiffs’ legitimate winnings once the plaintiffs reached Atlanta for their layover flight to Nevada.⁷⁶

The plaintiffs contended that since they felt the brunt of the illegitimate seizure in Nevada, and since the defendant agents could have foreseen as much based on the plaintiffs’ citizenship, the effects test should have been met.⁷⁷ The Court rejected this argument.⁷⁸ It reasoned that since the DEA agents only interacted with citizens of Nevada but had no actual connection to Nevada itself, personal jurisdiction could not follow.⁷⁹ It went on to say that “however significant the plaintiff’s contacts with the forum may be, those contacts cannot be ‘decisive in determining whether the defendant’s due process rights are violated.’”⁸⁰ This distinguished the case from *Calder*

71. *Id.* at 790.

72. For example, in *Dudnikov v. Chalk & Vermilion Fine Arts, Inc.*, the Tenth Circuit heard arguments regarding whether tortious or wrongful conduct need be alleged or if effects targeted at a forum are enough. The court dodged this issue by finding that the complaint alleged sufficiently wrongful conduct to meet the effects test regardless. *See Dudnikov v. Chalk & Vermilion Fine Arts, Inc.*, 514 F.3d 1065, 1071 (10th Cir. 2008); *see also* Teresa J. Cassidy, *Civil Procedure – Effects of the “Effects Test”: Problems of Personal Jurisdiction and the Internet: Dudnikov v. Chalk & Vermilion Fine Arts, Inc.*, 514 F.3d 1063 (10th Cir. 2008), 9 WYO. L. REV. 575, 591–92 (2009).

73. *See Walden v. Fiore*, 571 U.S. 277, 277–78 (2014).

74. *Id.* at 280.

75. *Id.* at 279–80.

76. *Id.* at 280–81.

77. *See id.* at 289–90.

78. *Id.*

79. *Id.* at 290.

80. *Id.* at 285 (quoting *Rush v. Savchuk*, 444 U.S. 320, 332 (1980)).

where the writers gathered information in California and wrote an article that was then circulated in California.⁸¹ Accordingly, the effects test seems to require express aiming at a forum by the defendant, not just an action in one forum that may later have impacts in a different forum.

2. *Stream-of-Commerce Contacts*

Another kind of contact that an entity can have with a forum is through the stream-of-commerce. Normally, these contacts occur when a product, or a piece of it, goes through multiple parties before ending up in the hands of an injured customer. In such cases, the courts developed case law to determine which of the multiple parties in the chain of control over the product that caused the injury may properly be sued in the forum in which the injury occurred.

World-Wide Volkswagen Corp. v. Woodson is one case where stream-of-commerce reasoning is discussed.⁸² In that case, the Court had to determine whether the defendant automobile retailer and its wholesale distributor could be sued in a state where an accident occurred that was different from the place the vehicle was sold.⁸³ The Court held it could not.⁸⁴ The plaintiffs in *Volkswagen* purchased a vehicle from defendants in New York while they lived in the state.⁸⁵ Then, as the plaintiffs were driving through Oklahoma, another vehicle struck them, causing a fire that severely injured the plaintiffs.⁸⁶ The plaintiffs filed suit in Oklahoma, alleging that the fuel system used in the vehicle caused heightened injuries.⁸⁷ The defendant, however, had no contacts with Oklahoma.⁸⁸

The Supreme Court of Oklahoma upheld jurisdiction, finding that Oklahoma's long-arm statute granted jurisdiction in this case and reasoned that the mobile nature of automobiles and the fact that the defendant substantially profited from sales of automobiles necessarily put the defendant in a position that it should foresee litigation in Oklahoma.⁸⁹ The Court rejected that argument and reversed the Supreme Court of Oklahoma's judgment.⁹⁰ It stated that even where a state and plaintiff have strong

81. *Id.* at 290.

82. *World-Wide Volkswagen Corp. v. Woodson*, 444 U.S. 286, 297–98 (1980).

83. *Id.* at 287.

84. *See id.* at 299.

85. *Id.* at 288.

86. *Id.*

87. *Id.*

88. *Id.* at 288–89.

89. *Id.* at 290–91.

90. *Id.*

interests in adjudicating a case in a forum and the defendant would not be burdened by such locale, jurisdiction is improper where, as in the case before the Court, the product's presence in the forum was based wholly on the unilateral and unincentivized activity of the nonresident plaintiffs.⁹¹ The Court further stated that foreseeability of a product's presence in a forum is a factor weighed towards whether a plaintiff has purposefully availed itself of a forum and should foresee litigation there; it is not enough on its own.⁹²

The stream-of-commerce theory was further explained in *J. McIntyre Machinery, Ltd. v. Nicastro*, where the Court held that a manufacturer could not be sued in a state where it could foresee that its products would end up in the forum but took no action to take advantage of the forum.⁹³ The plaintiff in that case was injured in his home-state of New Jersey by a product manufactured in England by the defendant.⁹⁴ The defendant argued that it had not purposefully availed itself of New Jersey's laws by targeting it as a state because it only sold its products to a general United States distributor, all of its United States physical contacts occurred in other states, and no more than four of its products ever ended up in New Jersey.⁹⁵ The Court accepted this argument, saying that contacts directed generally at the United States are insufficient to establish purposeful availment for an individual state.⁹⁶ Accordingly, it found that four products in New Jersey and a complete absence of other directed contacts was an insufficient basis for jurisdiction.⁹⁷ Stated simply, these cases essentially determined that specific jurisdiction exists under a stream-of-commerce theory when an entity develops a market in a given state.

3. *Expected Relationships Contacts*

The Court further acknowledged the importance of ongoing connections with a forum in *Burger King Corp. v. Rudzewicz*, where it held that failure to physically interact with a forum is no bar to purposeful availment where the defendant negotiated a contract contemplating an ongoing relationship with a forum's residents.⁹⁸ The defendant in *Burger King*, was a Michigan franchisee being sued by Burger King in Florida for breach of their twenty-

91. *See id.* at 297–99.

92. *Id.* at 296–97.

93. *See J. McIntyre Mach., Ltd. v. Nicastro*, 564 U.S. 873, 885–87 (2011).

94. *Id.* at 878.

95. *Id.*

96. *See id.* at 885–87.

97. *Id.*

98. *See Burger King Corp. v. Rudzewicz*, 471 U.S. 462, 476, 487 (1985).

year franchisee contract.⁹⁹ Burger King was incorporated and headquartered in Florida at the time of negotiating the franchisee contract with the defendant.¹⁰⁰ However, all negotiations occurred in Michigan at one of Burger King's locations.¹⁰¹ The franchisee had no physical contacts with Florida other than a brief training in Miami near the beginning of the contract.¹⁰² Over time, the franchisee fell behind on its required payments, but failed to halt business after Burger King exercised its right to revoke the franchisee's operation privileges.¹⁰³ Burger King sued in Florida to enjoin the franchisee's continual operation and for owed payments.¹⁰⁴

The franchisee argued that it could not be haled into Florida courts for litigation because it had never negotiated in Florida and its breach did not happen in Florida.¹⁰⁵ Burger King responded by pointing to a clause in the contract which stated:

This Agreement shall become valid when executed and accepted by BKC at Miami, Florida; it shall be deemed made and entered into in the State of Florida and shall be governed and construed under and in accordance with the laws of the State of Florida. The choice of law designation does not require that all suits concerning this Agreement be filed in Florida.¹⁰⁶

The Court found Burger King's argument more persuasive.¹⁰⁷ It reasoned that "[a]lthough such a provision standing alone would be insufficient to confer jurisdiction, . . . when combined with the 20-year interdependent relationship [the defendant] established with Burger King's Miami headquarters" the defendant had purposefully availed himself of Florida's laws.¹⁰⁸ Thus, the Court held specific jurisdiction was proper.¹⁰⁹

All three of these kinds of cases had some of their logic applied in *Ford Motor Company v. Montana Eighth Judicial District Court*, where the Court held that the state could exercise personal jurisdiction over the defendant, even though the plaintiffs purchased the vehicles elsewhere and then drove

99. *Id.* at 466–68.

100. *Id.* at 464.

101. *Id.* at 488–89 (Stevens, J., dissenting).

102. *See id.* at 466–67.

103. *Id.* at 468.

104. *Id.* at 468–69.

105. *Id.* at 469.

106. *Id.* at 481.

107. *See id.* at 487.

108. *Id.* at 482.

109. *Id.* at 487.

them to the state.¹¹⁰ In that case, the two suits at issue each involved a Ford vehicle that was the subject of litigation in one state where the plaintiffs lived and the crash occurred, but each vehicle had been sold by Ford in an entirely different state.¹¹¹ The vehicles only reached the forum state by a combination of resale and individual driving.¹¹² However, Ford had other contacts with the state: it advertised heavily in the state, had repair shops and services, and had sold those types of vehicles in the state.¹¹³

Ford argued that the courts could not properly exercise jurisdiction because, like in *Volkswagen*, it was the unilateral action of another that put the vehicles in those states.¹¹⁴ The Court rejected that argument, stating that *Volkswagen* was decided not solely on unilateral action, but also on the fact that the defendant in *Volkswagen* had not developed a market in that state for those vehicles.¹¹⁵ Here, Ford developed a market for its vehicles in the state by advertising and “work[ing] hard to foster ongoing connections to its cars’ owners” through repair shops and servicing.¹¹⁶ Thus, the Court held “[w]hen a company like Ford serves a market for a product in a State and that product causes injury in the State to one of its residents, the State’s courts may entertain the resulting suit.”¹¹⁷ This reasoning seemingly combines direct contacts, stream-of-commerce, and relationship expectation considerations in one case to come to the conclusion that the defendant could be properly subjected to personal jurisdiction in the state.

