

## From Hanging Chads to Data Hacks: Maintaining Election Integrity in the Digital Age

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# From Hanging Chads to Data Hacks: Maintaining Election Integrity in the Digital Age

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## INTRODUCTION

After the tumultuous 2000 presidential election, many states opted to conduct their elections through electronic voting devices.<sup>1</sup> However, with concerns about data breach, voter fraud, and election hacking becoming increasingly prominent in America's public discourse, reaching an apex during the 2016 presidential election, many states have passed legislation reverting to a paper-based method.<sup>2</sup> This has left the United States with a patchwork approach to voting technology. Importantly, many of these new approaches to voting corrected past identified problems, whilst simultaneously uncovering new vulnerabilities.<sup>3</sup> This paper seeks to analyze the history of voting technology in the United States, the current state of voting, and the implications of the different approaches to voting technology utilized by the states. Ultimately, this paper will conclude

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<sup>1</sup> Clive Thompson, *Can You Count on Voting Machines?*, N.Y. TIMES MAG. (Jan. 6, 2008), <http://www.nytimes.com/2008/01/06/magazine/06Vote-t.html>.

<sup>2</sup> Elizabeth Weise, *Paper Ballots are Back in Vogue Thanks to Russian Hacking Fears*, USA TODAY (Sep. 19, 2017, 5:00 AM), <https://www.usatoday.com/story/tech/news/2017/09/19/russia-hacking-election-fears-prompts-states-to-switch-to-paper-ballots/666020001/>.

<sup>3</sup> See *infra* Part VI.

that the best and most likely way forward is through the standardized use of scan-technology voting to address concerns of both verifiability and efficiency.

## I. THE HISTORY OF VOTING METHODS IN THE UNITED STATES

From the founding of the United States until the late 1800s, hand-counted paper ballots were the only type of voting equipment used.<sup>4</sup> Voters typically obtained pre-printed ballots with the names of the candidates for which they wished to vote.<sup>5</sup> However, vote-buying scandals throughout the early nineteenth century led to the “adoption of the Australian secret ballot, which was developed in 1856.”<sup>6</sup> Under this system, ballots listed the names of the candidates, and voters marked their choices in private.<sup>7</sup> However, hand-counted paper ballots faded in prominence throughout the late 20<sup>th</sup> century with the emergence of better technology, as the process of interpreting paper ballots was both time consuming and error prone due to undecipherable marking.<sup>8</sup> By 2000, only 1.3% of voters in the United States, mainly in rural areas, voted with hand-counted paper ballots.<sup>9</sup>

The decline of the paper ballot coincided with the first major advancement in voting technology, the lever voting machine, which was developed during the early

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<sup>4</sup> Clive Thompson, *Can You Count on Voting Machines?*, N.Y. TIMES MAG. (Jan. 6, 2008), <http://www.nytimes.com/2008/01/06/magazine/06Vote-t.html>.

<sup>5</sup> Elizabeth King, *How the U.S. Ended Up with Today's Paper Ballots*, TIME (Apr. 26, 2016), <http://time.com/4305508/paper-ballot-history/>.

<sup>6</sup> Daniel P. Tokaji, *The Paperless Chase: Electronic Voting and Democratic Values*, 73 FORDHAM L. REV. 1711, 1718 (2005).

<sup>7</sup> *Id.* at 1718-19.

<sup>8</sup> *Id.* at 1719.

<sup>9</sup> *Id.*

twentieth century.<sup>10</sup> The lever voting machine “was designed to address the possibility of tampering with paper ballots, since there is no document to tamper with.”<sup>11</sup> However, this was not the only major pre-twenty-first century advancement in voting technology. In 1964 a new form of voting technology emerged, punch-card ballots, the first technology to use computers to count votes.<sup>12</sup> Ultimately, these technologies nearly phased out hand-counted paper ballots entirely. By 1980, during the election between Ronald Reagan and Jimmy Carter, the two most common voting systems utilized by the states were punch-card devices and lever machines.<sup>13</sup>

However, these methods also fell victim to the same fate as hand-counted ballots. Lever machines, which were first invented in the 1890s, seemed bulky by the late twentieth century, and furthermore were expensive to maintain and repair.<sup>14</sup> This led to these machines being phased out over the next twenty years.<sup>15</sup> New York was the last state to phase out lever machines, officially retiring them in 2010.<sup>16</sup> Punch cards better withstood the test of time, maintaining relevance throughout the 1990s, but ultimately “lost ground to optical-scan and electronic systems”.<sup>17</sup> By 2000, optical-scan ballots were used by 27.5% of voters, second only in use to punch cards.<sup>18</sup> However, that

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<sup>10</sup> *Id.*

<sup>11</sup> *Id.*

<sup>12</sup> *Id.* 1719-20.

