



# There's an App for That: **Digital Contact Tracing** and Its Role in Mitigating a Second Wave

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## Executive Summary

This report provides a guide for decision makers who are considering implementing a digital contact tracing system in order to combat potential subsequent waves of the novel coronavirus in the United States. Though the report focuses primarily on the Bluetooth Low Energy (BLE) approach offered by Apple and Google, it examines decisions and principles that are applicable across the range of possible digital contact tracing systems. We have written this guide with a non-technical audience in mind, and outline the core policy considerations involved in both the design and implementation of such a system. Throughout the report, we recognize the ways in which digital contact tracing may face a trade-off between system effectiveness and privacy concerns, and examine ways in which decision makers can maximize efficacy without significantly compromising user privacy.

The considerations laid out in this report are time sensitive and should be analyzed with appropriate urgency. Tech companies such as Apple and Google have already begun constructing BLE contact tracing technology: policymakers who seek to influence this tech are best positioned to do so now, while it is still in development. Additionally, the earlier a BLE contact tracing system is launched, the more effective it will be in helping to contain the spread of COVID-19. If BLE contact tracing is attempted after a second wave of the virus has already begun, it is unlikely to be particularly effective. Given that the creation of this tech and the decisions surrounding if and how it should be implemented will take time, we urge decision makers to start assessing the options discussed in this report immediately.

The report begins by discussing the employment of mass contact tracing as part of the United States' longer-term COVID-19 response strategy, and suggesting that digital contact tracing could be a desirable addition to that effort given that it is less labor and resource intensive than traditional contact tracing. We focus on BLE both as this approach seems to have been gaining the most momentum and as it arguably best balances the trade-off between efficacy and privacy when compared to other contact tracing methods, both digital and traditional (though it's important to note that any one of a large number of implementation decisions could shift the efficacy or privacy protectiveness of a given contact tracing method).

There are three potential models for a BLE contact tracing system based off of the current Apple/Google proposal:

- **New App Model:** This is the first phase of the Apple/Google plan, in which the companies have already released an API (Application Programming Interface: the

kind of software that will enable BLE contact tracing) that allows health authorities to develop BLE-based contact tracing apps which can then be made available for download by the public.

- **OS Model:** In this second phase of the Apple/Google plan, Apple and Google would integrate BLE capability directly into their respective mobile users' operating systems, allowing devices to collect and transmit BLE data as a core function, even before downloading externally developed apps.
- **Pre-Existing App Model:** In this model, an already existing mobile application like Facebook would integrate Apple/Google's software into an update of that app.

The OS model is the most likely choice, as it has both the support of Apple and Google and the highest predicted public participation rate. High public participation is crucial, considering that a 60% participation rate is required for BLE contact tracing to be effective on its own without being combined with other more invasive or non-anonymized data. The OS model would also be the easiest to make compulsory if necessary: Apple and Google would need to push automatic updates onto smartphones that remove any opt-in and disabling capabilities.

In addition to a comparison of the three potential BLE models, the report also discusses a number of general design concerns for decision makers to assess. These include:

- **How to authenticate positive cases.** In order to prevent people from falsely claiming they have tested positive and destroying the validity of the app, an authentication method (such as a QR code or temporary pin number) that can be enacted by public health officials after a person tests positive must be employed.
- **Time and distance parameters.** An app with strict time and distance parameters would result in more meaningful potential exposure alerts but risks being underinclusive and creating a false negative problem where potentially exposed individuals are not notified. An app with looser time or distance parameters risks being overinclusive and creating a false positive problem, where a plethora of potential exposure alerts may lead to either public apathy or mass hysteria.
- **Mandatory vs. consent based.** While a mandatory system would obviously increase crucial participation rates, such a system is unlikely to be used in the U.S. due to its political unpopularity and Apple/Google's resistance to the idea. What notice should be given to users before requiring their consent to participate in BLE contact tracing carries practical and normative considerations that must be weighed by advocates, tech companies, and government.
- **Type of data collected.** The Apple/Google API is consciously developed in a way that preserves privacy and data security. Additional data collected alongside BLE anonymized IDs (e.g. if a user was wearing a mask, date/time, etc.) can increase

the efficacy of a BLE contact tracing system but must be weighed against the further privacy concerns and risks of re-identification that it creates.

- **Centralized data vs. decentralized data.** Apple and Google have insisted any data gathered through their API must be decentralized. An app could theoretically collect centralized BLE data on their own without the API, but this would require the app to be running in the foreground of a user's phone at all times. It is also unclear how useful centralized BLE contact tracing data would actually be to public health authorities, especially given that health officials already have other ways of obtaining useful centralized analytics.

After a BLE contact tracing system is designed, a variety of implementation factors can impact the success of the system. The report covers a number of key implementation decisions for decision makers to consider when determining how to best utilize BLE technology, or whether to utilize it at all:

- **How should users be advised to respond to an alert?** Having received a notification of potential exposure on your phone, we can imagine a range of possible responses from least intrusive (doing nothing) to most intrusive (self-quarantining for two weeks). Whether the BLE design used is underinclusive (i.e. false negatives), perfectly inclusive, or overinclusive (i.e. false positives) should inform how users should respond to exposure alerts.
- **How can authorities encourage alert compliance?** Again, there is a range of responses authorities can take here that should be determined based on the inclusivity of the app design. Potential government responses include doing nothing, education and communication, resource allocation, and enforcement.
- **Supplementing vs. replacing traditional contact tracing.** BLE contact tracing is extremely unlikely to be able to replace traditional contact tracing due to the high participation rate it requires from a target populace in order to be effective on its own. Rather, BLE contact tracing will likely be implemented as a supplement to traditional contact tracing.
- **One app vs. many apps.** While having state apps would allow for customization, flexibility, and resilience, it is nonetheless likely better to have a single federal app. A nationwide app can still provide state specific information, but it also accounts for interstate travel, is more time-efficient and cost-effective (especially given the current strain on state budgets), and will make marketing easier.
- **Promoting equitable access.** There are a number of serious equity concerns regarding BLE contact tracing. First, 19% of U.S. adults do not own a smartphone: this lack of access to a BLE-capable mobile device disproportionately impacts low income populations. Groups like Covid Watch are exploring ways to develop inexpensive Bluetooth devices, but it's crucial that such devices can be worn or carried unobtrusively so as not to serve as a marker signaling out lower income

Americans. Indigenous peoples and older adults are two additional populations at risk of having inequitable access to the benefits of digital contact tracing.

Individual privacy concerns are at the core of current discussions surrounding BLE contact tracing. This report provides three key ways in which to consider these privacy concerns: what *can* be, what *ought* to be, and what *will* be. To the first end of what *can* be, we provide an overview of the ongoing discussion surrounding potential constitutional constraints on BLE contact tracing, with a focus on Fourth Amendment privacy rights and states' police powers. In the normative context of what *ought* to be, we present a summary of three publicly proposed data rights frameworks designed to maximize privacy protection in a BLE contact tracing system. Finally, we describe the capacity for illegal private sector privacy invasion (and the potential for subsequent discrimination) that *will* be inherently created by individuals' receipt of BLE contact tracing exposure notifications. These illegal potential privacy invasions include employers and landlords demanding to see individual's possible exposure alerts and discriminating against workers and tenants based on the results of those alerts.

Finally, this report considers who should be in charge of making the decisions previously outlined. While government and tech companies have been presumed by many to be the natural executors of any digital contact tracing system, both of these actors face severe limitations. We recommend that Jonathan Zittrain's 'Process Era' digital governance framework be used to create the decision making apparatus that will govern a BLE contact tracing system. We then propose that, in line with the Process Era framework, an independent board or stakeholder board may be the best entity to govern BLE contract tracing.

## Introduction

As the United States begins to map out its longer-term COVID-19 response strategy, contact tracing will almost surely be part of the solution. As the name suggests, contact tracing is a process that works to identify everyone an infected individual could have potentially spread the infection to over a preceding period of time (in the case of COVID-19, likely the prior two weeks).<sup>2</sup> Those identified individuals are then notified and can be asked to take certain actions, like getting tested or self-quarantining, in order to stop the disease's spread. Public health officials have long utilized this strategy to contain other infectious diseases, ranging from a small measles outbreak in Oklahoma<sup>3</sup> to the 2014 Ebola outbreak in West Africa.<sup>4</sup> Indeed, contact tracing has already proven effective to slow the spread of COVID-19 across the world; countries like China,<sup>5</sup> South Korea,<sup>6</sup> and Singapore<sup>7</sup> rolled out contact tracing efforts early in the spread of the disease in order to contain the worst of the outbreak.