III. OVER-THE-AIR UPDATES (OTAUs) EXPLAINED

With the legal framework now provided, OTAUs can be explained. An OTAU, for the purposes of this paper, is the wireless delivery of data to change how an endpoint on a network functions.¹¹⁸ An endpoint of a

110. *Ford Motor Co. v. Mont.* Eighth Jud. Dist. Ct., 592 U.S. 351, 354–55 (2021).

111. *Id.*

112. *Id.* at 357.

113. *Id.*

114. *Id.* at 366–68.

115. *See id.*

116. *Id.* at 365.

117. *Id.* at 355.

118. *See* Erica Mixon & Colin Steele, *OTA Update (Over-the-Air Update)*, TECHTARGET: MOBILE COMPUTING (Dec. 2022), <https://www.techtarget.com/searchmobile/computing/definition/OTA-update-over-the-air-update> [<https://perma.cc/C6T8-7Q72>]. The differences between OTA updates, relating to software, and FOTA updates, relating to firmware, are not addressed in this paper. Instead, OTAUs will be an acronym used to refer to all over-the-air update processes for purposes of exploring the situations where such processes constitute legally significant contacts under personal jurisdiction law. For more information distinguishing between SOTA and FOTA see generally *Software-Over-the-Air (SOTA) Versus*

network refers to the final recipient of data on a network.¹¹⁹ Examples would be a cellphone receiving a phone call or a vehicle receiving an OTAU. OTAUs are a legally relevant classification of contacts requiring special consideration because they are intangible contacts that have unique and substantial real-world impacts on a product's functionality. As this paper intends to show that such updates can establish personal jurisdiction, it will focus on the subset of OTAUs most likely to confer personal jurisdiction under current precedent—automobile updates. However, while modern vehicles, especially those squarely in the self-driving or assisted driving category, are an example of potentially jurisdictionally relevant OTAU usage, such legal relevance may analogize to Internet of Things (IoT) medical devices,¹²⁰ Software as a Service (SaaS) relationships,¹²¹ and many other highly integrated IoT devices like Smart Home devices.¹²²

The automotive and mobile phone industries pioneered OTAUs over the last few decades.¹²³ Since then OTAUs have proliferated almost all IoT and cellular devices including smartphones, tablets, computers, automobiles, and miscellaneous household devices like Smart TVs.¹²⁴ OTAUs can theoretically be deployed through any over-the-air data transfer technology with sufficient range and speed for a given task.¹²⁵ The most common modes of deployment are through cellular and Wi-Fi networks.¹²⁶ Cellular networks

Firmware-Over-the-Air (FOTA) and JamaicaCAR, AICAS REALTIME, <https://donar.messe.de/exhibitor/hannovermesse/21/whitepaper-fota-vs-sota-eng-504662.pdf> [https://perma.cc/YZ6V-EEQB].

119. *See id.*

120. *See generally* Darshan Talati, *Understanding the Working of Embedded IoT Medical Devices*, EINFOCHIPS (Jan. 25, 2024), <https://www.einfochips.com/blog/understanding-the-working-of-embedded-iot-medical-devices/> [https://perma.cc/WVG4-DNMG] (describing components of IoT-enabled medical devices and how they function).

121. *See generally* *What is SaaS?*, SALESFORCE, <https://www.salesforce.com/in/saas/> [https://perma.cc/7KT6-9RRY] (explaining history, characteristics, and features of SaaS).

122. *See How to Approach OTA Updates for IoT*, MEDIUM: TEMBOO (June 8, 2018), <https://medium.com/@temboo/how-to-approach-ota-updates-for-iot-d088c217b31c> [https://perma.cc/S9VP-6YTS].

123. *See* Sam Byford, *Tesla Model S Getting First Ever Over-the-Air Car Firmware Upgrade Next Week*, THE VERGE (Sep. 24, 2012, 9:00 PM), <https://www.theverge.com/2012/9/24/3385506/tesla-model-s-over-the-air-car-firmware-update> [https://perma.cc/N73K-HZQD]; *Mixon & Steele*, *supra* note 118.

124. *Mixon & Steele*, *supra* note 118.

125. *See generally* Denis A. Pankratev et al., *Wireless Data Transfer Technologies in a Decentralized System*, in 2019 IEEE CONFERENCE OF YOUNG RUSSIAN RESEARCHERS IN ELECTRICAL & ELECTRIC ENGINEERING 620 (IEEE 2019), <https://ieeexplore.ieee.org/document/8656671> [https://perma.cc/M3FN-FH4J] (discussing problems and potential solutions relating to data exchange between modules of a decentralized system via wireless communication channels).

126. *Mixon & Steele*, *supra* note 118.

rely upon cell towers sending and receiving signals as intermediary nodes in a network between senders and receivers.¹²⁷ Wi-Fi networks function by connecting at home IoT devices to an internet service provider's routers, physical cable network, or other hardware necessary to connect the sender and receiver.¹²⁸

OTAU network diagrams can range from simple to extraordinarily complex depending on the implementation. The simplest network only has two points: a control system that sends the data and an endpoint that receives and implements it. Such a simple network is almost never used because usually there are many routers or cell towers necessary in-between to get the data from sender to receiver. Further complicating the network, OTAU systems can use a centralized or decentralized model.¹²⁹ In a centralized networking model, each end point receives its information from a single central sender.¹³⁰ However, a decentralized model uses multiple nodes acting as senders to assigned subsets of receivers.¹³¹

Such decentralized OTAU networks frequently utilize “the cloud” or “cloud computing,” particularly in the automotive industry since networks include millions of different vehicle endpoints.¹³² The cloud is a phrase that developed through tech industry lingo that refers to a method of decentralized computing and data storage that is more powerful and versatile than previous iterations of data networks.¹³³ Previously, a network consisted of endpoints that could run programs to complete complex tasks with data, and the in-between components, like routers and servers, merely passed data according to communication protocols.¹³⁴ A cloud networking model diffuses computing tasks to the in-between points as well through a process called virtualization that allows each point to run multiple different tasks as

127. See *The Difference Between Internet, Ethernet, Wifi and Cellular*, SIGNAL BOOSTERS: BLOG (Sep. 14, 2020), <https://www.signalboosters.com/blog/internet-ethernet-wifi-bluetooth-and-cellular-whats-the-difference/> [<https://perma.cc/96XT-XQ97>].

128. See *id.*

129. Pankratev et al., *supra* note 125, at 620 (explaining Wi-Fi decentralization); Kendall Perez et al., *Decentralizing Cellular Networks*, MAGMA: BLOG (June 8, 2022), <https://magmacore.org/blog/decentralizing-cellular-networks/> [<https://perma.cc/YCF8-ZEAR>].

130. See Pankratev et al., *supra* note 125, at 620.

131. See *id.*

132. See *Deploy Over-the-Air Infrastructure Using Open Source Technologies*, RED HAT (Apr. 13, 2022), <https://www.redhat.com/en/resources/deploy-over-the-air-infrastructure-overview> [<https://perma.cc/WN2B-DUYN>].

133. See Grace Lewis, *Basics About Cloud Computing*, CARNEGIE MELON: SOFTWARE ENG'G INST. (Sept. 2010), <https://tv-prod.s3.amazonaws.com/documents%2Fnull-Cloudcomputingbasics.pdf> [<https://perma.cc/D49B-WAUY>]; *What is the Cloud?: Cloud Definition*, CLOUDFLARE, <https://www.cloudflare.com/learning/cloud/what-is-the-cloud/> [<https://perma.cc/X3BU-7K5W>].

134. See *What is the Cloud?: Cloud Definition*, *supra* note 133.

if it were different computers running many programs.¹³⁵ This reduces the processing power needed at the endpoints of the network, improving efficiency and preventing bottlenecks, a term describing when networks experience what could best be analogized as a traffic jam.¹³⁶

OTAUs are continually being improved and pushed into more use-cases. The most complex use-case to date is automobile updates. Each modern vehicle includes anywhere from 80–150 Electronic Control Units (ECUs),¹³⁷ which are basically small computers, and roughly “100 million lines of software code.”¹³⁸ The amount of code is expected to rise to 300 million by 2030.¹³⁹ Comparatively, passenger airplanes only use about 15 million lines of code.¹⁴⁰ Accordingly, such updates are extremely complex, difficult, and if done improperly, dangerous. And yet, the economic incentives to use OTAUs are so strong that they will only be utilized more heavily.