<sup>13</sup> Drew Desilver, *On Election Day, Most Voters Use Electronic or Optical-Scan Ballots*, PEW RESEARCH CTR. (Nov. 8, 2016), <http://www.pewresearch.org/fact-tank/2016/11/08/on-election-day-most-voters-use-electronic-or-optical-scan-ballots/>.

<sup>14</sup> *Id.*

<sup>15</sup> *Id.*

<sup>16</sup> *Id.*

<sup>17</sup> *Id.*

<sup>18</sup> Tokaji, *supra* note 6, at 1721.

same year accelerated the punch card's decline. The nail in the coffin came in the form of the "2000 Florida election recount debacle that brought the term 'hanging chad'" into the cultural vocabulary.<sup>19</sup> This election demonstrated the pitfalls of punch card voting as many issues arose surrounding these ballots. Such issues included misunderstandings over which punch-hole corresponded with which candidate, cards being incompletely punched, and several other consistent problems with decipherability.<sup>20</sup>

Ultimately, in the wake of the 2000 election, states turned to electronic machines to avoid a prolonged and contested ballot counting process.<sup>21</sup> These states were aided by a \$3 billion federal investment in electronic voting machines in response to the 2000 presidential election.<sup>22</sup> Additionally, many of these changes on the state-level were now mandated.<sup>23</sup>

In 2002, the United States Congress passed the Help America Vote Act ("HAVA").<sup>24</sup> The purpose of the Act was to implement reform to the country's voting process.<sup>25</sup> HAVA specifically addressed improvements to voting systems and voter access that were identified as problems following the 2000 election.<sup>26</sup> HAVA created new mandatory minimum standards for states to follow in multiple areas of election

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<sup>19</sup> Desilver, *supra* note 13.

<sup>20</sup> Tokaji, *supra* note 6, at 1720.

<sup>21</sup> Cory Bennet, *States Ditch Electronic Voting Machines*, THE HILL (Nov. 3, 2014, 9:00 AM), <http://thehill.com/policy/cybersecurity/222470-states-ditch-electronic-voting-machines>.

<sup>22</sup> *Id.*

<sup>23</sup> Help America Vote Act of 2002, Pub. L. No. 107-252, 116 Stat. 1666 (2002).

<sup>24</sup> *Id.*

<sup>25</sup> Presidential Statement on Signing the Help America Vote Act, 2002 WL 31421560 (Oct. 29, 2002).

<sup>26</sup> *Id.*

administration.<sup>27</sup> The Act also provided funding to assist states in meeting those standards.<sup>28</sup> HAVA additionally established the Election Assistance Commission (“EAC”) to assist states in HAVA compliance and to distribute the Act’s funds to the states.<sup>29</sup> One of the Act’s loftiest goals was the phasing out of punch-card voting systems and the replacement of outdated voting machines.<sup>30</sup>

Ultimately, this move towards electronic voting brought Direct Record Electronic Machines (“DREs”) into precincts across the country. DRE machines were first introduced in the 1970s, but did not rise to prominence until the early 2000s.<sup>31</sup> They are “stand-alone machines that record votes in their internal memories.”<sup>32</sup> Crucially, DREs were “only used by 10.7% of American voters” during the 2000 presidential election.<sup>33</sup> Yet by the 2004 election, 28.9% of Americans were voting using DREs.<sup>34</sup>

Critically, after the 2000 election, concerns over election technology were not only expressed in the legislature, these same concerns were also echoed in the American court system. Voting rights advocates in several states “filed lawsuits seeking to require the replacement of antiquated systems.”<sup>35</sup> While the lawsuits varied, each relied on the Supreme Court decision in *Bush v. Gore*<sup>36</sup>, arguing “the use of different types of voting equipment with

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<sup>27</sup> Help America Vote Act of 2002, Pub. L. No. 107-252, 116 Stat. 1666 (2002).

<sup>28</sup> 52 U.S.C. § 20901(b) (2018).

<sup>29</sup> 52 U.S.C. § 20921 (2018).

<sup>30</sup> Help America Vote Act of 2002, Pub. L. No. 107-252, 116 Stat. 1666 (2002).