But 'traditional' human-powered contact tracing is highly resource intensive. Trained contact tracers must interview infected patients in minute detail to learn about all of their whereabouts and interactions, which can take hours and be fruitless if patients don't remember their recent contacts.<sup>8</sup> This is followed by more hours spent calling potentially hundreds of people and convincing them to get tested or self-quarantine (and later following up to ensure compliance). To respond to COVID-19, public health

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<sup>2</sup> "Contact Tracing," *World Health Organization*, May 9, 2017, <https://www.who.int/news-room/q-a-detail/contact-tracing>.

<sup>3</sup> Eric Boodman, "Speed is critical: As coronavirus spreads in U.S., officials face daunting task of tracing case contacts," *Stat*, March 1, 2020, <https://www.statnews.com/2020/03/01/speed-is-critical-as-coronavirus-spreads-in-u-s-officials-face-daunting-task-of-tracing-case-contacts/>.

<sup>4</sup> World Health Organization, "Contact Tracing During an Outbreak of Ebola Virus Disease," September 2014, <https://www.who.int/csr/resources/publications/ebola/contact-tracing-during-outbreak-of-ebola.pdf>.

<sup>5</sup> World Health Organization, "Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19)," February 16-24, 2020, <https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf>.

<sup>6</sup> Dennis Normile, "Coronavirus cases have dropped sharply in South Korea. What's the secret to its success?" *Science Magazine*, March 17, 2020, <https://www.sciencemag.org/news/2020/03/coronavirus-cases-have-dropped-sharply-south-korea-what-s-secret-its-success>.

<sup>7</sup> Dean Koh, "Singapore government launches new app for contact tracing to combat spread of COVID-19," *Mobi Health News*, March 20, 2020, <https://www.mobihealthnews.com/news/asia-pacific/singapore-government-launches-new-app-contact-tracing-combat-spread-covid-19>.

<sup>8</sup> Boodman, "Speed is critical: As coronavirus spreads in U.S., officials face daunting task of tracing case contacts."

researchers have called for as many as 100,000<sup>9</sup> to 300,000<sup>10</sup> contact tracers to implement a successful system nationwide (compared to the estimated 2,200 contact tracers currently in place<sup>11</sup>). While cities and states have already begun making efforts to meet this target<sup>12</sup>, there's a long way to go for public health agencies that are already facing severe resource constraints. And, given the speed of COVID-19's viral spread, some researchers have argued manual contact tracing will never be fast enough to control the disease.<sup>13</sup>

This has naturally spurred discussion around how the United States can leverage digital technology to aid the contact tracing effort. And with more than 80 percent of Americans carrying around a smartphone,<sup>14</sup> Bluetooth-enabled handheld devices have become the focal point of this digitally-enabled strategy. In theory, digital contact tracing can help solve two of the biggest problems with traditional contact tracing. First, it can identify far more people who may have interacted with an infected person than traditional contact tracing, where the infected person may not be able to remember or identify potential contacts. Second, digital contact tracing is significantly faster than laborious in-person interview and phone calls.

But the great promise of digitally-enabled contact tracing also opens up a Pandora's box of serious questions and concerns. For example, how should mobile applications and contact tracing procedures be designed to balance effectiveness with patient privacy and anonymity? How do we prevent a digital surveillance system from being abused by future government actors? How can public health departments incorporate smartphone data into their virus response in an equitable way? This report attempts to identify these open questions for decision makers to consider along each step of a digitally-enabled contact tracing response, and provides suggestions to maximize the effectiveness and minimize the harm of such a system.

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<sup>9</sup> Nicole Westman, "What is contact tracing?" *The Verge*, April 10, 2020, <https://www.theverge.com/2020/4/10/21216550/contact-tracing-coronavirus-what-is-tracking-spread-how-it-works>.

<sup>10</sup> Tom Frieden, "I Used to Run the C.D.C. Here's What It Can Do to Slow This Pandemic." *New York Times*, April 12, 2020, <https://www.nytimes.com/2020/04/12/opinion/cdc-coronavirus.html>.

<sup>11</sup> Association of State and Territorial Health Officials, April 10, 2020, <https://www.astho.org/Federal-Government-Relations/Correspondence/ASTHO-Issues-Contact-Tracing-Memo-to-Congress/>.

<sup>12</sup> For example, Massachusetts, for example, is allocating \$44 million to hire 1,000 contact tracers. Ellen Barry, "An Army of Virus Tracers Takes Shape in Massachusetts," *The New York Times*, April 16, 2020, <https://www.nytimes.com/2020/04/16/us/coronavirus-massachusetts-contact-tracing.html>.

<sup>13</sup> Luca Ferretti et al., "Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing," *Science*, March 31, 2020, <https://science.sciencemag.org/content/early/2020/04/09/science.abb6936>.

<sup>14</sup> Pew Research, "Mobile Fact Sheet," June 12, 2019, <https://www.pewresearch.org/internet/fact-sheet/mobile/>.



The United States is likely too far along in *this* wave of the pandemic for contact tracing to successfully combat the virus; there are too many infections, community spread is too extensive, and much of the general population is sheltering in place.<sup>15</sup> But public health officials view mass contact tracing as a key component in suppressing potential subsequent waves of COVID-19.<sup>16</sup> If there are indeed significant subsequent waves of the virus, it's not clear that continuing even intermittent serious social distancing measures, such as stay at home orders, will be feasible either politically or economically. Social discontent with these measures is growing<sup>17</sup>, and the economic damage has been enormous with some estimates citing over 20 million reported job losses in the U.S. in three weeks.<sup>18</sup>

It is therefore imperative that local, state, and federal governments, along with the private sector, start to make these difficult decisions *now* to ensure that we are ready to deploy a contact tracing infrastructure that is effective, secure, and respectful of our civil liberties if the need arises in the predicted second wave.

#### *A Note on Public Health Capabilities*

While this report focuses specifically on contact tracing, this is but one piece of a robust pandemic response. Contact tracing relies on other public health functions working well, including ample, swift, and accessible testing (public health experts have called for up to a million tests per week<sup>19</sup>); adequate data collection, information, and notification systems; healthcare worker training; sufficient PPE and other essential health equipment; and public buy-in. Without a cohesive, system-wide response, digitally-assisted contact tracing will almost certainly fall short.

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<sup>15</sup> Jacob Gershman, "A Guide to State Coronavirus Lockdowns," *Wall Street Journal*, April 25, 2020, <https://www.wsj.com/articles/a-state-by-state-guide-to-coronavirus-lockdowns-11584749351>.

<sup>16</sup> Scott Gottlieb, MD et al., "National Coronavirus Response: A Road Map to Reopening," *AEI*, March 28, 2020, <https://www.aei.org/wp-content/uploads/2020/03/National-Coronavirus-Response-a-Road-Map-to-Recovering-2.pdf>.

<sup>17</sup> Though it's important to note that a significant majority of Americans still support stay at home orders, with 81% saying they would support a national stay at home order in early April. "Fauci, Governors Get Highest Marks For Response To Coronavirus, Quinnipiac University National Poll Finds; Majority Say Trump's Response Not Aggressive Enough," *Quinnipiac University*, April 8, 2020, <https://poll.qu.edu/national/release-detail?ReleaseID=3658>.

<sup>18</sup> Chuck Jones, "One Chart Shows Coronavirus' Stunning Job Losses," *Forbes*, April 18, 2020, <https://www.forbes.com/sites/chuckjones/2020/04/18/one-chart-shows-coronavirus-stunning-job-losses/#65549ffc7fb0>.

<sup>19</sup> Aaron E. Carroll, "We Need 1 Million Tests a Week," *The Atlantic*, March 31, 2020, <https://www.theatlantic.com/ideas/archive/2020/03/we-need-1-million-tests-week/609154/>.