Tesla used the first OTAU for automobiles in 2012 with the Tesla Model S.¹⁴¹ Since then, almost every recognizable name in automobile manufacturing has implemented OTAUs in some way—ranging from updating the infotainment systems, which are the little screens in most modern cars that control the radio, climate, GPS, etc.,¹⁴² to updating core safety and driving features in vehicles.¹⁴³

Furthermore, there are many parts to an automobile OTAU. A single network may include or be responsive to the following entities: “Car, Cloud Server, Mobile Phone, [Original Equipment Manufacturer] (OEM), Spare

135. *Id.*

136. See Jim O’Reilly, *Resolve a Bottleneck with these Techniques*, TECHTARGET: DATA CENTER (Mar. 10, 2015), <https://www.techtarget.com/searchdatacenter/tip/Dissolve-a-network-bottleneck-with-these-techniques> [<https://perma.cc/M4BQ-P6UQ>].

137. *ECUs Uncovered: The Secret Engine Behind Your Car!*, AUTOPI.10 (Oct. 23, 2023), <https://www.autopi.io/blog/what-is-electronic-control-unit-definition/#:~:text=How%20Many%20ECUs%20Does%20a%20150%20ECUs%20or%20more> [<https://perma.cc/48EX-7APJ>].

138. Opinion Writers, *Vehicle Cybersecurity: Control the Code, Control the Road*, VEHICLE DYNAMICS INT’L (Mar. 18, 2020), <https://www.vehicledynamicsinternational.com/features/vehicle-cybersecurity-control-the-code-control-the-road.html#:~:text=Recent%20years%20have%20seen%20huge,lines%20of%20code%20by%202030> [<https://perma.cc/AGY8-H654>].

139. *Id.*

140. *Id.*

141. Byford, *supra* note 123.

142. See Justin Fischer, *Over-the-Air (OTA) Updates: How Automakers Are Betting on Software to Keep up with the Pace of Innovation*, CAREEDGE (Oct. 2, 2023), <https://caredge.com/guides/ota-updates-for-cars> [<https://perma.cc/F8LT-XC3E>].

143. See *id.*; By 2028, Automakers Will Save US\$1.5 Billion Using Over-the-Air Updates to Fix Recalled Cars, ABIRESEARCH (May 3, 2023), <https://www.abiresearch.com/press/by-2028-automakers-will-save-us15-billion-using-over-the-air-updates-to-fix-recalled-cars/> [<https://perma.cc/NNY9-KWFF>].

part OEM, Software Distributor (SD), Car Owner, Service Center, Cellular Operator, Insurance Company [,] and Law and Enforcement Personnel.”¹⁴⁴ These entities are not always entirely separate legal parties though. For example: a single OEM may also provide the spare parts and the software for the component.¹⁴⁵ Accordingly, automobile OTAU networks can be quite complex, but they all accomplish the same task—changing the functionality of a vehicle.

IV. PERSONAL JURISDICTION LAW APPLIED TO OVER-THE-AIR UPDATES

With the general technological discussion out of the way, OTAUs can be analyzed under current precedent. As noted above, there are the traditional methods of establishing personal jurisdiction and contacts-based general and specific personal jurisdiction. It seems unlikely that OTAUs will have a significant impact on the traditional methods or do enough to confer general personal jurisdiction through contacts, so that analysis will be quickly provided up front. However, it is very likely that OTAU contacts can meet specific personal jurisdiction purposeful availment requirements. This paper will prove that thesis with concrete facts, using Tesla’s operations in South Carolina as a case study.

A. OTAUs’ Minimal Impacts on Traditional and General Personal Jurisdiction

OTAUs do not have any legal effect on citizenship, consent, waiver, or service of process. Those concepts exist wholly separate from sending updates. In light of *Mallory*, there may be an argument that sending updates in a state should constitute foreign business operations, thus requiring registration, and thereby requiring consent under certain statutory schemes.¹⁴⁶ But that argument is not unique to OTAUs, it is personal jurisdiction derived from statutory interpretation, which is not the focus of this paper.

OTAUs may have minimal relevance to general personal jurisdiction contacts analysis because the contacts caused by OTAUs can potentially consolidate actions, thereby making a company appear more “at home” in a

144. Subir Halder et al., *Secure OTA Software Updates in Connected Vehicles: A Survey*, 178 COMPUT. NETWORKS art no. 107343, at 3 (2020).

145. *See id.* at 2.

146. *See generally* *Mallory v. Norfolk S. Ry. Co.*, 600 U.S. 122 (2023) (finding under a traditional consent theory that a foreign business registration statute conferred personal jurisdiction over a corporation doing business in the state).

forum. As discussed above, OTAUs reduce the number of physical recalls or in-person repairs necessary for vehicles. Instead, a company can fix such issues remotely through an OTAU. Thus, all the physical presence a company would have had in a forum before OTAUs, would shift to an intangible contact stemming from a different forum. In the narrow circumstance where a company uses a centralized network and controls almost all the steps of OTAUs from a single forum, that one central forum would be the home-base for all those contacts in a way that appears systematic, continuous, and unique as required by the *Daimler* precedent.¹⁴⁷

However, even where a company uses a centralized network model, if that central server is in a different area than a significant and unique separate part of the company's activities, it is very unlikely that the company would be considered at home in that forum because those contacts would be like the insufficient, significant contacts of the defendant in *BNSF*.¹⁴⁸ Such update contacts would be similar because in *BNSF* even 2000 miles of railroad and thousands of employees were insufficient since such activity constituted only a small portion of the railroad's business.¹⁴⁹ Thus, even if such contacts bring a forum closer to a company's "home," this would only be relevant in a small sliver of cases where the server is also in a state where the company was almost already at home anyway.

Additionally, with the more common decentralized networks, the origin of an update can be seriously debated. Is the origin the place where leadership gave the go-ahead to send the update? The place(s) from which the code was first uploaded? Or maybe whichever node first received the applicable code from software engineers? Or perhaps whichever node the endpoint contacted for the download? This is like the kind of diffused management the Court indicated would complicate nerve center jurisdiction analysis in *Hertz Corp. v. Friend* dicta.¹⁵⁰ Without more precedent to clarify where the origin contact would be, it is unlikely that a court would use such a model to find a business "at home" in a forum. Accordingly, OTAUs likely have minimal impact on the at home analysis as well.

B. OTAUs Can Constitute Purposeful Availment—Tesla in South Carolina as a Case Study

On the other hand, OTAU contacts can constitute purposeful availment. This section presents Tesla as an example of a business that may be liable

147. See *Daimler AG v. Bauman*, 571 U.S. 117, 119 (2014).

148. See *BNSF Ry. Co. v. Tyrrell*, 581 U.S. 402, 413–14 (2017).

149. See *id.*

150. See *Hertz Corp. v. Friend*, 559 U.S. 77, 95–96 (2010).

for injury in a state that likely bears no jurisdiction over it for its non-OTAU contacts but may be subject to specific personal jurisdiction based on its OTAUs. Furthermore, Tesla is a good case study because its practices are becoming increasingly relevant to South Carolinians as more and more of Tesla's vehicles and technology are on the roads.¹⁵¹ This subsection proceeds as follows: (1) establishes the likelihood of litigation against Tesla in South Carolina, (2) explains why a South Carolina Court would have to analyze specific jurisdiction based on Tesla's OTAU usage, (3) explains Tesla's OTAU usage, and (4) shows why current Supreme Court precedent would classify OTAU usage as purposeful availment.

1. *Likelihood of Litigation Against Tesla in South Carolina*

As of September 2022, there are approximately 6,400 registered Tesla vehicles in South Carolina.¹⁵² Every single one of those vehicles is built to receive OTAUs that regularly “add new features and enhance existing ones.”¹⁵³ Those new features enter South Carolina roads within hours, or even minutes, of download, leaving little room to catch errors between update and road use.¹⁵⁴ Furthermore, it is no secret that driving is an inherently risky endeavor, especially in South Carolina: South Carolina leads the nation in deaths per mile driven.¹⁵⁵ This statistic reflects not only a tragic waste of human life, but also a serious blow to the financial interests of everyone involved with a crash, even where involvement is merely tangential.¹⁵⁶ In addition, South Carolina has many undermaintained roads,¹⁵⁷ poor signage visibility,¹⁵⁸ and sky-high rates of intoxicated

151. See Rebecca Elliot, *Tesla Reports Uptick in Vehicle Deliveries After Price Cuts*, WSJ (Apr. 2, 2023, 1:16 PM), <https://www.wsj.com/articles/tesla-reports-uptick-in-vehicle-deliveries-after-price-cuts-981863fd> [<https://perma.cc/T48H-U5UB>].

152. Herb Frazier, *Big Story: Effort to Break Direct Car Sale Ban Stalls at Statehouse*, STATEHOUSE REP. (Sept. 2, 2022, 11:42 AM), <https://www.statehousereport.com/2022/09/02/big-story-effort-to-break-direct-car-sale-ban-stalls-at-statehouse/> [<https://perma.cc/MCE5-3J48>].

153. *Software Updates*, TESLA, <https://www.tesla.com/support/software-updates#:~:text=Tesla%20vehicles%20receive%20over%2Dthe,Software%20tab%20on%20your%20touchscreen> [<https://perma.cc/57ZP-BRLM>].