<sup>31</sup> Tokaji, *supra* note 6, at 1722.

<sup>32</sup> *Id.*

<sup>33</sup> *Id.*

<sup>34</sup> Desilver, *supra* note 13.

<sup>35</sup> Tokaji, *supra* note 6, at 1729.

<sup>36</sup> *Bush v. Gore*, 531 U.S. 98 (2000).

different levels of accuracy within a state violated the Fourteenth Amendment.”<sup>37</sup> For example, the American Civil Liberties Union (ACLU) brought suit on behalf of Florida voters to end punch card voting in the state.<sup>38</sup> Subsequently, the ACLU “brought lawsuits in Georgia, Illinois, California, and Ohio on similar grounds.”<sup>39</sup> Plaintiffs argued in each of these cases that “the continuing use of punch-card voting equipment denied their rights under the Fourteenth Amendment and the Voting Rights Act.”<sup>40</sup> Crucially, while the success of these lawsuits was mixed<sup>41</sup>, this onslaught of litigation demonstrated an appetite in the United States for drastic change in the realm of election administration.

## II. Problems with Electronic Voting

The flaws in the American election system are widespread and plaguing. Critically, this is true from the low to high end of the voting technology spectrum. During every election numerous votes are lost due to voting technology shortcomings.<sup>42</sup> In 2008, the ten lowest failure rates (the percent of votes cast, but not counted) among the states due to voting technology and voter confusion fell below 0.5%.<sup>43</sup> However, in states that fared worse, the rate of failure was

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<sup>37</sup> Tokaji, *supra* note 6, at 1729.

<sup>38</sup> *Id.*

<sup>39</sup> *Id.*

<sup>40</sup> *Id.*

<sup>41</sup> *Id.* at 1729-30.

<sup>42</sup> Adam Liptak, *Lost Votes, Problem Ballots, Long Waits? Flaws Are Widespread, Study Finds*, N.Y. TIMES (Feb. 5, 2013), <http://www.nytimes.com/2013/02/06/us/politics/us-voting-flaws-are-widespread-study-shows.html>.

<sup>43</sup> *Id.*

much higher. For example, in West Virginia the failure rate was 3.2%,<sup>44</sup> a concerning yet unsurprising figure.

In 2006, Princeton professor of computer science Edward Felten obtained an AccuVote TS, one of the most widely used touch-screen voting machines at the time.<sup>45</sup> Felten and his team began the process of reverse-engineering the AccuVote TS.<sup>46</sup> In September 2006, they published a research paper, and released a video, detailing how code could be spread to an AccuVote TS, completely changing the record of the votes to whatever outcome the code writers desired.<sup>47</sup> Furthermore, such code could spread like a virus to other machines.<sup>48</sup> Several other projects have been performed on other direct-recording electronic voting machines, showing similar results.<sup>49</sup> Despite this, Georgia still uses the AccuVote TS, and four other states—Delaware, Louisiana, New Jersey and South Carolina—still rely entirely on DRE machines.<sup>50</sup> This is critical, as the machines that pose the greatest risk to election integrity are electronic machines that leave no voter-verified paper trail.<sup>51</sup> “If someone were to manipulate such a voting machine’s underlying software, there would be no way to

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<sup>44</sup> *Id.*

<sup>45</sup> Jessica Schulberg, *Good News for Russia: 15 States Use Easily Hackable Voting Machines*, HUFFPOST (Jul. 17, 2017, 11:02 AM), [https://www.huffingtonpost.com/entry/electronic-voting-machines-hack-russia\\_us\\_5967e1c2e4b03389bb162c96](https://www.huffingtonpost.com/entry/electronic-voting-machines-hack-russia_us_5967e1c2e4b03389bb162c96).

<sup>46</sup> *Id.*

<sup>47</sup> *Id.*

<sup>48</sup> *Id.*

<sup>49</sup> *Id.*

<sup>50</sup> *Id.*

<sup>51</sup> A.J. Vicens, *Trump Says the Election Will Be Rigged. In These States, It May Be Impossible to Prove Him Wrong*, MOTHER JONES (Aug. 9, 2016, 4:59 PM), <https://www.motherjones.com/politics/2016/08/millions-voters-could-cast-ballots-machines-leave-no-paper-trail/>.