## Section 1: Why Focus on Bluetooth-Based Contact Tracing?

Digital technology has the potential to scale the benefits of traditional contact tracing to a virus as infectious as COVID-19. A recent Oxford study suggests that contact tracing can only effectively contain the current viral spread if it includes a robust digital component,<sup>20</sup> and many have argued that mass quarantine restrictions can only safely be lifted with a digital contact tracing scheme in place.<sup>21</sup>

Digital contact tracing has been attempted previously, when two Cambridge researchers developed an app called FluPhone to stem the spread of influenza.<sup>22</sup> Though the app never quite caught on, the rapid proliferation of smartphones over the last nine years has changed the game, and many proposals have emerged that build on FluPhone's basic premise to address COVID-19. A number of East Asian countries have already found some success in using digital contact tracing to lessen the spread of COVID-19, but are largely employing data-invasive approaches that Western societies appear unwilling to adopt.<sup>23</sup> Some proposals, such as MIT's Private Kit,<sup>24</sup> promise innovative ways to preserve the usefulness of location data while making its use secure and anonymous. Location data is perhaps a familiar tool to many, already used by a multitude of apps to ostensibly improve user experience. It could likewise be a powerful tool for health authorities and governments to track the virus's spread from a bird's-eye view, creating heat maps and monitoring mobility trends. Indeed, Google,<sup>25</sup> Facebook,<sup>26</sup> and Apple<sup>27</sup> (just to name a few) are already making anonymized data sets available to the public for such use; and Palantir has acquired numerous contracts to do so for governments around the world.<sup>28</sup>

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<sup>20</sup> Luca Ferretti et al., "Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing," *Science*, March 31, 2020, <https://science.sciencemag.org/content/early/2020/04/09/science.abb6936>.

<sup>21</sup> See "App-based contact tracing may help countries get out of lockdown," *The Economist*, April 16, 2020, <https://www.economist.com/science-and-technology/2020/04/16/app-based-contact-tracing-may-help-countries-get-out-of-lockdown>.

<sup>22</sup> Jon Crowcroft and Eiko Yoneki, "FluPhone: disease tracking by app," *University of Cambridge: Research*, April 21, 2011, <https://www.cam.ac.uk/research/news/fluphone-disease-tracking-by-app>.

<sup>23</sup> Fred Vogelstein and Will Knight, "Health Officials Say 'No Thanks' to Contact-Tracing Tech," *WIRED*, May 8, 2020, <https://www.wired.com/story/health-officials-no-thanks-contact-tracing-tech/>.

<sup>24</sup> Massachusetts Institute of Technology, "Welcome to Private Kit," April 2020, <https://privatekit.mit.edu/>.

<sup>25</sup> Google LLC, "COVID-19 Community Mobility Reports," April 2020, <https://www.google.com/covid19/mobility/>.

<sup>26</sup> COVID-19 Mobility Data Network, "Facebook Data for Good Mobility Dashboard," April 2020, <https://visualization.covid19mobility.org/>.

<sup>27</sup> Apple, Inc., "COVID-19 Mobility Trends Reports," April 2020, <https://www.apple.com/covid19/mobility>.

<sup>28</sup> Tom McKay, "Trump Admin Gives Coronavirus Tracking Contract to Peter Thiel's Palantir: Report," April 21, 2020, <https://gizmodo.com/trump-admin-gives-coronavirus-tracking-contract-to-pete-1842994647>.

But using such data to track individuals' health is a different issue, and amplifies already hotly-debated privacy issues, meaning the function of centralized data analysis is best done separately from individualized, health-related data used for contact tracing. Even if such problems could be rapidly solved (for instance, through the type of anonymization promised by Private Kit), the reliability of location data for contact tracing is questionable at best. By current best estimates, such data is likely only accurate to within 7-13 meters in urban areas.<sup>29</sup> It could, perhaps, be paired with other types of data already collected by many apps to improve accuracy significantly. But using location data alone to accurately determine whether device users were within the zone of infection would be difficult, and could vary substantially by the type of device and the user's environment.

### 1.1: Features and Bugs of BLE Contact Tracing

Another approach, however, has potential to make digital contact tracing both feasible and privacy-preserving—potentially providing a path for authorities to lift restrictions while keeping tabs on the virus's spread. And a recent partnership between Apple and Google<sup>30</sup> based on this alternate approach (using Bluetooth Low Energy, or “BLE,” to anonymously log smartphones' “contacts” with each other) now has considerable momentum. In fact, groups ranging from MIT developers<sup>31</sup> to a broader coalition of tech, privacy, and epidemiology experts<sup>32</sup> to leading European researchers<sup>33</sup> all seem to agree that BLE is the right way forward. At least three countries have already released apps built on the Apple-Google framework, with many others planning to do so.<sup>34</sup> While details vary in each possible implementation (and these details matter), the Apple/Google approach preserves the essential elements of initial BLE proposals while adding the momentum that comes naturally with the tech giants' actions.

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<sup>29</sup> Krista Merry and Pete Bettinger, “Smartphone GPS accuracy study in an urban environment,” *PLOS.org*, July 18, 2019, <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0219890>.

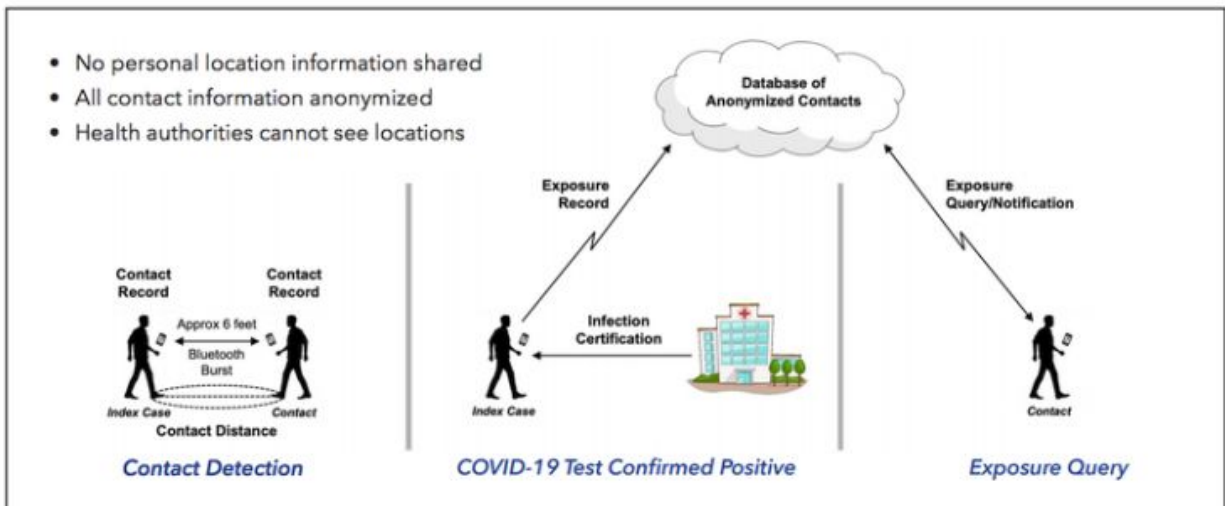
<sup>30</sup> Apple, Inc., and Google LLC, “Privacy-Preserving Contact Tracing,” April 2020, <https://www.apple.com/covid19/contacttracing>.

<sup>31</sup> MIT, Boston University, Brown University, Massachusetts General Hospital, and more came together to develop a BLE-based proposal for digital contact tracing. See PACT: Private Automated Contact Tracing, “Private Automated Contact Tracing,” April 2020, <https://pact.mit.edu/>.

<sup>32</sup> TCN Coalition, “A Global Coalition for Privacy-First Digital Contact Tracing Protocols to Fight COVID-19,” April 2020, <https://tcn-coalition.org/>.

<sup>33</sup> “DP3T” is currently the leading proposal for digital contact tracing in Europe, with broad similarities to Apple and Google's approach, but disagreements over certain data handling features. See DP-3T, “Decentralized Privacy-Preserving Proximity Tracing,” *GitHub*, April 12, 2020, <https://github.com/DP-3T/documents/blob/master/DP3T%20White%20Paper.pdf>.

<sup>34</sup> Cristina Criddle and Leo Kelion, “Coronavirus contact-tracing: World split between two types of app,” May 7, 2020, <https://www.bbc.com/news/technology-52355028>.



PACT

Figure 1: The basics of the BLE contact tracing process shown in a diagram from MIT’s PACT, whose design is similar in most regards to the Apple/Google proposal. Source: <https://pact.mit.edu/>.