154. See *id.*

155. See *Fatality Facts 2021: State by State*, IIHS HLDI (May 2023), <https://www.iihs.org/topics/fatality-statistics/detail/state-by-state#fn1> [<https://perma.cc/X4QA-6UKC>].

156. Bryant Walker Smith, *Automated Driving and Product Liability*, 2017 MICH. ST. L. REV. 1, 21–25 (2017).

157. Mark Joye, *South Carolina Roads: Rated the Worst in America*, JOYE L. FIRM, <https://www.joyelawfirm.com/2019/12/south-carolina-ranks-worst-for-roads-in-usa/> [<https://perma.cc/N97R-UUZB>].

drivers.¹⁵⁹ Each of these factors, among others, make South Carolina a particularly difficult place to deploy advanced vehicle guidance software—especially if the software purports to be “self-driving.”¹⁶⁰ And yet, Tesla allows its advanced “self-driving” software on South Carolina roads, seemingly with no defined geographical deployment zones.¹⁶¹ Various academic writers have suggested that automaker’s increased technological connectivity to vehicles on the roads inevitably corresponds to increased liability exposure.¹⁶² Furthermore, these vehicles, especially in such conditions, will almost invariably cause a fatal or destructive crash while in the state, making it a question of *when* a crash will occur, not *if*.¹⁶³ Accordingly, should a crash occur with one of these vehicles, Tesla will almost certainly need to prepare its legal team.

In fact, such a crash may have already occurred. On September 18, 2022, a Tesla crash near Lake Murray cost two people their lives when the vehicle “left the road” and smashed into a tree, causing a fiery scene in which both the driver and front passenger were killed.¹⁶⁴ South Carolina Highway Patrol began an investigation, but no explicit indication of cause was reported in the news coverage of the accident.¹⁶⁵ Again, on July 28, 2023, in Phoenix, South Carolina a Tesla inexplicably plunged into a private

158. *See id.*

159. IHHS HLDI, *supra* note 155 (indicating that over a third of vehicular deaths in South Carolina in 2021 involved alcohol).

160. *See* Bryant Walker Smith, *How Governments Can Promote Automated Driving*, 47 N.M. L. REV. 99, 114–17 (2017).

161. *See* Frazier, *supra* note 152 (providing that 6,400 Tesla vehicles are currently registered in South Carolina); *Autopilot and Full Self-Driving Capability*, TESLA, <https://www.tesla.com/support/autopilot#:~:text=Autopilot%20comes%20standard%20on%20every,and%20Full%20Self%2DDriving%20Capability> [https://perma.cc/5AVD-R568] (“Autopilot comes standard on every new Tesla.”).

162. *See generally* Bryant Walker Smith, *Proximity-Driven Liability*, 102 GEO. L.J. 1777 (2014) (“This Article argues that commercial sellers’ growing information about, access to, and control over their products, product users, and product uses could significantly expand their point-of-sale and post-sale obligations toward people endangered by these products.”).

163. Bryant Walker Smith, *Driving at Perfection*, STAN. L. SCH.: THE CTR. FOR INTERNET & SOC’Y (Mar. 11, 2012, 3:20 PM), <https://cyberlaw.stanford.edu/blog/2012/03/driving-perfection> [https://perma.cc/A7EX-NGJR] (discussing how systems invariably fail).

164. Christopher Buchanan, *Fiery Crash Involving Electric Car Kills 2 Near Lake Murray*, NEWS19 (Sept. 18, 2022, 12:12 PM), <https://www.wltx.com/article/traffic/two-dead-electric-car-tree-catches-fire-lake-murray/101-7ca404ff-9980-42bd-afb7-7efdfbbaf9da> [https://perma.cc/2BSY-YP3N].

165. *Id.*

home's pool after crashing through a substantial brick privacy fence.¹⁶⁶ While there were no injuries reported, the vehicle, fence, and pool were irreparably damaged.¹⁶⁷ The cause of the crash was once again unclear; all that could be said was that the vehicle appeared to be going faster than it should have been.¹⁶⁸ Even more recently, on October 12, 2023 in Sumter County, South Carolina, a man died in a fiery Tesla single-vehicle crash after being ejected from the flipping vehicle.¹⁶⁹ Again, the cause was unclear.¹⁷⁰ Such causal unclarity makes clear that litigation asserting Tesla should bear part of the liability for the crashes is possible.

Furthermore, even if Tesla had been sued, Tesla's practice of including forced arbitration provisions in each of its buyer contracts obscures the visibility of litigation against them.¹⁷¹ In fact, seven senators recently urged Tesla to end its use of forced arbitration stating, among other things, "we . . . have no visibility into what complaints may have already been made and what other potential safety issues with Tesla vehicles may exist."¹⁷² Thus, it is clear that Tesla already has been, or at least will be in the near future, the subject of South Carolinian litigation. What remains unclear is whether South Carolina courts can obtain personal jurisdiction over Tesla in such suits based on Tesla's uniquely situated business and the factual scenario presented.

2. *Why a South Carolina Court Would Have to Analyze Specific Jurisdiction Based on Tesla's OTAU Usage*

The relevance of OTAUs in personal jurisdiction law is that they may establish personal jurisdiction in cases where other ways to establish personal jurisdiction do not apply. To prove that relevance in a real-world example, this subsection shows how traditional and general personal

166. *Tesla Crashes Through Wall, Plunges into Phoenix Backyard Pool*, FOX CAROLINA (July 28, 2023, 7:21 PM), <https://www.foxcarolina.com/video/2023/07/28/tesla-crashes-through-wall-plunges-into-phoenix-backyard-pool/> [<https://perma.cc/6Y5M-54WP>].

167. *Id.*

168. *Id.*

169. Christopher Buchanan, *Man Dies After Being Ejected from Fiery Wreck in Sumter County, Coroner Says*, NEWS19 (Oct. 12, 2023, 4:47 PM), <https://www.wltx.com/article/traffic/sumter-county-crash-one-dead-thursday-morning/101-14295940-cec0-4029-97b2-114779846680> [<https://perma.cc/QN7D-Q786>].

170. *See id.*

171. *See* Lauren Feiner & Lora Kolodny, *Tesla Urged by Seven Senators to End Forced Arbitration for Workers and Customers*, CNBC (May 8, 2023, 5:18 PM), <https://www.cnbc.com/2023/05/08/tesla-urged-by-senators-to-end-arbitration-for-employees-consumers.html> [<https://perma.cc/K8UB-JPLA>].

172. *Id.*

jurisdiction likely do not apply to Tesla in South Carolina. Furthermore, it shows how South Carolina's long-arm statute, when interpreted in accordance with the Due Process Clause and applied to Tesla's non-OTAU contacts, would likely not confer personal jurisdiction for a substantial swathe of likely litigation. Accordingly, OTAUs will be particularly relevant to personal jurisdiction analysis over Tesla in South Carolina.

a. Inapplicability of Traditional and General Jurisdiction to Tesla in South Carolina

As discussed above, a state traditionally has jurisdiction over parties that are its citizens. Furthermore, waiver, some kinds of service of process, and consent conclusively satisfy a state's long-arm and a defendant's constitutional due process requirements, thereby subjecting an entity to state court personal jurisdiction on those issues. Finally, general jurisdiction follows from contacts that make a company "at home" in a state. In Tesla's case, it is likely that none of these apply, and a court would be required to analyze Tesla's contacts with South Carolina under specific personal jurisdiction precedent.

Tesla is not a citizen of South Carolina because Tesla Motors, Inc. is incorporated in Texas,¹⁷³ and its headquarters, which is most likely its nerve center, is also in Texas.¹⁷⁴ Also, it seems likely that Tesla would not waive a potential personal jurisdiction defense that may increase its bargaining power for settling a case, so waiver likely does not apply. Furthermore, the situations where service of process may establish personal jurisdiction are heavily dependent on the specific facts of a case, so such possibilities will not be addressed in depth here.

Finally, consent is likely inapplicable here because there is little indication that Tesla has consented to litigate suits regarding vehicle liability in South Carolina. A potential argument that Tesla has consented to such suits would rely on the recent decision in *Mallory* regarding the impact of business registration statutes. South Carolina's business registration statute, S.C. Code Ann. § 33-15-101 *et seq.*, requires every "foreign" corporation, meaning any non-South Carolina corporation, to register with the South

173. See Eric Revell, *Elon's Exodus: Tracking Musk's Business Incorporation State Changes*, FOX BUS. (Feb. 16, 2024, 8:00 AM), <https://www.foxbusiness.com/technology/elons-exodus-tracking-musks-business-incorporation-state-changes> [<https://perma.cc/FH8G-Y8KJ>].

174. See *Gigafactory*, TESLA: CAREERS, <https://www.tesla.com/giga-texas> [<https://perma.cc/LP2Z-9EGV>].

Carolina Secretary of State before doing business in the state.¹⁷⁵ An ostensible plaintiff could argue that, due to that registration, Tesla necessarily consented to general personal jurisdiction, or at least jurisdiction in relation to its business in the state.