prove it by comparing the machine's vote count to a paper record."<sup>52</sup>

This sentiment was echoed in June 2017 when more than 100 cybersecurity and voting experts penned a letter to Congress suggesting several objectives for protecting the integrity of the election system.<sup>53</sup> The letter came in the wake of Jeanette Manfra, Acting Deputy Undersecretary for Cybersecurity and Communications at the Department of Homeland Security, notifying the Senate Intelligence Committee that hackers targeted election-related systems in 21 states during the 2016 election cycle.<sup>54</sup> Critically, in the letter, the experts state, "all jurisdictions should create voter-verified paper ballots and phase out electronic voting machines" to handle the increase in cybersecurity risks.<sup>55</sup>

While there has never been a proven case of manipulation of an electronic voting machine, that does not indicate their infallibility. In fact, the greatest downfall of electronic voting machines might come in the form of their aging software and imperfect engineering. DRE machines, without any known malicious tampering, have historically produced questionable results.<sup>56</sup> In Florida, "more than 18,000 iVotronic machines did not record a vote in a 2006 congressional race in which the margin of victory was less than 400 votes."<sup>57</sup> Meanwhile, in Fairfax County, Virginia, "electronic machines subtracted one vote for every hundred

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<sup>52</sup> *Id.*

<sup>53</sup> Selena Larson, *100 Experts Tell Congress How to Improve Election Security*, CNN (Jun. 21, 2017, 1:30 PM), <http://money.cnn.com/2017/06/21/technology/voter-security-letter-sent-to-congress/index.html>.

<sup>54</sup> *Id.*

<sup>55</sup> *Id.*

<sup>56</sup> Andy Sullivan, *Despite Flaws, Paperless Voting Machines Remain Widespread in the U.S.*, REUTERS (Sep. 20 2016, 7:38 AM), <https://www.reuters.com/article/us-usa-election-machines/despite-flaws-paperless-voting-machines-remain-widespread-in-the-u-s-idUSKCN11Q0EU>.

<sup>57</sup> *Id.*

cast for one candidate in a 2003 school-board race.”<sup>58</sup> Further “more than 4,400 electronic ballots in Carteret County, North Carolina, were lost and never recovered in the 2004 presidential election.”<sup>59</sup> These events highlight the very real consequences these machines can impose when glitches occur.

These DRE machines may also jeopardize election integrity simply due to the passage of time. As most DRE machines were purchased in the wake of the 2000 election debacle, the age of these devices raises real concerns.<sup>60</sup> For machines purchased since 2000, the expected lifespan for the core components is generally between ten and fifteen years.<sup>61</sup> This is worrisome, as the oldest voting machines in forty-three states were at least ten years old by the 2016 election.<sup>62</sup> In fourteen states they were more than fifteen years old.<sup>63</sup>

One of the most obvious problems with aging equipment is calibration. A number of voting machines still in commission rely on hardware from the 1990s to calibrate their screens.<sup>64</sup> Often at polling places, the accuracy of the calibration of these machines noticeably degrades throughout the day.<sup>65</sup> This has led to complaints of “vote

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<sup>58</sup> *Id.*

<sup>59</sup> *Id.*

<sup>60</sup> Lawrence Norden & Christopher Famighetti, *America's Voting Machines at Risk*, BRENNAN CTR. FOR JUSTICE, 9 (2015), [https://www.brennancenter.org/sites/default/files/publications/Americas\\_Voting\\_Machines\\_At\\_Risk.pdf](https://www.brennancenter.org/sites/default/files/publications/Americas_Voting_Machines_At_Risk.pdf).

<sup>61</sup> *Id.* at 4.

<sup>62</sup> *Id.*

<sup>63</sup> *Id.*

<sup>64</sup> Pam Fessler, *Some Machines Are Flipping Votes, But That Doesn't Mean They're Rigged*, NPR (Oct. 26, 2016, 1:13 PM), <https://www.npr.org/2016/10/26/499450796/some-machines-are-flipping-votes-but-that-doesnt-mean-theyre-rigged>.