At its core, BLE leverages the Bluetooth capability embedded in every smartphone to allow devices to “chirp” anonymous ID codes to one another when they’re within a specified range. To further ensure de-identification, the Apple/Google approach uses multiple layers of anonymous ID codes, with the “public” ID (the one broadcast to other phones) changing every 15 minutes. Each device keeps track of the anonymous ID codes it has come in contact with, along with its own list of changing anonymous IDs, storing that log securely on the device. If a user tests positive for the virus, they can then choose (in consultation with a healthcare provider) to broadcast their “log” of anonymous keys to the network, notifying other devices who came in contact with the infected user’s device. While the Apple/Google approach leaves open a variety of design choices for those actually implementing contact tracing (discussed below), it allows almost every smartphone to store smartphone users’ “memory” of who they’ve come in contact with, drastically reducing the recall issues inherent in traditional contact tracing and expanding the scope of notification—all while keeping contact data anonymous.

This approach is far from perfect, however. Apple and Google plan to use Received Signal Strength Indicator (“RSSI”) to determine when a “contact” has taken place, but research on RSSI’s reliability for such purposes remains scarce. RSSI may be significantly affected by a device’s orientation, meaning a phone upside down in a user’s back pocket (for instance) may register as further away than one held up to a user’s ear.<sup>35</sup> Such flaws could generate misleading results, depending on calibration in

<sup>35</sup> Patrick Howell O’Neill, “Bluetooth contact tracing needs bigger, better data,” *MIT Technology Review*, April 22, 2020,

the software. Apple and Google recently said they are updating the software to make signal detection more accurate, and will continue to do so.<sup>36</sup> This highlights one appealing feature of digital contact tracing: that it can be improved in real time, without re-training armies of professional contact tracers.

For users in compact living situations (such as in urban areas, where contact tracing will likely be most useful), false positives could run rampant if BLE signals penetrate walls, floors, and ceilings between apartments. Developers from both companies have responded to such concerns by arguing that RSSI may indeed be a good indicator of shared airflow that allows contagion; walls may permit weakened signal to pass through only to the extent that units in a building also share some amount of airflow.<sup>37</sup> Maybe so—but BLE data alone is also incapable of logging protective measures, such as whether users are wearing masks. Opportunities for misleading data abound.

And while the companies seem to be working hard to protect privacy, BLE data is nonetheless vulnerable to re-identification of users. Ashkan Soltani, the former CTO of the FTC, recently described in an interview how anybody with a surveillance camera could execute a “correlation attack” in which they match the BLE data collected by their phone with time-stamped video footage to re-identify COVID-positive users of the system. So-called trolls may also take advantage of the system by attaching devices to pets or falsely reporting themselves as COVID-positive.<sup>38</sup> Trolling concerns could be largely addressed by including healthcare providers in the process, requiring their authorization before sending device data to the network.

## 1.2: Balancing Efficacy and Privacy

A brief analysis of the main options for digital contact tracing reveals a challenging trade-off (depicted below): more effective tracing seems to inevitably mean less user privacy. With traditional contact tracing as a starting point, we can see how each approach affects this trade-off. Using all available methods would provide considerable benefits: location and Bluetooth data could be incorporated into one algorithm,

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<https://www.technologyreview.com/2020/04/22/1000353/bluetooth-contact-tracing-needs-bigger-better-data/>.

<sup>36</sup> David Phelan, “Apple & Google Surprise Update to COVID-19 App: Better Privacy, Improved Bluetooth, No Huawei,” *Forbes*, April 24, 2020,

<https://www.forbes.com/sites/davidphelan/2020/04/24/apple-google-reveal-surprise-update-to-covid-19-contact-tracing-better-privacy-more-precise-bluetooth-no-huawei/#1ecee31a6ad9>.

<sup>37</sup> Andy Greenberg, “Does Covid-19 Contact Tracing Pose a Privacy Risk? Your Questions, Answered,” *WIRED*, April 17, 2020,

<https://www.wired.com/story/apple-google-contact-tracing-strengths-weaknesses/>.

<sup>38</sup> *Ibid.*

enhancing each other's accuracy and being further verified by traditional contact tracing. But consolidating multiple types of data further exacerbates privacy concerns. Apple and Google recognize this, and recently announced they won't allow their API (Application Programming Interface: the kind of software that will enable BLE contact tracing) to be combined with use of location data.<sup>39</sup> Of course, if privacy tops the list of concerns, not contact tracing at all will serve that goal—but numerous public and private sector leaders have affirmed the importance of tracing as an essential component of a long-term response. The goal of policymakers, then, should be striking the balance between the privacy and efficacy of a contact tracing system.

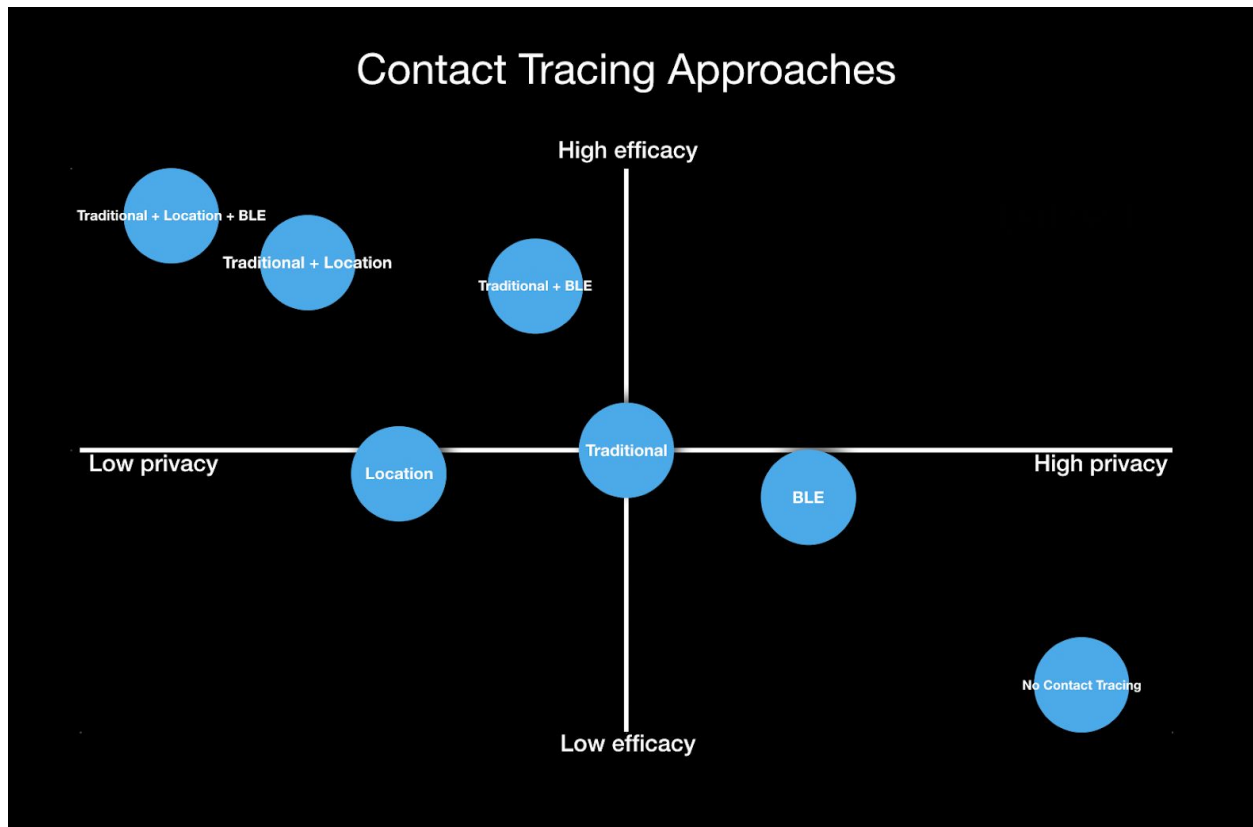


Figure 2: A rough depiction of each of the major approaches' efficacy and privacy preservation in relation to traditional contact tracing. While implementation decisions, participation rates, etc. could drastically change how each is plotted, we attempt to plot them here in the purest form of each technology, if they truly work "as intended."