However, S.C. Code Ann. § 33-15-101 is distinguishable from the statute in *Mallory*, 42 Pa. Cons. Stat. § 5301(a)(2)(i), (b), because registration in South Carolina only explicitly requires the corporation to consent to personal jurisdiction for adjudication of tax liability—it does not say that such entities consent to general personal jurisdiction in the state.¹⁷⁶ Furthermore, it would seem only a few parts of the *Mallory* decision became precedent due to splits, and many of the justices wrote separately about the potential invalidity of such jurisdictional grants as a violation of other constitutional provisions.¹⁷⁷ Thus, a South Carolina court would not likely apply the *Mallory* precedent to its business registration statute where it has no such explicit consent provision. Thus, while it is possible that in a specific case, consent, waiver, or service might establish personal jurisdiction over Tesla, this paper addresses the more likely scenario in which none of those apply.

Finally, it is clear based on Tesla’s non-South Carolina contacts that it is not “at home” in South Carolina under *Daimler* and *BNSF* because it sells a substantially larger portion of vehicles in California and many other non-citizen states than it does in South Carolina.¹⁷⁸ Thus, any South Carolina court would need to justify its jurisdiction through specific personal jurisdiction contacts analysis.

b. The Reach of South Carolina’s Long Arm

South Carolina’s enumeration long arm statute says that South Carolina courts can exercise personal jurisdiction over an entity so long as jurisdiction arises from the entity’s following actions:

- (1) transacting any business in this State; (2) contracting to supply services or things in the State; (3) commission of a tortious act in whole or in part in this State; (4) causing tortious injury or death in

175. Tesla is no exception. See S.C. Sec’y of State, *Tesla, Inc.*, BUS. ENTITIES ONLINE, <https://businessfilings.sc.gov/BusinessFiling/Entity/Profile/337eb3c6-776c-45bc-8fb-4498548b0626> [<https://perma.cc/A783-FMR4>].

176. Compare 42 PA. CONS. STAT. § 5301(a)(2)(i), (b) (2019) with S.C. CODE ANN. §§ 33-15-105, -107 (2006).

177. See *Mallory v. Norfolk S. Ry. Co.*, 600 U.S. 122, 143–46 (2023).

178. See *Tesla Sales by State 2024*, WORLD POPULATION REV., <https://worldpopulationreview.com/state-rankings/tesla-sales-by-state> [<https://perma.cc/Y9AG-VR3L>].

this State by an act or omission outside this State if he regularly does or solicits business, or engages in any other persistent course of conduct, or derives substantial revenue from goods used or consumed or services rendered in this State; (5) having an interest in, using, or possessing real property in this State; (6) contracting to insure any person, property, or risk located within this State at the time of contracting; (7) entry into a contract to be performed in whole or in part by either party in this State; or (8) production, manufacture, or distribution of goods with the reasonable expectation that those goods are to be used or consumed in this State and are so used or consumed.¹⁷⁹

But, over time, the South Carolina Supreme Court, through standard principles of statutory interpretation, shifted away from analyzing the factors separately and transmuted this long arm from an enumeration long arm into the newer approach by holding that these eight circumstances simply mean South Carolina courts can exercise jurisdiction in any case that due process permits.¹⁸⁰ Thus, the only question here is whether due process would allow South Carolina courts to exercise general or specific jurisdiction based on such OTAU contacts. Due to the principle of constitutional avoidance, this analysis usually takes into account both state and federal constitutional considerations.¹⁸¹ The discussion below assumes state constitutionality and addresses rights afforded by the United States Constitution only. Thus, as discussed above, the most determinative question is whether a party purposefully availed itself of a forum.

c. Tesla's Non-OTAU Contacts Likely Do Not Constitute Purposeful Availment

Despite the growing number of Tesla vehicles in South Carolina, Tesla, Inc. has very limited contacts with South Carolina,¹⁸² making OTAU its

179. S.C. CODE ANN. § 36-2-803 (Supp. 2023).

180. *See* State v. NV Sumatra Tobacco Trading, Co., 379 S.C. 81, 89, 666 S.E.2d 218, 222 (2008) (“South Carolina’s long-arm statute has been construed to extend to the outer limits of the due process clause. Because South Carolina treats its long-arm statute as coextensive with the due process clause, the sole question becomes whether the exercise of personal jurisdiction would violate due process.”).

181. *See* WRIGHT & MILLER, *supra* note 5, § 1069.

182. This only refers to the parent corporation—Tesla, Inc. While Tesla may have subsidiaries that operate independently for certain tasks in South Carolina, subsidiary contacts are considered separately. *See generally* James M. Beck, *Post-BMS: Jurisdiction over Subsidiary ≠ Jurisdiction over Parent*, DRUG & DEVICE L. (Apr. 9, 2019),

most significant contact with the state. Firstly, Tesla has no physical dealerships in South Carolina.¹⁸³ This is due, at least in part, to S.C. Code Ann. § 56-15-45(D), which protects South Carolina car dealerships by precluding vehicle manufacturers from running their own dealerships in the state.¹⁸⁴ There is little indication that this statute will be changed any time soon, as a bill to amend that section of the code died in committee just last year.¹⁸⁵ So, it is unlikely that Tesla will have any dealerships in South Carolina for the foreseeable future. Furthermore, Tesla just recently announced that it will open a distribution facility in Greenville, South Carolina in mid-2024 that will be its “inaugural” facility in the state.¹⁸⁶ The facility will only redistribute parts, and will not be a base for vehicle sales or manufacturing.¹⁸⁷

Accordingly, Tesla relies upon internet sales or customer travel to its Charlotte, North Carolina, or various Georgia dealerships for South Carolinians to obtain a Tesla vehicle. Even such internet sales require vehicle pickup from their out-of-state locations when customers do not want to pay for home delivery of a purchased vehicle.¹⁸⁸ Furthermore, Tesla maintains no repair facilities in the state.¹⁸⁹ In fact, it appears that the only physical assets Tesla maintains in the state are its charging stations, and even those are sparse, with only a few dozen locations in the entire state.¹⁹⁰ Those stations are also more heavily concentrated in developed areas.¹⁹¹

<https://www.druganddeviceblog.com/2018/04/post-bms-jurisdiction-over-subsiary-%E2%89%A0-jurisdiction-over-parent.html> [<https://perma.cc/8D7Z-FUBQ>] (discussing effect of subsidiary’s contacts on whether parent has purposefully availed itself of a forum).

183. See *US Tesla Stores & Galleries*, TESLA, <https://www.tesla.com/findus/list/stores/United+States> [<https://perma.cc/DVB7-B9VH>].

184. See S.C. CODE ANN. § 56-15-45(D) (Supp. 2023).

185. See Frazier, *supra* note 152.

186. Stephanie Moore, *Tesla Opening Facility in Greenville County, Company Announces*, WYFF 4 (Jan. 18, 2024, 12:54 PM), <https://www.wyff4.com/article/south-carolina-tesla-greenville-county/46436985> [<https://perma.cc/6GLG-TPSL>].

187. See *id.*

188. See *generally Taking Delivery*, TESLA, <https://www.tesla.com/support/taking-delivery> [<https://perma.cc/WYQ9-8ADG>] (explaining Tesla delivery policy and procedure).

189. See *US Tesla Service Centers*, TESLA, <https://www.tesla.com/findus/list/services/United%20States> [<https://perma.cc/VKA6-ZEUN>].

190. See *Go Anywhere*, TESLA, <https://www.tesla.com/trips> [<https://perma.cc/Z9QD-ZLBQ>].

191. See *id.*

Additionally, Tesla relies heavily on word-of-mouth to promote its brand.¹⁹² It only recently announced that it intends to begin advertising its vehicles.¹⁹³ It is not clear on what platforms and to what extent it will do so.¹⁹⁴ It seems unlikely that Tesla would advertise in a significant way in South Carolina as it is not its main market.¹⁹⁵

Furthermore, while Tesla does offer home-address vehicle servicing and repairs,¹⁹⁶ Tesla states that its vehicles “require [no] annual maintenance,” so such at-home service is only upon request.¹⁹⁷ This is due in part to OTAUs, but also because Teslas are exclusively electric vehicles.¹⁹⁸ The Tesla service page states, “[u]nlike gasoline cars, Tesla vehicles require no traditional oil changes, fuel filters, spark plug replacements or emission checks. Even brake pad replacements are rare because regenerative braking returns energy to the battery, significantly reducing wear on the brakes.”¹⁹⁹ It goes on to recommend a very small list of regular maintenance tasks, most of which only need to be completed once every few years.²⁰⁰ Thus, home services are likely few and far in between and only cover a small percentage of potential vehicle malfunctions.

Accordingly, Tesla’s non-OTAU contacts with South Carolina are minimal and likely do not constitute purposeful availment. Even if a court disagreed and held that such acts do constitute purposeful availment, it is likely that only a small subset of litigation would arise out of or relate to Tesla’s non-OTAU contacts. Therefore, South Carolina courts would likely need to analyze Tesla’s OTAU contacts to obtain specific personal jurisdiction relating to a product-liability action against Tesla.

192. *Advertising Age Names Tesla One of “America’s Hottest Brands”*, TESLA (Apr. 20, 2010), <https://www.tesla.com/blog/advertising-age-names-tesla-one-%E2%80%9Camerica%E2%80%99s-hottest-brands%E2%80%9D> [https://perma.cc/2LLW-QJUL].