<sup>65</sup> *Id.*

flipping”.<sup>66</sup> In Texas, during the 2016 election, a number of “voters in at least three counties reported they had selected straight Republican tickets, only to have Clinton/Kaine pop up instead of Trump/Pence.”<sup>67</sup> Most election officials are aware of the problem of aging voter technology, but have come up against tightened state and county budgets, resulting in the replacement of these machines as unfeasible.<sup>68</sup> This is not surprising as estimates suggest replacing old electronic voting machines in the United States could top \$1 billion.<sup>69</sup>

### III. STATE REVERSION FROM ELECTRONIC VOTING

Since the late 2000s, many states have passed legislation reverting away from electronic voting.<sup>70</sup> Maryland was among the first states to abandon paper balloting after the 2000 presidential election.<sup>71</sup> The state spent \$65 million in 2002 to buy electronic voting machines from Diebold, Incorporated.<sup>72</sup> However, issues with these machines arose shortly after. For example, in Maryland’s 2006 primary election, glitches plagued the polling stations leading state

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<sup>66</sup> “Vote flipping” is the act of an electronic voting machine recording a vote for the opposite selection chosen by the voter. *Id.*

<sup>67</sup> *Id.*

<sup>68</sup> Lawrence Norden & Christopher Famighetti, *Now Is the Time to Replace Our Decrepit Voting Machines*, SLATE (Nov. 17, 2016, 12:07 PM), [http://www.slate.com/articles/technology/future\\_tense/2016/11/now\\_is\\_the\\_time\\_to\\_fix\\_our\\_old\\_voting\\_machines.html](http://www.slate.com/articles/technology/future_tense/2016/11/now_is_the_time_to_fix_our_old_voting_machines.html).

<sup>69</sup> *Id.*

<sup>70</sup> Cory Bennet, *States Ditch Electronic Voting Machines*, THE HILL (Nov. 3, 2014, 9:00 AM), <http://thehill.com/policy/cybersecurity/222470-states-ditch-electronic-voting-machines>.

<sup>71</sup> Erin Cox, *New Voting Machines Finally On Horizon*, BALTIMORE SUN (Dec. 16, 2014, 8:50 PM), <http://www.baltimoresun.com/news/maryland/politics/bs-md-voting-machines-20141216-story.html>.

<sup>72</sup> *Id.*

leaders to “urge voters to cast paper absentee ballots instead.”<sup>73</sup>

Thus, in 2007, the Maryland General Assembly unanimously passed Chapter 548 of the 2007 Acts.<sup>74</sup> This bill required a new voter-verifiable paper record voting system to replace the touchscreen voting system, which had proven susceptible to hacks and glitches.<sup>75</sup> However, budget concerns delayed funding for the new system until 2014, as estimates indicated switching to the voter-verifiable paper system would cost the state \$28.1 million.<sup>76</sup> Ultimately, the State Board of Elections’ contract to lease new voting equipment was finalized in December 2014, and the system was used for the first time in the 2016 presidential election.<sup>77</sup> Other states like California and Ohio, have addressed the issue by adding printers to their touch-screen machines allowing for a backup paper trail if necessary.<sup>78</sup>

In the summer of 2017, the Virginia State Board of Elections also moved to do away with touchscreen voting machines, imposing the state’s November elections as the deadline for phasing out all such machines.<sup>79</sup> This decision came in the wake of Virginia’s Department of Elections recommending the decertification of touchscreen voting machines.<sup>80</sup> The recommendation was made “after security

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<sup>73</sup> *Id.*

<sup>74</sup> 2007 Bill Text MD H.B. 18 (May 17, 2007).

<sup>75</sup> *Id.*

<sup>76</sup> Voting Systems, MD. STATE BD. OF ELEC., [http://www.elections.state.md.us/voting\\_system/learn\\_about\\_the\\_new\\_voting\\_system.html](http://www.elections.state.md.us/voting_system/learn_about_the_new_voting_system.html).

<sup>77</sup> *Id.*

<sup>78</sup> Andy Sullivan, *Despite Flaws, Paperless Voting Machines Remain Widespread in the U.S.*, REUTERS (Sep. 20 2016, 7:38 AM), <https://www.reuters.com/article/us-usa-election-machines/despite-flaws-paperless-voting-machines-remain-widespread-in-the-u-s-idUSKCN11Q0EU>.

<sup>79</sup> *Id.*

<sup>80</sup> *Id.*

experts breached numerous types of voting machines with ease at the DEF CON cybersecurity conference in Las Vegas in July 2017.<sup>81</sup> It is also not coincidental that the move came amid “heightened concerns over foreign interference in future elections, in light of the U.S. intelligence community’s conclusion that Russia used cyber-attacks and disinformation to interfere in the 2016 presidential election.”<sup>82</sup> This however was not the first time Virginia faced dilemmas in regards to voting technology. In 2015 Virginia decertified thousands of insecure WinVote machines.<sup>83</sup> A security researcher describing the matter stated, anyone within a half mile could have modified every vote, undetected without any technical expertise.<sup>84</sup> Therefore, the serious implications of these security vulnerabilities are beginning to be addressed at the state level.