The trade-off depicted here is admittedly simplified, and isn't meant to obscure other important factors in evaluating which method is best. For instance, some methods will be under-inclusive or over-inclusive in identifying contacts. Traditional contact tracing

<sup>39</sup> Patrick Howell O'Neill, "Google and Apple ban location tracking in their contact tracing apps," *MIT Technology Review*, May 4, 2020, <https://www.technologyreview.com/2020/05/04/1001060/google-and-apple-lay-out-rules-for-contact-tracing-apps/>.

provides a high degree of certainty because individuals are only notified once someone has tested positive and recalls being in contact with the notified individual. Patients will likely only identify people they truly had close contact with, so notifications are accurate *when they occur*—but patients’ difficulty in remembering (or ever knowing) those they may have exposed means the traditional method is significantly under-inclusive. BLE provides a more “light touch” approach, collecting less (and more anonymous) data per infected patient, but casting its net wider. But BLE and location data may be over-inclusive. Devices may identify that they have “contacted” each other, but will not know whether users were wearing masks or were separated by particle board—resulting in false positives. Tech-enabled approaches may also be under-inclusive if, as discussed below, participation rates are low or tech is faulty. Numerous decisions could change the efficacy of each method, ranging from how centralized (and therefore useful for analysis) the data is, to whether data is paired with user inputs, and much more.

Likewise, a whole array of implementation decisions could shift each method’s location on the privacy axis. If, for instance, BLE data is collected in a centralized server to make implementation easier, privacy concerns could be significantly higher than depicted. Or if case files produced by traditional contact tracers are destroyed after notification occurs rather than being centralized by a health authority, privacy concerns could be lower than depicted. In each case, the central trade-off between efficacy and privacy remains. But with those central values in view, policymakers can analyze the types of decisions that might move tracing options closer to “high efficacy” without significantly compromising privacy.

Pairing BLE with traditional contact tracing, when carefully implemented, may achieve greater efficacy without adding significant privacy concerns. Under the Apple/Google proposal for BLE tracing, authorities already planning to use traditional contact tracing have a readily available option to increase the efficacy of their system while making minimal privacy compromises. Yes, BLE tracing is flawed. It’s worth noting, however, that few of its flaws are unique to digital contact tracing. Traditional contact tracing, too, is rife with opportunity for missing or misleading data. As discussed throughout this report, any success of BLE contact tracing relies heavily on both a high participation rate and robust, accurate testing. It also relies on a whole range of seemingly minute decisions to be made about implementation. But each of these decisions ultimately face this trade-off between efficacy and privacy, and BLE is a promising way to achieve the former without sacrificing too much of the latter.



## Section 2: Comparison of Different BLE Contact Tracing Models

Since Apple and Google control nearly all US smartphones' operating systems,<sup>40</sup> it seems likely that many U.S. contact tracing apps will utilize the API these companies have developed together. Although the Apple/Google API will likely be the fundamental code for BLE tracing, some of the most consequential questions remain unanswered. Considerations of if, when, how, and by whom the API will be employed have implications that will ultimately determine the content and efficacy of such efforts.

The announcements from Apple and Google indicate that their collaboration has two potential stages: the first, already begun, makes the API available for use in authorized apps (those sponsored by health officials) which will be available for download from each platform's respective app store.<sup>41</sup> The second stage will integrate the API directly into each device's operating system (presumably with an accompanying app), through either an optional or automatic update.<sup>42</sup>

The content of the two stages of the Apple/Google API gives rise to three main ways in which the BLE API could be implemented: as a component of a new app developed by a third party, as an integrated part of each device's operating system, or as a capability added to a pre-existing app. Each of these three options, although sharing the same core technological underpinnings and function, would look very different in terms of how they are installed and put into use. They would also have differing implications for participation rates, privacy levels, government involvement, and overall efficacy.

### 2.1: Descriptions of Each Model

#### *New App Model*

The first potential app implementation of the Google/Apple API corresponds with phase one of the companies' announcement. Using the API, new contact tracing apps developed by federal or state health officials can be made available for download on the Google Play or Apple App Store. After hearing about such apps from media/advertising campaigns, smartphone users who choose to opt-in would have to download one of

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<sup>40</sup> James Vincent, "99.6 Percent of New Smartphones Run Android or iOS." *The Verge*, Feb 16, 2017, [www.theverge.com/2017/2/16/14634656/android-ios-market-share-blackberry-2016](http://www.theverge.com/2017/2/16/14634656/android-ios-market-share-blackberry-2016).

<sup>41</sup> Matthew Panzarino, "Apple and Google are launching a joint COVID-19 tracing tool for iOS and Android." *TechCrunch*, April 10, 2020, <https://techcrunch.com/2020/04/10/apple-and-google-are-launching-a-joint-covid-19-tracing-tool/>.

<sup>42</sup> *Ibid.*

these apps; only then would BLE tracing start for that user, and the tracing system would only include those who have also downloaded such an app.

The biggest variable to this approach is how many apps there would be and what governmental entities would be associated with them. Google and Apple suggest that only apps developed or sponsored by health officials and agencies will be authorized to employ the API. This restriction is crucial to limit the emergence of dozens of privately developed apps, each claiming to provide contact tracing, without governmental authenticity or accountability. Therefore, under this approach, it is possible to have both states and the federal government develop and promote their own app: the trade-off between having one app vs. multiple is discussed below. The common API would allow these different apps to be interoperable (in other words, you'd still be notified if you had a contact with a person who uses a different app and tested positive).

No matter which health officials would develop such apps, under this model they would all have to convince their relevant populations to find and download their app. Given the importance of a high participation rate, the problem lies in getting a large number of compatible smartphone users to (1) find out about the app, (2) open their respective app download store and find the proper application, (3) download the app, and (4) open the app to consent to and activate its use. We know that skepticism, apathy, laziness, and user fatigue all decrease the percentage of people willing to carry out each of those affirmative steps.

The considerable resources each state/health officials and agencies may spend on advertising campaigns to promote their apps may prove to be a less than optimal use of limited contact tracing resources. Additionally, the fact that individuals must navigate their way to the app download may create opportunities for scammers to take advantage of unsophisticated smartphone users searching for the proper app or receiving illegitimate notifications.<sup>43</sup> This legitimacy issue may prompt Apple and Google to send notifications listing the names of the legitimate apps or to ask a series of questions to determine the most appropriate one for a user to download, at which point integrating the API into the OS is only a small leap further.

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<sup>43</sup> See, e.g., Jason Murdock, "POLICE WARN OF CORONAVIRUS TEXT SCAM THAT CONTAINS FAKE ALERT ABOUT POTENTIAL INFECTION," *Newsweek*, April 16, 2020, <https://www.newsweek.com/police-warn-coronavirus-text-message-scam-fake-alert-infection-contact-tracing-1498225>.

### *OS Model*

The second possible utilization of the Apple/Google API relates to phase two of the companies' plan. Under this model, Apple and Google would integrate the API directly into each device's operating system. This modification to all Apple and Android phones would be implemented either by an opt-in or an automatic operating system update. Under this approach, every device which receives the update would immediately begin recording and transmitting encrypted BLE "chirps" with each other, regardless if apps are downloaded (though this approach does not preclude the use of apps developed by state and local governments discussed in the 'New Apps Model'). For this reason, and due to the sheer fact that more than 99% of US smartphones run either iOS or Android,<sup>44</sup> this model will likely result in the highest participation rate of any approach. However, the process of how the OS update will be installed and operationalized— that is, whether it would be mandatory, opt-in, or opt-out—still has not been decided. Google has stated they would push out their update automatically through Google Play on all Android devices.<sup>45</sup> Apple has yet to comment on how they would implement an iOS update for the same purpose. The OS Model will probably involve a national collaboration with federal health agencies like the CDC and is likely to include a default contact tracing app in the OS update.

### *Pre-Existing App Model*

The third possible implementation of the API is a hybrid of the first two. In this model, a pre-existing application which is already widely installed and used on smartphones, like Facebook, would collaborate with the CDC and integrate the API functionality into an update of its app. In some sense, this approach would be similar to an OS update, with a large percentage of smartphones receiving the API without any additional app downloads. However, this model supposes a ubiquitous app like Facebook has the desire to take on a nationwide contact tracing operation, which is hardly guaranteed (despite the efforts of Facebook to address pandemic misinformation and promote CDC information). Additionally, it raises serious concerns about privacy since apps like Facebook already collect an enormous amount of sensitive data (like geolocation) from users in a non-anonymized way. In addressing this potential issue, Google and Apple have indicated that geolocation data collection will be banned in apps using their API,

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<sup>44</sup> James Vincent, "99.6 Percent of New Smartphones Run Android or iOS," *The Verge*, Feb 16, 2017, [www.theverge.com/2017/2/16/14634656/android-ios-market-share-blackberry-2016](http://www.theverge.com/2017/2/16/14634656/android-ios-market-share-blackberry-2016).