193. Chris Isidore, *Tesla Will Advertise for the First Time*, CNN: BUS. (May 16, 2023, 7:58 PM), <https://www.cnn.com/2023/05/16/business/tesla-advertising/index.html> [https://perma.cc/7LUP-LBWM].

194. *See id.*

195. *See Tesla Sales by State 2024*, *supra* note 178 (demonstrating South Carolina is not even in the top 50% of Tesla markets based on estimated sales for 2021–22).

196. *See Preparing for a Mobile Service Appointment*, TESLA, <https://www.tesla.com/support/mobile-service> [https://perma.cc/XP58-XNRZ].

197. *See id.*; *Vehicle Maintenance*, TESLA, <https://www.tesla.com/support/vehicle-maintenance#:~:text=your%20Tesla%20vehicle.,Unlike%20gasoline%20cars%2C%20Tesla%20vehicles%20require%20no%20traditional%20oil%20changes,reducing%20wear%20on%20the%20brakes> [https://perma.cc/G86P-G52C].

198. *See Vehicle Maintenance*, *supra* note 197.

199. *Id.*

200. *See id.*

3. *Tesla's OTAUs Explained*

Tesla's only apparent remaining contacts are with its roughly 6,400 current vehicles²⁰¹ through OTAUs. Tesla maintains and expands almost all of its vehicles' software through OTAUs.²⁰² According to Tesla CEO Elon Musk, each Model 3 vehicle body is designed to have a "million mile life," and the battery packs should last between 300–500 thousand miles.²⁰³ That means with a single battery replacement, a Tesla vehicle could last 44–74 years based on Department of Transportation average vehicle driver statistics.²⁰⁴ However, it is likely more appropriate to view that timeline as an electric vehicle longevity goal, as that timeline seems farfetched. After all, Tesla only puts an eight-year warranty on vehicles currently, whereas Kia and Hyundai offer ten-year warranties in some circumstances.²⁰⁵ While electric vehicle longevity is difficult to predict given electric vehicle newness, it is probably reasonable to credit them with a twenty-year lifespan with a single battery replacement.²⁰⁶

Tesla also uses a decentralized cloud-based computing update network, and Tesla has equipped all of its vehicles with the capability to connect to cellular and Wi-Fi networks.²⁰⁷ Furthermore, Tesla is widely recognized as the leader in OTAU usage among automobile manufacturers, with "[n]early every vehicle component and system" upgradable by OTAUs.²⁰⁸ It also pushes promotions about additional purchasable vehicle software upgrades,

201. See Frazier, *supra* note 152 (providing that 6,400 Tesla vehicles are currently registered in South Carolina).

202. See *Software Updates*, *supra* note 153.

203. Elon Musk (@elonmusk), X (Apr. 13, 2019, 12:18 PM), <https://twitter.com/elonmusk/status/1117099861273219073> [<https://perma.cc/9SX8-79L2>].

204. See Jacob Marsh, *How Long Does a Tesla Car Battery Last?*, ENERGYSAGE (May 4, 2023), <https://www.energysage.com/electric-vehicles/how-long-do-tesla-car-batteries-last/> [<https://perma.cc/6H9H-DSNT>].

205. Nick Zamanov, *How Many Years Will an Electric Car Last?*, CYBER SWITCHING (Nov. 26, 2022), <https://cyberswitching.com/how-many-years-will-an-electric-car-last/> [<https://perma.cc/H8EE-LKB2>].

206. See *id.*

207. See Giedrius Pakalka & Alius Noreika, *How Tesla Cars Connect to Internet? (Easy Guide)*, TECHNOLOGY.ORG, <https://www.technology.org/how-and-why/how-tesla-cars-connect-to-internet/> [<https://perma.cc/ZQ8K-Z38U>]; see also Brian Wang, *Future Tesla AI Cloud Vs Amazon AWS, Google Cloud, Alibaba*, NEXT BIG FUTURE (Aug. 22, 2021), <https://www.nextbigfuture.com/2021/08/future-tesla-ai-cloud-vs-amazon-aws-google-cloud-alibaba.html> [<https://perma.cc/HN92-QNZP>].

208. See Fischer, *supra* note 142.

like activating heated seats, to its vehicle owners using the Tesla App.²⁰⁹ That kind of transaction would not be possible without OTAUs.

However, not all systems within a Tesla vehicle employ OTAUs in the same way. Functions that are central to the vehicle or are already unlocked by the vehicle owner are subject to automatic prompts to update.²¹⁰ To access updates, Tesla vehicles regularly check various Tesla cloud servers for software updates and receive other diagnostic information.²¹¹ This can include everything from infotainment systems to automatic braking systems and assisted steering.²¹² But whether each component is subject to automatic update prompts or has upgrades stuck behind a paywall is up to Tesla.²¹³

Additionally, Tesla generally equips its vehicles with all the hardware necessary for the implementation of monetizable features, but not necessarily all the software.²¹⁴ This requires the vehicle to be engineered from the beginning with continual interactions with the vehicle in mind. Tesla's pay to activate policies pervade even the most sophisticated operations of the vehicles because advanced software in certain models is subject to activation and deactivation based on a vehicle owner's continued payments.²¹⁵ Tesla's three marketed levels of assisted driving software, "Autopilot," "Enhanced Autopilot," and "Full Self-Driving" (FSD),²¹⁶ each

209. See *Upgrades*, TESLA, <https://www.tesla.com/support/upgrades#tesla-accordion-123-are-over-the-air-software-updates-no-longer-free> [<https://perma.cc/K57P-DQS7>].

210. See *Software Updates*, *supra* note 153 ("When an update is available, we will notify you through an alert on your vehicle's touchscreen and the Tesla app. . . . We do not send software updates to individual vehicles upon request.")

211. See Andrew Tierney, *Reverse Engineering the Tesla Firmware Update Process*, PEN TEST PARTNERS (Feb. 12, 2020), <https://www.pentestpartners.com/security-blog/reverse-engineering-the-tesla-firmware-update-process/> [<https://perma.cc/STL5-EJ6V>] (discussing how Tesla hardcodes in communication protocols with its servers that loop to ensure accurate and secure data transfers for its firmware update process).

212. Sean O'Kane, *Tesla Can Change So Much with Over-the-Air Updates that It's Messing with Some Owners' Heads*, THE VERGE (June 2, 2018, 1:00 PM), <https://www.theverge.com/2018/6/2/17413732/tesla-over-the-air-software-updates-brakes> [<https://perma.cc/G95M-7D3J>] ("Tesla has shipped OTA updates to its cars for years now that have changed everything from its Autopilot driver assistance system to the layout and look of its touchscreen interfaces. At one point last year, it even used an update to extend the range of some cars to help customers evacuate the path of Hurricane Irma.")

213. See *id.*

214. See *id.*; see also *Autopilot and Full Self-Driving Capability*, *supra* note 161.

215. See *Autopilot and Full-Self Driving Capability*, *supra* note 161 (describing the levels of automation); *Full Self-Driving Capability Subscriptions*, TESLA, <https://www.tesla.com/support/full-self-driving-subscriptions> [<https://perma.cc/7QQA-QC5M>] (describing payment plan for full self-driving capability).

216. *Autopilot and Full-Self Driving Capability*, *supra* note 161. The prudence of Tesla labelling each software package this way is beyond the scope of this paper, but it should be noted that this software—when placed in the standard six ascending levels of driving

can be deployed through a subscription plan or made inherent to a purchased vehicle.²¹⁷ A Model 3 vehicle could one day be a basic Model 3 equipped only with Autopilot, the next day be the Enhanced version boasting greater road performance, and the next day be purportedly FSD.²¹⁸ Even worse, a payment plan may lapse, and a previously FSD vehicle may go back to Autopilot and a driver be unaware of the change.

Since Tesla monetizes the software, that necessarily requires each vehicle be associated with a particular account and owner; thereby requiring a connection with verifiable information between sender and receiver. This means Tesla must have enough Personal Identifiable Information (PII), like “VIN, region, [and] model,” for each user vehicle to ensure effective rollout of updates.²¹⁹ Tesla admits such PII includes the region of the vehicle.²²⁰ Additionally, Tesla receives data back from each vehicle’s driving information to train its vehicle AI,²²¹ and, regardless of whether a Tesla vehicle is using cellular or Wi-Fi deployment, such networks can be used to identify the geographical location of a vehicle endpoint.²²² That means Tesla knows the physical location of the vehicles it updates.²²³

automation (L0–L5)—ranges from level 1 to level 2+ by most standards. *See* Bryant Walker Smith, *How Reporters Can Evaluate Automated Driving Announcements*, 2020 J.L. & MOBILITY 1, 4 (2020). Only recently have level 3 automated vehicles become commercially available, and still even those vehicles are far from level 5 automation, the level that comports most clearly with the layman understanding of a self-driving vehicle. Furthermore, such level 3 vehicles are only permitted in specific places. *See* Mercedes-Benz, *Automated Driving Revolution: Mercedes-Benz Announces U.S. Availability of DRIVE PILOT – The World’s First Certified SAE Level 3 System for the U.S. Market*, MERCEDES-BENZ: MEDIA NEWSROOM USA (Sept. 27, 2023), <https://media.mbusa.com/releases/automated-driving-revolution-mercedes-benz-announces-us-availability-of-drive-pilot-the-worlds-first-certified-sae-level-3-system-for-the-us-market> [<https://perma.cc/9QC8-8WQA>] (announcing Mercedes-Benz’s first of the kind level 3 driving car).