#### **IV. THE STATE OF ELECTRONIC VOTING TODAY**

Today, there are many ways Americans cast their votes. Roughly 80% of Americans vote with paper ballots or vote on machines that leave a paper trail.<sup>85</sup> However, that leaves 20% of Americans casting ballots with no paper record. Voters in “Delaware, Georgia, Louisiana, New Jersey, and South Carolina all use machines with no paper trail, as do

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<sup>81</sup> *Id.*

<sup>82</sup> *Id.*

<sup>83</sup> Kim Zetter, *Virginia Finally Drops America’s ‘Worst Voting Machines’*, WIRED (Aug. 17, 2015 7:00 am), <https://www.wired.com/2015/08/virginia-finally-drops-americas-worst-voting-machines/>.

<sup>84</sup> *Id.*

<sup>85</sup> A.J. Vicens, *Trump Says the Election Will Be Rigged. In These States, It May Be Impossible to Prove Him Wrong*, MOTHER JONES (Aug. 9, 2016, 4:59 PM), <https://www.motherjones.com/politics/2016/08/millions-voters-could-cast-ballots-machines-leave-no-paper-trail/>.

voters in some parts of Texas, Tennessee, Indiana, Kentucky, Virginia, Pennsylvania, Arkansas, Kansas, Mississippi, and Florida.”<sup>86</sup> These counties, in sum, had more than 60 million registered voters as of November 2014, a sizable portion of the entire voting population.<sup>87</sup> The scale of this problem is particularly troubling, as errors, whether malicious or unintentional, could alter the results of not only state and local elections, but also national elections. Thus, this problem concerns voters regardless of whether they reside in jurisdictions that use non paper-verifiable voting methods.

## V. IMPLICATIONS IN THE STATES

The 2016 presidential election demonstrated the particular vulnerabilities of electronic voting systems. On November 8, 2016, in Durham, N.C., electronic poll books used to check voter registration malfunctioned in the morning, forcing voters to wait in long lines and use paper back-up copies.<sup>88</sup> In response, the Southern Coalition for Social Justice filed a lawsuit “in hopes of forcing the Durham County Board of Elections to keep polls open an additional 90 minutes.”<sup>89</sup> Ultimately, voting was “extended by the state Board of Elections for up to an hour in eight precincts affected by the malfunctions.”<sup>90</sup>

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<sup>86</sup> *Id.*

<sup>87</sup> *Id.*

<sup>88</sup> Mark Berman, William Wan, & Sari Horwitz, *Voters Encounter Some Malfunctioning Machines, Other Headaches on Election Day*, WASH. POST (Nov. 8, 2016), [https://www.washingtonpost.com/news/post-nation/wp/2016/11/08/election-day-voters-report-long-lines-intimidation-and-confusion-in-some-parts-of-the-country/?utm\\_term=.b5b16ae87eeb](https://www.washingtonpost.com/news/post-nation/wp/2016/11/08/election-day-voters-report-long-lines-intimidation-and-confusion-in-some-parts-of-the-country/?utm_term=.b5b16ae87eeb).

<sup>89</sup> *Id.*

<sup>90</sup> *Id.*

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Meanwhile, in Colorado “portions of the state’s voter-verification system went down for about 30 minutes in the afternoon, briefly forcing state officials to issue provisional ballots to an undisclosed number of voters, and also briefly preventing them from processing mail ballots.”<sup>91</sup> In Washington County, Utah, election officials had “to scramble to get electronic voting machines back up and running after machines at many precincts failed to operate immediately after polls opened at 7 a.m.”<sup>92</sup> Only 99 of the 380 machines had correctly programmed memory cards.<sup>93</sup> Similar electronic voting machine malfunctions slowed lines in Philadelphia, Detroit, and Manhattan.<sup>94</sup>

On the other hand, in Maryland, where paper ballots were utilized for the first time in over a decade, some voters also faced delays.<sup>95</sup> In Baltimore County, voters reported more than two-hour waits in precincts with only one ballot scanner.<sup>96</sup> In several polling places the scanners broke down, “requiring voters to place their ballot sheets into secured boxes affixed to the machines”.<sup>97</sup> However, ultimately, fewer than 20 of the 2,900 ballot scanners malfunctioned on Election Day in the state, a relative success.<sup>98</sup> A far better result than in 2004 where reports

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<sup>91</sup> Richard Wolf & Kevin McCoy, *Voters in Key States Endured Long Lines, Equipment Failures*, USA TODAY (Nov. 8, 2016, 6:03 AM), <https://www.usatoday.com/story/news/politics/elections/2016/11/08/voting-polls-election-day/93201770/>.