<sup>45</sup> Richard Nieva, Shara Tibken, and Alfred Ng, "How you'll get Apple and Google's contact tracing update for your phone," *CNET News*, April 14, 2020, <https://www.cnet.com/news/how-youll-get-apple-and-googles-contact-tracing-update-for-your-phone/>.

which will likely prevent many pre-existing apps from integrating in BLE contact tracing capabilities.<sup>46</sup>

## 2.2: Assessment of Potential Participation Rates Under Each Model

High participation rates are critical to the success of digital contact tracing. Oxford researchers estimate that a 60% participation rate is the minimum necessary for digital contact tracing to be effective by itself and, as the participation rate drops, the efficacy of digital contact tracing decreases exponentially.<sup>47</sup> This leaves very little room for error, given that there are already a number of constraints preemptively limiting public participation.

For example, smartphone penetration rates among U.S. adults<sup>48</sup> are estimated to be approximately 81%,<sup>49</sup> with a slightly higher penetration rate of 83% in urban areas.<sup>50</sup> If 19% of Americans don't have smartphones, this means we will need a participation rate of 74% among smartphone owners to get to our overall 60% participation rate among the entire US population. Based on the results of other countries' efforts so far, participation rates at this level are extremely hard to achieve. Trolling may also skew the data of any of the three models - whether contact tracing is done through an app or the OS itself doesn't prevent agitators from attaching their phone to a non-human entity or leaving it hidden in a public place. And, of course, even a mandatory implementation of these models can't stop people from simply leaving their phones at home when they go out into the world.

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<sup>46</sup> Stephen Nellis and Paresh Dave, "Apple, Google ban use of location tracking in contact tracing apps," *Reuters*, May 4, 2020, <https://www.reuters.com/article/us-health-coronavirus-usa-apps/apple-google-ban-use-of-location-tracking-in-contact-tracing-apps-idUSKBN22G28W>.

<sup>47</sup> Luca Ferretti et al., "Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing," *Science*, March 31, 2020, <https://science.sciencemag.org/content/early/2020/04/09/science.abb6936>.

<sup>48</sup> Smartphone penetration rates for minors begins to equal that of adult ownership rates at age 13 (72%) and outpaces adult ownership by age 18 (91%). Victoria Rideout and Michael B. Robb, "The Common Sense census: Media use by tweens and teens," *Common Sense Media*, 2019, <https://www.commonsensemedia.org/sites/default/files/uploads/research/2019-census-8-to-18-full-report-updated.pdf>.

<sup>49</sup> "Mobile Fact Sheet," *Pew Research Center*, June 12, 2019, <https://www.pewresearch.org/internet/fact-sheet/mobile/>.

<sup>50</sup> S. O'Dea, "Share of Adults in the United States Who Owned a Smartphone from 2011 to 2018, by Location," *Statista*, Feb 27, 2020, <https://www.statista.com/statistics/195003/percentage-of-us-smartphone-owners-by-geographic-location/>.

## *New App Model*

The potential participation rate of users downloading an entirely new contact tracing app is very difficult to estimate and would likely depend on factors such as who builds the app, what permissions the app requires, and how the app is marketed. However, other countries using national contact tracing apps have not been able to come near the necessary 60% participation rate. Iceland, a highly homogeneous country with a small national population (364,000 people) has one of the highest participation rates seen thus far with 40% of the country using the contact tracing app 'Rakning C-19.'<sup>51</sup> Singapore has seen only a 12% adoption of its contact tracing app, 'TraceTogether.'<sup>52</sup>

## *OS Model*

The OS model is likely to have the highest participation rate of the three options. However, not all users keep their OS regularly updated, and this may be exacerbated if some users intentionally avoid an OS update that contains the contact tracing API. iPhones have a much higher OS update rate than Android phones: while Google hasn't released the adoption rate of Android 10.0 (its newest OS update), Android 9.0 was adopted by just over 20% of users a full year after its release<sup>53</sup>. Comparatively, in late January 2020 (approximately 6 months after release), 77% of iPhones had updated to iOS 13, the most recent Apple OS.<sup>54</sup> However, even with iPhones, the majority of users aren't updating their OS instantaneously: iOS 12 and iOS 13 both took between 23-36 days post-release to hit a 50% adoption rate.<sup>55</sup>

It's also not clear just how Apple and Google are planning to design the OS update and at what stage or stages a user must choose whether to opt in. For example, will the update include only the API, or will it contain other regular OS updates that may

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<sup>51</sup> "App-based contact tracing may help countries get out of lockdown," *The Economist*, April 16, 2020, <https://www.economist.com/science-and-technology/2020/04/16/app-based-contact-tracing-may-help-countries-get-out-of-lockdown>.

<sup>52</sup> Casey Newton, "Apple and Google have a clever way of encouraging people to install contact-tracing apps for COVID-19," *The Verge*, April 14, 2020, <https://www.theverge.com/interface/2020/4/14/21219289/apple-google-contact-tracing-app-android-ios-pros-cons-quarantine-testing>.

<sup>53</sup> Emil Protalinski, "Android Pie passes 20% adoption after 12 months," *VentureBeat*, Oct 23, 2019, <https://venturebeat.com/2019/10/23/android-pie-passes-20-adoption-after-12-months/>.

<sup>54</sup> Richard Nieva, Shara Tibken, and Alfred Ng, "How you'll get Apple and Google's contact tracing update for your phone," *CNET News*, <https://www.cnet.com/news/how-youll-get-apple-and-googles-contact-tracing-update-for-your-phone/>.

<sup>55</sup> Nick Statt, "Apple's iOS 13 is running on 50 percent of all iPhones after three weeks," *The Verge*, Oct 16, 2019, <https://www.theverge.com/2019/10/16/20918359/apple-iphone-11-pro-ios-13-adoption-rate-google-android-10>.

encourage users to download it? Will the update itself be automatic so that all Apple and Android phones at least have the capacity to enable BLE contact tracing, whether or not the user chooses to switch it on?<sup>56</sup> We do know that users that have the OS update (and have contact tracing capabilities turned on, in an opt-in system) will receive notifications about their potential exposure to the virus even if they have not downloaded any contact tracing app.<sup>57</sup> However, Apple and Google could also include a contact tracing app that is automatically downloaded as part of the OS update.

### *Pre-Existing App Model*

The pre-existing app model is likely to have serious variations in participation rates depending on which pre-existing app is utilized. Besides YouTube, Facebook is the most used social media platform among US adults with a usage rate of 69% as of early 2019 (the next major social media platform after Facebook is Instagram, which captures only 37% of US adults).<sup>58</sup> The large majority of that 69% are mobile Facebook users<sup>59</sup>, but it's unclear the exact percentage of US users who only access Facebook via their desktop and never use the mobile app. It's difficult to determine what the adoption rate of an opt-in contact tracing capability offered by existing apps might be, but it appears that Facebook is likely the only feasible platform with a large enough user base to be able to meet the 60% total participation number necessary for digital contact tracing - and that's only if all 69% of US Facebook users have the mobile app and if the opt-in rate to a added Facebook contact tracing capability could encompass a whopping 87% of those users.

### *Conclusion*

The OS model demonstrates the highest potential participation rate. It would also be the easiest model for the government to make mandatory if deemed necessary (Apple and Google would need to push automatic updates onto smartphones that remove any

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<sup>56</sup> Google has indicated that it will use Google Play Services to push the update directly, which does not require approval from the Android device. It is unclear if Apple's OS update will be automatic or if it must be downloaded by the device user. Richard Nieva, Shara Tibken, and Alfred Ng, "How you'll get Apple and Google's contact tracing update for your phone," *CNET News*, <https://www.cnet.com/news/how-youll-get-apple-and-googles-contact-tracing-update-for-your-phone/>.

<sup>57</sup> Casey Newton, "Apple and Google have a clever way of encouraging people to install contact-tracing apps for COVID-19," *The Verge*, April 14, 2020, <https://www.theverge.com/interface/2020/4/14/21219289/apple-google-contact-tracing-app-android-ios-pros-cons-quarantine-testing>.