217. *See Autopilot and Full Self-Driving Capability*, *supra* note 161.

218. *See id.*

219. *See generally* Lennon Cihak, *Why Tesla Doesn’t Update All of Its Vehicles at Once*, NOT A TESLA APP (Oct. 11, 2022), <https://www.notateslaapp.com/tesla-reference/921/why-tesla-doesn-t-update-all-of-its-vehicles-at-once> [<https://perma.cc/DH2B-WCMW>] (describing how Tesla releases its updates).

220. *See id.*

221. *See Obtain a Copy of the Data Associated with Your Tesla Account*, TESLA, <https://www.tesla.com/support/privacy#:~:text=Tesla%20vehicles%20record%20operational%20and,the%20Dair%20to%20our%20servers> [<https://perma.cc/KGJ5-572X>] (discussing some of the data recorded by vehicles and how Tesla accesses it); Agam Shah, *How Tesla Uses and Improves Its AI for Autonomous Driving*, ENTERPRISE AI (Mar. 8, 2023), <https://www.enterpriseai.news/2023/03/08/how-tesla-uses-and-improves-its-ai-for-autonomous-driving/#:~:text=Tesla%20mines%20its%20network%20of,cars%20through%20FSD%20software%20upgrades> [<https://perma.cc/5TAS-4UHP>].

222. *See generally* Univ. of S. Cal., *Is Your Mobile Provider Tracking Your Location? New Technology Could Stop It*, SCIENCEDAILY (Aug. 12, 2021), <https://www.sciencedaily.com>.

Furthermore, the power of such OTAUs is uncontested; after all, changing from a basic model to an FSD vehicle which can purportedly “drive itself almost anywhere with minimal driver intervention” will certainly impact vehicle functionality, safety, and consumer expectations.²²⁴ Yet these capability changes can be sent from an entirely separate forum. So, this vehicle is morphing its capabilities while potentially just sitting still in a garage somewhere—and Tesla is the one controlling such capabilities.

The augmentation power of these updates is often used to Tesla’s legal and economic benefit as well because Tesla secures compliance with various administrative safety standards through its OTAUs. In December of 2023 alone, Tesla had two massive “recalls” mandated by the National Highway Traffic Safety Administration (NHTSA).²²⁵ The first was Tesla’s largest recall, requiring almost all Tesla vehicles on the road in the United States—nearly 2 million vehicles—to receive an update to the Autopilot feature to better engage drivers.²²⁶ The second, required Tesla to send an update out to roughly 120,000 vehicles, to prevent doors from opening in crashes.²²⁷ Similarly, in a January 2023 NHTSA safety recall report, every single Tesla FSD vehicle on the road was deemed a safety risk because each one was

com/releases/2021/08/210812135929.htm [https://perma.cc/KPT5-MGZC] (discussing cellular location tracking); Chris Hoffman, *How Devices Use Wi-Fi to Determine Your Physical Location*, HOW-TO GEEK (Jan. 18, 2021), <https://www.howtogeek.com/708500/how-devices-use-wi-fi-to-determine-your-physical-location/> [https://perma.cc/9527-LX68] (discussing how Wi-Fi alone is enough to determine physical location in many instances).

223. See *Cihak*, *supra* note 219 (stating that Tesla updates its vehicles based on a regional rollout system); see also Mark Harris, *Who Actually Owns Tesla’s Data?*, IEEE SPECTRUM (Aug. 5, 2022), <https://spectrum.ieee.org/tesla-autopilot-data-ownership> [https://perma.cc/VT4H-66QR] (arguing that the breadth of data collected under the Tesla self-driving apparatus alone would make it almost impossible to not know a vehicle’s location and the owner of the vehicles). *But see Disclaimers*, TESLA, https://www.tesla.com/ownersmanual/model3/en_jo/GUID-2E8E5E0B-DAA8-40B8-9804-45F5960538DF.html#:~:text=Tesla%20does%20not%20disclose%20the%20data%20recorded%20%20in,the%20vehicle%20owner%20or%20identification%20information.%20More%20items [https://perma.cc/G667-9SWZ] (claiming that Tesla does not save location data related to specific vehicles in its Event Data Recorder (EDR) except in the event of a crash).

224. Again, the propriety of Tesla’s verbiage is contestable because its vehicles are not safe for unsupervised use. See *Autopilot and Full Self-Driving Capability*, *supra* note 161, for Tesla’s descriptions.

225. Alain Sherter, *Tesla Recalls More than 120,000 Vehicles Because Doors Can Unlatch in a Crash*, CBS NEWS (Dec. 22, 2023, 11:19 AM), <https://www.cbsnews.com/news/tesla-recall-2023-doors-lock-autopilot-nhtsa/> [https://perma.cc/5F8K-CL69].

226. *See id.*

227. *See id.*

pending installation of, or was already using, a Tesla FSD software package that was not up to safety standards.²²⁸

This happens on the international scene as well. In May 2023, China required Tesla to recall approximately 1.1 million vehicles, nearly every vehicle it sold in the country, to address an issue with faulty braking systems.²²⁹ Before the days of OTAUs, Tesla would have been required to physically access each vehicle included in these recalls. But Tesla did not have to do so, instead it merely pushed an update out that brought the vehicles into compliance,²³⁰ saving a veritable truckload of cash.²³¹

On the other hand, Tesla's OTAUs do have some limits. In a July 2023 report, NHTSA identified approximately one thousand Tesla vehicles out of safety specifications due to front-facing camera misalignment, a problem that can cause the vehicle to perceive the world around it incorrectly.²³² This recall is noteworthy because it was a traditional physical recall,²³³ thereby highlighting the current limits of OTAUs. Where a physical component is defective that is potentially crucial to diagnosing issues or simply lacks the physical infrastructure necessary to be manipulated remotely, a physical recall is still necessary. This may explain Tesla's resistance to a recent Reuters report chiding Tesla's physical suspension systems.²³⁴ Such a recall

228. See NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., U.S. DEP'T OF TRANSP., 23V-085, PART 573 SAFETY RECALL REPORT (2023), <https://static.nhtsa.gov/odi/rcl/2023/RCLRPT-23V085-3451.PDF> [<https://perma.cc/S98M-8MB5>].

229. Nora Naughton, *Tesla Is Recalling Almost Every Car It Has Ever Sold in China*, BUS. INSIDER (May 12, 2023, 11:23 AM), <https://www.businessinsider.com/tesla-issues-recall-cars-china-2023-5> [<https://perma.cc/Q4T4-ZCPK>].

230. See *id.* Note that the term software here is used generally. Distinctions between firmware and software may be important for a more nuanced discussion of effected systems, but such distinctions will not be addressed here. See Tatsiana Tsiukhai, *How OTA Technology Helps Update Connected Cars on the Fly*, SOFTEQ (June 17, 2021), <https://www.softeq.com/blog/ota-technology-updating-connected-cars-on-the-go> [<https://perma.cc/S5G8-PECW>] for a discussion of OTAUs that includes firmware versus software distinctions.

231. See Lurah Lowery, *OEM Shift to OTA Recall Fixes Predicted to Occur by 2028*, REPAIRER DRIVEN NEWS (May 9, 2023), <https://www.repairerdrivennews.com/2023/05/09/oem-shift-to-ota-recall-fixes-predicted-to-occur-by-2028/> [<https://perma.cc/WX5X-XFN2>] (discussing the financial advantages of using OTAUs).

232. See NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., U.S. DEP'T OF TRANSP., 23V-489, PART 573 SAFETY RECALL REPORT (2023), <https://static.nhtsa.gov/odi/rcl/2023/RCLRPT-23V489-8374.PDF> [<https://perma.cc/JYZ7-XH7S>].

233. Kevin Armstrong, *Tesla Issues Physical Recall After Identifying a Forward-Facing Camera Issue*, NOT A TESLA APP (July 25, 2023), <https://www.notateslaapp.com/news/1532/tesla-issues-physical-recall-after-identifying-a-forward-facing-camera-issue> [<https://perma.cc/3N26-848E>].

234. See Steve Stecklow, *Exclusive: Two US Senators Call for Tesla Recalls After Reuters Investigation*, REUTERS (Dec. 28, 2023, 7:45 AM), <https://www.reuters.com/business/>

would almost certainly require physical intervention. And yet, the Reuters investigation drew the attention of Congress members, and Tesla may have to recall the vehicles anyway.²³⁵

However, the circumstances where Tesla's OTAUs cannot solve vehicle issues do not change the fact that OTAUs can augment many integral vehicle components. Accordingly, Tesla has developed a system of vehicle management that gives Tesla far more connectivity and control over each vehicle than has been seen in the past. That system should also provide courts specific personal jurisdiction over Tesla under current legal precedent.