<sup>92</sup> *Id.*

<sup>93</sup> *Id.*

<sup>94</sup> *Id.*

<sup>95</sup> Doug Donovan & Scott Dance, *Election Hiccups in Maryland: Delays, Long Lines, Adjusting to Paper Ballots*, BALT. SUN (Nov. 8, 2016 10:52 p.m.), <http://www.baltimoresun.com/news/maryland/politics/bs-md-election-day-20161108-story.html>.

<sup>96</sup> *Id.*

<sup>97</sup> *Id.*

<sup>98</sup> *Id.*

showed “voters in three counties never even saw the Senate primary on their voting machine screens.”<sup>99</sup>

Beyond the typical malfunctions and glitches, malicious hacking also plagued the 2016 presidential election. While there is no evidence of manipulation of voting or tabulation machines, breaches of election-related data did occur.<sup>100</sup> For example, in Arizona and Illinois, Russian hackers breached the states’ internet-linked voter registration databases.<sup>101</sup> The exposure of these registration databases is particularly troubling as in nearly every state, one cannot vote if he or she is not registered.<sup>102</sup> Thus, such breaches can indirectly affect election integrity. Furthermore, these breaches, regardless of their direct impact, can have further repercussions by undermining public confidence in the election system’s integrity more broadly.<sup>103</sup>

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<sup>99</sup> Merrill Fabry, *A Brief History of Voting Problems on Election Day*, TIME (Nov. 8, 2016), <http://time.com/4531415/history-voting-problems-election-day/>.

<sup>100</sup> Ellen Nakashima, *Russian Hackers Targeted Arizona Election System*, WASH. POST (Aug. 29, 2016), [https://www.washingtonpost.com/world/national-security/fbi-is-investigating-foreign-hacks-of-state-election-systems/2016/08/29/6e758ff4-6e00-11e6-8365-b19e428a975e\\_story.html?utm\\_term=.4d78656ea220](https://www.washingtonpost.com/world/national-security/fbi-is-investigating-foreign-hacks-of-state-election-systems/2016/08/29/6e758ff4-6e00-11e6-8365-b19e428a975e_story.html?utm_term=.4d78656ea220).

<sup>101</sup> *Id.*

<sup>102</sup> Eli Watkins, *How to Register to Vote in Every U.S. State and Territory*, CNN (Oct. 12, 2016), <https://edition.cnn.com/2016/08/14/politics/how-to-register-to-vote-in-every-us-state-and-territory/index.html>.

<sup>103</sup> Massimo Calabresi, *Election Hackers Altered Voter Rolls, Stole Private Data, Officials Say*, TIME (Jun. 22, 2017), <http://time.com/4828306/russian-hacking-election-widespread-private-data/>.

## VI. THE CASE FOR SECURE AND STANDARD VOTING TECHNOLOGY

Ultimately, voting technology is almost entirely controlled at the state level.<sup>104</sup> In the United States there are no mandatory standards for voting technologies set by the federal government.<sup>105</sup> However, there are voluntary standards for computer-based voting systems developed by the Federal Election Commission at the direction of Congress.<sup>106</sup> Additionally, the administration of elections is nearly always handled at the county or local level.<sup>107</sup> As a result of this form of administration, there is a great amount of variability regarding the way Americans vote from precinct to precinct. In fact, almost all states use more than one voting technology, and a number of states use all five forms of technology.<sup>108</sup> Thus, the United States, which began its democracy with only one method for casting votes, now has a patchwork approach to voting that has only been exacerbated in recent decades by the introduction of several new voting technologies.<sup>109</sup> Despite this variance in voting methods, what the various jurisdictions have in common is plaguing election administration concerns over efficiency and reliability.

Interestingly, a natural convergence among the states, in regards to resolving these issues, is currently occurring. Voting through the use of scan-technology has

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<sup>104</sup> Help America Vote Act of 2002, Pub. L. No. 107-252, 116 Stat. 1666 (2002).

<sup>105</sup> *Id.*

<sup>106</sup> 52 U.S.C. § 20921 (2018).