<sup>58</sup> John Gramlich, "10 facts about Americans and Facebook," *Pew Research Center*, May 16, 2019, <https://www.pewresearch.org/fact-tank/2019/05/16/facts-about-americans-and-facebook/>.

<sup>59</sup> Blake Drosch, "More Than Half of US Social Network Users Will Be Mobile-Only in 2019," *eMarketer*, April 26, 2019, <https://www.emarketer.com/content/more-than-half-of-social-network-users-will-be-mobile-only-in-2019>.

opt-in and disabling capabilities). To be clear, the lower projected participation rates for the other models do not mean that the OS model is the only feasible option for BLE contact tracing. However, if less than a 60% participation rate among the target population is achieved, then BLE contact tracing may only be useful when combined with other more invasive or non-anonymized data.

It's also important for policymakers to keep in mind that participation in any opt-in system will be impacted by factors beyond the differences in these models, such as levels of public trust and whether participating makes people feel like they are helping support the common good.<sup>60</sup> As noted by the Oxford researchers exploring a Bluetooth contact tracing app, "Successful and appropriate use of the App relies on it commanding well-founded public trust and confidence."<sup>61</sup> People are more likely to download an app if it's created by a company or government agency they know and trust, if the app permissions are limited, and if there is full transparency about what data is being gathered and how it will be used.

### **2.3: Assessment of Potential for Government Control Under Each Model**

Determining who gets to design, control, and dismantle digital contact tracing systems is a major policy choice with serious implications. Limiting the scope of this technology both functionally and temporally is important in avoiding privacy invasions and abuse. While this section assesses the level of government control possible under the above BLE models, it should be noted that both major tech companies and the U.S. government have a record of breaking the public trust and violating citizens' privacy interests.<sup>62</sup> The option of having an oversight board for BLE contact tracing that is

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<sup>60</sup> "App-based contact tracing may help countries get out of lockdown," *The Economist*, April 16, 2020, <https://www.economist.com/science-and-technology/2020/04/16/app-based-contact-tracing-may-help-countries-get-out-of-lockdown>.

<sup>61</sup> Luca Ferretti et al., "Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing," *Science*, March 31, 2020, <https://science.sciencemag.org/content/early/2020/04/09/science.abb6936>.

<sup>62</sup> See, e.g., "Surveillance Under the Patriot Act," *ACLU*, <https://www.aclu.org/issues/national-security/privacy-and-surveillance/surveillance-under-patriot-act>; "Edward Snowden: Leaks that exposed US spy programme," *BBC News*, <https://www.bbc.com/news/world-us-canada-23123964>; Nicholas Confessore, "Cambridge Analytica and Facebook: The Scandal and the Fallout So Far," April 4, 2018, *The New York Times*, <https://www.nytimes.com/2018/04/04/us/politics/cambridge-analytica-scandal-fallout.html>; Jeb Su, "Confirmed: Apple Caught In Siri Privacy Scandal, Let Contractors Listen To Private Voice Recordings," *Forbes*, July 30, 2019, <https://www.forbes.com/sites/jeanbaptiste/2019/07/30/confirmed-apple-caught-in-siri-privacy-scandal-let-contractors-listen-to-private-voice-recordings/#12cfbe3d7314>; Douglas MacMillan and Robert McMillan, "Google Exposed User Data, Feared Repercussions of Disclosing to Public," *The Wall Street Journal*, Oct 8, 2018,

predominantly controlled neither by the government nor tech companies is discussed in Section 6.2.

### *New App Model*

Whether the New App model is more or less difficult to control will depend on if there are many apps, or just one app that can be controlled by a federal agency, such as the CDC or Department of Health and Human Services. If there are many apps built by different tech companies, it will be more difficult to try and dismantle them or to get users to delete them. If there's just one app controlled by the federal government, then maximum governmental control of this technology is achieved<sup>63</sup>: once the pandemic is over, the government can simply disable or alter its own app.

### *OS Model*

Having contact tracing capabilities embedded in mobile operating systems arguably makes it more likely that this system will become permanent.<sup>64</sup> On the other hand, this model is arguably easier to dismantle because it requires a single update to remove Bluetooth contact tracing capabilities from phones. Though some critics remain skeptical<sup>65</sup>, Apple and Google have already promised that: (1) they will dismantle their contact tracing system after the pandemic ends; (2) the system will not be used for other purposes beyond coronavirus contact tracing; (3) only governmental organizations will be given access to the system.<sup>66</sup> It seems plausible that public pressure and media scrutiny could hold the companies to this pledge if they attempt to break it. If that is unsuccessful, Congress would have to step in to regulate or dismantle the OS Bluetooth contact tracing system.

### *Pre-Existing App Model*

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<https://www.wsj.com/articles/google-exposed-user-data-feared-repercussions-of-disclosing-to-public-1539017194>.

<sup>63</sup> As previously mentioned, there is a very legitimate question surrounding whether maximum government control is actually desirable, given the history of US government invasions of citizens' privacy. See, e.g., "Edward Snowden discloses U.S. government operations," *History*, <https://www.history.com/this-day-in-history/edward-snowden-discloses-u-s-government-operations>.

<sup>64</sup> Sara Morrison, "Apple and Google look like problematic heroes in the pandemic," *Vox*, April 16, 2020, <https://www.vox.com/recode/2020/4/16/21221458/apple-google-contact-tracing-app-coronavirus-covid-privacy>.

<sup>65</sup> *Ibid.*

<sup>66</sup> Casey Newton, "Apple and Google have a clever way of encouraging people to install contact-tracing apps for COVID-19," *The Verge*, April 14, 2020, <https://www.theverge.com/interface/2020/4/14/21219289/apple-google-contact-tracing-app-android-ios-pros-cons-quarantine-testing>.



The government would likely have the least control in the Pre-Existing App model. Unlike in the other two models where app function can be limited solely to Bluetooth contact tracing, pre-existing apps are not being designed from scratch under government guidance and limitations. For example, apps like Facebook already collect a lot of other personal data from users. The public will also be unlikely to delete these apps when the pandemic ends, as they use them for other purposes. If multiple pre-existing, private apps added contact tracing functionality and refused to take it away, Congress would either have to compel Apple and Google to dismantle the API or force the pre-existing apps to each remove their contact tracing capabilities. It would be more difficult for the government to oversee both the operation of digital contact tracing tech and its eventual removal in this decentralized model which uses existing apps run by private tech companies.

## Section 3: General Design Considerations

Beyond the three basic system models presented above, there are a number of additional design factors that can impact the efficacy and privacy protectiveness of BLE contact tracing. We have identified some of the key questions that should be addressed when considering the creation of any BLE contact tracing system.

### 3.1: How to Authenticate Positive Cases

Another consideration is how an app will authenticate positive cases. The threat of trolls falsely claiming they have tested positive and in turn causing mass notifications and destroying the validity of the app is a first order consideration. This threat further underscores recommendations above that digital contact tracing be used primarily as a way to augment, and not replace, traditional contact tracing—and that healthcare providers remain closely involved in the digital tracing “loop” via some form of authentication.

The authentication method needs to satisfy two conditions: it must originate from a trusted health official source and be unique so that it cannot be sent around by trolls for reuse. MIT’s design of a BLE contact tracing app posits the use of a QR Tag generator, where a health official at a testing center has a device that generates a QR tag to be scanned by the patient.<sup>67</sup> This solution is limited in its use by the fact that QR tag scans require in-person interaction, which may not occur when a test takes several days to come back or is dropped off as part of a self test. As a result, a unique and temporary pin number may be a better option, and is the method employed by Singapore’s TraceTogether.<sup>68</sup> However, a pin number could also be utilized by someone other than the person who tested positive if the recipient does not use it themselves and gives it to someone else to use with the intent of disrupting the system’s validity. Whether one or both of these methods is employed, it will require some training of trusted health employees to administer authentications and substantial partnership with health care providers and officials.

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<sup>67</sup> Kylie Foy, “Bluetooth signals from your smartphone could automate Covid-19 contact tracing while preserving privacy,” *MIT News*, April 8, 2020, <http://news.mit.edu/2020/bluetooth-covid-19-contact-tracing-0409>.

<sup>68</sup> Team TraceTogether, “How does TraceTogether Work?,” *TraceTogether*, March 25, 2020, <https://tracetgether.zendesk.com/hc/en-sg/articles/360043543473-How-does-TraceTogether-work->.