4. *Tesla's OTAUs Constitute Purposeful Availment*

Supreme Court precedent across each category of contact supports a finding that Tesla's OTAU usage should constitute purposeful availment of South Carolina as a forum because the overlapping similarities between OTAU usage and types of contacts the Court determined constituted purposeful availment far outweigh any potential distinctions. The similarities between OTAUs and each kind of contact will be discussed in turn.

While physical contact with or presence in a forum is not required for personal jurisdiction, it is worth discussing to what extent OTAUs will be considered physical contacts under the law. As discussed, OTAU data comes in the form of either cellular or Wi-Fi radio waves to a particular endpoint in a forum. Radio waves are a particular frequency of wave that occurs on the same spectrum as visible light.²³⁶ Some courts may already recognize OTAUs as physical contacts with a forum because under the "modern trend" of trespass law, courts have adopted tort law accepting light as a basis for trespass where light damages property.²³⁷ This is similarly true for battery, as sending light out to cause epileptic seizures has been sufficient contact for battery.²³⁸

autos-transportation/two-us-senators-call-tesla-recalls-after-reuters-investigation-2023-12-27/
[<https://perma.cc/6Q97-9ZYQ>].

235. *See id.*

236. *See The Electromagnetic Spectrum*, NASA HUBBLESITE (Sept. 30, 2022), <https://hubblesite.org/contents/articles/the-electromagnetic-spectrum> [<https://perma.cc/EQD4-8YA9>].

237. *See Int'l Union of Painters & Allied Trades Dist. Council 15 Loc. 159 v. Great Wash Park, LLC*, No. 67453, 2016 WL 4499940, at *2 (Nev. App. Aug. 18, 2016).

238. *See Debra Cassens Weiss, Sending a Flashing GIF to Provoke a Seizure Can Constitute Battery, Federal Judge Rules*, ABA: ABA JOURNAL (June 7, 2018, 7:00 AM), https://www.abajournal.com/news/article/sending_a_flashing_gif_to_provoke_a_seizure_can_constitute_battery_federal [<https://perma.cc/P3Z5-465A>].

Another route one could take to argue that OTAUs are physical contacts is based on the processing power required to receive such updates. In *Compuserve Inc. v. Cyber Promotions*, a district court upheld a trespass to chattels claim based on the defendant sending spam emails through plaintiff's servers because the electronic signals were being processed by the servers and diminishing each server's processing capacity.²³⁹ Similarly, one could argue that, since an OTAU must be processed by an endpoint and implemented, each OTAU is necessarily a physical contact with that endpoint. Accordingly, some courts may view OTAU contacts as actions not just directed at a forum or in relation to it, but actually in the forum. Such actions, like in *Keeton*, are almost always considered purposeful availment.

Furthermore, even where a court is unwilling to see OTAUs as physical presence, the *Calder* effects test likely indicates Tesla's OTAU usage constitutes purposeful availment. As noted, Tesla's updates are frequently used to bring software into compliance with safety regulations and Tesla knows the location of the users that receive the updates. In a case where Tesla knowingly or negligently sent out an unsafe update to users, the targets would each be in forums in which users are to receive updates and the effects would be uniquely felt in those forums through the real-world impact of an unsafe self-driving vehicle. This argument is even stronger where Tesla sends an update to a particular user who purchased a vehicle upgrade because, rather than potentially interacting with multiple targets and forums at a time and obfuscating the targeting analysis, it would be a specific target in a single forum. This distinguishes Tesla's OTAU use from the contacts contemplated in *Walden*, because in *Walden* the actions of the DEA agents did not rely on any Nevada contacts, whereas Tesla would be relying on update infrastructure and contacting a vehicle that is already in the forum to accomplish its goals. Accordingly, in Tesla's case it may be unnecessary to go any further into case law to support an argument that its OTAUs constitute purposeful availment.

Even so, Tesla's OTAUs are significant under stream-of-commerce contacts considerations because it uses its OTAUs to maintain its vehicles in any reachable forum. Stream-of-commerce cases state that where a manufacturer or distributor can foresee its product arriving in a forum, and it takes steps to develop that market, it has purposefully availed itself of the forum. As Tesla uses its OTAUs to maintain vehicles and prevent the necessity of manual recalls, one of the largest benefits of OTAUs is that such capabilities improve the marketability of such vehicles in any place where cellular or Wi-Fi capabilities exist. Those capabilities are legally

239. See *Compuserve Inc. v. Cyber Promotions, Inc.*, 962 F. Supp. 1015, 1025–28 (S.D. Ohio 1997).

significant because they are much like the capabilities that established jurisdiction over the defendant in *Ford Motor Co.*

Recall that in *Ford Motor Co.* one of the Court's deciding factors was that the defendant had repair and service shops in the state. In Tesla's case, since its vehicles are almost solely dependent on OTAUs, such updates basically replace the need for such shops and serve the same purpose. In both cases the infrastructure ensures the party controls vehicle repairs, parts, and functioning, trades on the company's reputation to incentivize vehicle presence in the forum, and provides measurable economic benefit to the infrastructure owner. Thus, it would be counter-intuitive to find that the defendant's infrastructure in *Ford Motor Co.* constituted purposeful availment of a forum but Tesla's implementation of a system with similar effects in the forum does not.

Tesla would likely point to *World-Wide Volkswagen Corp.* and *Nicastro* to argue that all South Carolina vehicles were necessarily sold in other states, and it is therefore unforeseeable that the vehicles would be in South Carolina. However, foreseeability is a non-issue in Tesla's OTAU case because the company has live information about where the vehicles are to update them and, unlike the four products that reached the forum in *Nicastro*, there are roughly 6,400 Tesla vehicles in South Carolina. Accordingly, Tesla may argue that it could not foresee the vehicles being in South Carolina at the time of sale, which still seems unlikely since purchasers disclose residency upon purchase, but even so, such an argument is irrelevant since Tesla purposefully contacts the vehicles through OTAUs after the vehicle has entered the forum. This is what distinguishes *Ford Motor Co.* and Tesla's OTAU usage from previous stream-of-commerce cases. In other stream-of-commerce cases, there were minimal, if any, post-sale contacts contemplated in relation to the product. But *Ford Motor Co.* stands for the proposition that such planned post-sale contacts and infrastructure establish foreseeability and can constitute purposeful availment. Accordingly, such precedent also supports the proposition that OTAUs can constitute purposeful availment.

Finally, Tesla's OTAUs land squarely within the reasoning used to uphold personal jurisdiction in *Burger King Corp.* and other reasoning in *Ford Motor Co.* because Tesla's OTAUs prove that a long-term relationship was contemplated with the residents of the forum when they purchased the product. The fact that Tesla's OTAUs are meant to maintain vehicles throughout the vehicle's entire lifespan and that such a lifespan is approximately twenty years, establishes a long-term relationship exists between Tesla and its vehicles through OTAUs. This is much like the 20-year relationship that was a substantial basis for conferring jurisdiction in *Burger King Corp.* The argument becomes even stronger as vehicle

longevity increases. Such a relationship strongly indicates that contacts between Tesla and its vehicles in various forums are not “random, isolated, or fortuitous” contacts, but rather part of a string of expected activity with the capacity to affect many lives. Furthermore, since Tesla vehicles purportedly last anywhere from 44–74 years for the average driver, or there is at least a goal to make them last that long, the relevance of this factor will likely only increase.

Accordingly, Supreme Court precedent, regardless of the type of contact in question, supports the idea that OTAUs can constitute purposeful availment of a forum. Thus, when such considerations are combined like the Court did in *Ford Motor Co.*, Tesla’s OTAUs almost necessarily constitute purposeful availment of South Carolina’s market. Furthermore, many significant forms of litigation could arise out of or relate to Tesla’s OTAU purposeful availment, and there are no apparent reasons why subjecting it to such litigation would offend principles of fairness. Thus, Tesla’s OTAUs are likely a constitutional basis to subject Tesla to the power of South Carolina courts, allowing South Carolinians to obtain in-state adjudication of their rights.

V. CONCLUSION

Over-the-air updates (OTAUs) are a powerful technological tool for businesses that benefit both the seller and buyer of products. Tesla uses that tool in a cutting-edge way to enhance its products, maintain customer relationships, and increase the reach of its business. It does this by building its vehicles from the ground-up with OTAU technology in mind and consistently improving its implemented technologies in response to new developments in safety. While such use will likely have minimal effects on traditional personal jurisdiction law or the general personal jurisdiction “at home” test, under current facts, it will likely be the main basis for any South Carolina court to properly exercise specific personal jurisdiction over Tesla. The number of similarly legally significant OTAU uses will likely only increase, not just in the automotive industry, but also in fields like medical implants, Smart Home devices, or other IoT devices. Accordingly, OTAUs depart from the trend of technology complicating personal jurisdiction because they are a kind of technological intangible contact that can be so impactful on a forum that they make personal jurisdiction purposeful availment analysis easier. Thus, while the Court is not an expert on the internet, its precedent still indicates that OTAUs deserve special attention when discussing the forums in which a defendant may properly be sued.