<sup>107</sup> Election Administration at State and Local Levels, NAT'L CONF. OF STATE LEGISLATURES (Jun. 15, 2016), <http://www.ncsl.org/research/elections-and-campaigns/election-administration-at-state-and-local-levels.aspx>.

<sup>108</sup> Desilver, *supra* note 13.

<sup>109</sup> *Id.*

been occupying an increasingly larger portion of precincts since 2006.<sup>110</sup> This is a positive trend as it indicates a solution to these ongoing dilemmas might finally be emerging. While no solution can fix every problem, scan-technology appears to be the most effective in this regard. Furthermore, this trend is likely to continue as more than 40 out of 50 states have plans to update their voting machinery before the 2020 election.<sup>111</sup>

This shift to scanned ballots is likely to address many of the issues seen consistently throughout the spectrum of voting technology. Paper ballots are generally considered superior to electronic voting machines in terms of verifiability.<sup>112</sup> Even machines that are high end and well maintained cannot sufficiently address the systemic issues of electronic voting. The inability to manually recount, to properly audit, to prevent rigging and widespread fraud, simply cannot be divorced from DRE machines.<sup>113</sup> Yet, simply relying on paper ballots is time consuming in terms of counting, and as a result, a nearly obsolete practice.<sup>114</sup> Scanned ballots overcome this issue of efficiency, while still offering a back-up trail to identify inconsistencies and verify results if issues do arise.<sup>115</sup> Furthermore, scanned ballots address the issue of decipherability due to human variance, as the scanner indicates if a form is not sufficiently

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<sup>110</sup> *Id.*

<sup>111</sup> Michael Wines, *Wary of Hackers, States Move to Upgrade Voting Systems*, N.Y. TIMES (Oct. 14, 2017), <https://www.nytimes.com/2017/10/14/us/voting-russians-hacking-states-.html>.

<sup>112</sup> Selena Larson, *100 Experts Tell Congress How to Improve Election Security*, CNN (Jun. 21, 2017 1:30, PM), <http://money.cnn.com/2017/06/21/technology/voter-security-letter-sent-to-congress/index.html>.

<sup>113</sup> Brian Barrett, *America's Electronic Voting Machines Are Scarily Easy Target*, WIRED (Aug. 2, 2016, 9:57 AM), <https://www.wired.com/2016/08/americas-voting-machines-arent-ready-election/>.

<sup>114</sup> Tokaji, *supra* note 6, at 1719.

<sup>115</sup> *Id.* at 1721-22.

readable, by adhering to certain standards of readability which are necessary for a scanner to function properly.<sup>116</sup>

## CONCLUSION

Ultimately, the pendulum of American electoral politics has swung back in favor of paper-verifiable voting methods, and this trend seems likely to stay. While direct recording electronic voting is incredibly efficient in terms of ballot counting, it simply is too vulnerable to attacks, and does not offer a sufficient fallback so that in the event of a failure, glitch, or attack, the integrity of the vote count is not compromised. On the other end of the spectrum, low technology voting, such as print-ballots, is relatively time consuming, labor intensive, and error-prone due to indecipherability and human mistake. Thus, since 2000, as states moved rapidly from one end of this voting technology spectrum to the other, many of the problems of election integrity remained uncorrected.

Ultimately, the nation is now witnessing a period of correction. Many states are now moving towards a middle ground that incorporates both levels of technology. This is scan-voting technology. This model incorporates the efficiency of high technology voting whilst offering the peace of mind low-technology voting offers. If errors occur, there is a corresponding paper ballot, to ensure verifiability is not lost. Thus it is not surprising that 47% of registered voters live in areas that now use scan-voting technology, with this number projected to rise.<sup>117</sup> Meanwhile, since 2006 direct recording electronic voting has occupied an increasingly smaller percentage of voting precincts, while punch cards and paper ballots have nearly disappeared.<sup>118</sup> Considering

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<sup>116</sup> *Id.*

<sup>117</sup> Desilver, *supra* note 13.

<sup>118</sup> *Id.*

the continued issues with DRE voting integrity, and the relative inefficiency and risk of human error associated with low technology voting, this trend is logical.

Voting technology in the United States stands as a reminder of the importance of centered responses. Each election cycle, the nation endeavors to rectify issues learned from past elections, however, this has led to over correction and the discovery of new obstacles to election integrity. These endeavors have often come at a lofty price. Ultimately, however, in the last decade states have reckoned with this conundrum, and responded appropriately, leading the nation to a much-needed, and increasingly closer, standard voting technology equilibrium—the shift towards scan-voting technology.