### 3.2: Time and Distance Parameters

What receiving an exposure alert notification will mean is intricately connected with app design and the accuracy of BLE. With an app that has strict time and distance parameters, perhaps by incorporating certain metadata indicators like geographical location or allowing users to input certain information,<sup>69</sup> an alert could indicate the individual was in close, extensive contact with a COVID-positive person.<sup>70</sup> In this case, an alert is likely quite meaningful and should indicate heightened COVID-19 infection risk. That said, under-sensitivity or system errors (e.g. phone orientation issues, as discussed in Section 1.1) could also create a false *negative* problem in which individuals are in contact with COVID-positive people but get no phone notification.<sup>71</sup> This could give infected individuals an inaccurate sense of security with potentially deadly consequences.

With an app that has looser distance or time parameters, an alert could mean the individual drove past a COVID-positive person on the highway or sat at a desk on the opposite side of a wall from them. Here, the app may be scooping up so many phone IDs that a notification means very little. This false *positive* problem could *also* have potentially detrimental ramifications. On one end of the spectrum, false positives could create mass apathy for the entire contact tracing system; if driving to work or walking around an office building generates lots of potentially meaningless phone alerts, people will likely start to ignore them (or simply resist downloading the app in the first place). On the other end of the spectrum, lots of highly inaccurate alerts could create societal mass hysteria that could harm more than it helps and undercut other pandemic response goals. That said, a “happy medium” of false positives is likely necessary for a successful contact tracing system. This ensures enough people are getting tested

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<sup>69</sup> Ronald L. Rivest et al., “The PACT protocol specification,” *Massachusetts Institute of Technology*, April 8, 2020, <https://pact.mit.edu/wp-content/uploads/2020/04/The-PACT-protocol-specification-ver-0.1.pdf>.

<sup>70</sup> Apple and Google’s BLE technology will likely be able to estimate distance between two devices by estimating the strength of the Bluetooth signal. See David Phelan, “Apple & Google Surprise Update To Covid-19 App: Better Privacy, Improved Bluetooth, No Huawei,” *Forbes*, April 24, 2020, <https://www.forbes.com/sites/davidphelan/2020/04/24/apple-google-reveal-surprise-update-to-covid-19-contact-tracing-better-privacy-more-precise-bluetooth-no-huawei/#1571a2996ad9>.

<sup>71</sup> Researchers also believe COVID-19 spreads on surfaces, which BLE would not pick up at all. This could be another contributor to underinclusivity and proliferating a false sense of security. Meghan Herbst, “How Long Does the Coronavirus Live on Surfaces? How Do I Know If I’m Immune? Your Covid-19 Questions, Answered,” *Wired*, April 19, 2020, <https://www.wired.com/story/whats-social-distancing-flattening-curve-covid-19-questions/>.

(public health officials believe we should target a 10% positive rate for testing),<sup>72</sup> and it could perhaps enhance broader public engagement in the pandemic response.

Of course, the uncertainty presented by potentially *both* of these scenarios is exacerbated by the opt-in problem. According to Farzad Mostashari, the former national coordinator for health information and technology at the U.S. Department of Health and Human Services, opt-in rates must be quite high for contacts to be captured by the app. Even if one-third of the population downloads the app, only about 10% of interactions will be captured. In this scenario, individuals could be left with massive amounts of false negatives from those who opted out and false positives from those who opted in.

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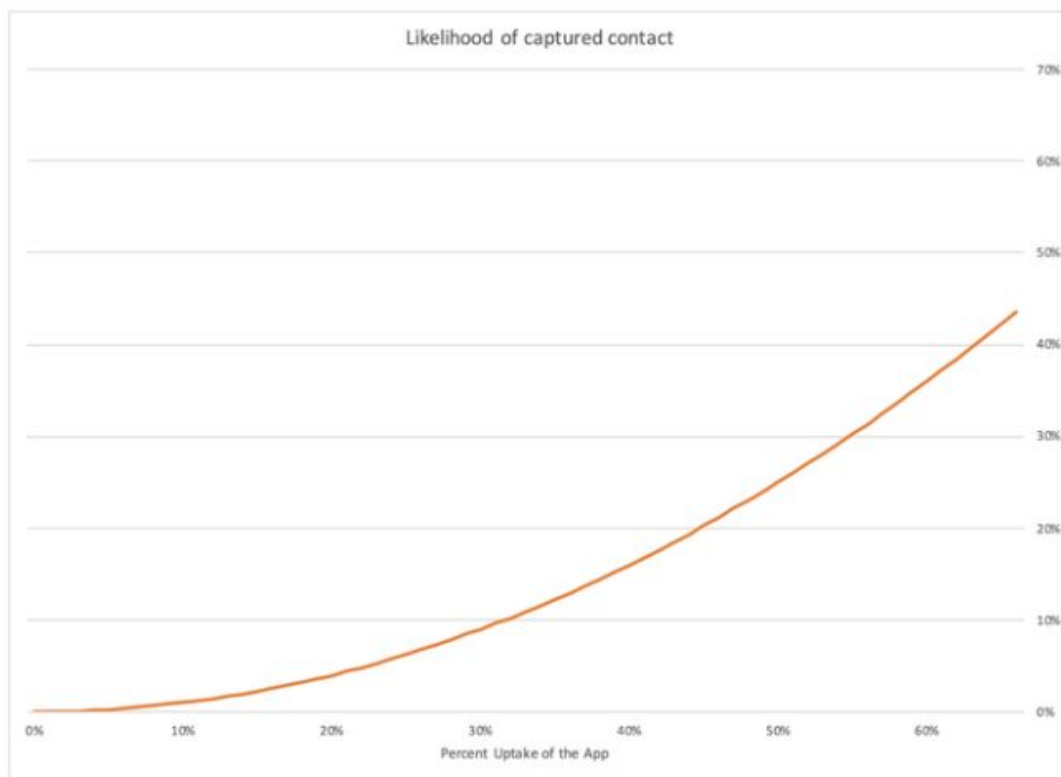


Figure 3: Likelihood of captured contact based on percent of people using a Bluetooth contact tracing app. <https://www.popularmechanics.com/technology/security/a32108923/bluetooth-contact-tracing-app/>.

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<sup>72</sup> Scott Gottlieb, MD et al., “National Coronavirus Response: A Road Map to Reopening,” *AEI*, March 28, 2020, <https://www.aei.org/wp-content/uploads/2020/03/National-Coronavirus-Response-a-Road-Map-to-Recovering-2.pdf>.

<sup>73</sup> Courtney Linder, “Can Bluetooth Contact Tracing Apps Really Help Fight Pandemics?” *Popular Mechanics*, April 13, 2020, <https://www.popularmechanics.com/technology/security/a32108923/bluetooth-contact-tracing-app/>.

At this point, it is too soon to say how BLE will fall along this underinclusive-overinclusive spectrum. However, what we want an alert to mean, and our comfort level with certain types of errors over others (i.e. would we rather it be overinclusive or underinclusive?), should inform app design and process implementation.

### 3.3: Mandatory vs. Consent-Based

Even if the policy considerations lead us to see an OS update as the most viable path, how an OS update occurs and results in BLE running on devices involves several choices which implicate tradeoffs between participation rates and consent. The assumption is that the more affirmative steps and layers of consent required, the lower the amount of participation rate. Apple and Tim Cook have expressed that the API will only be authorized for use that “respects transparency and consent.”<sup>74</sup> So far national efforts employing similar technology like Singapore’s TraceTogether<sup>75</sup> have been consistent with coalitions of privacy advocates and scientists who insist any digital contact tracing must be voluntary.<sup>76</sup> However, given the challenge of reaching sufficiently high participation rates and the potential for a more severe second wave,<sup>77</sup> a mandatory measure may be more appealing to policy-makers in crisis hoping to ensure the measure’s efficacy as they allocate limited contact tracing funds to such an effort. There is potential for legislation that mandates use of a contact tracing app. Robert Chesney of LawFare warns that federal legislation of this kind would face *Sebelius*-style constitutional challenges for compelling affirmative commercial activity, while state legislation of the same kind would not have that issue under their police power to ensure public health.<sup>78</sup> However, any such legislation in practice could constitute Fourth Amendment violations.<sup>79</sup> For these reasons and in preservation of norms, it appears that a mandatory digital tracing app in the US is highly unlikely. Even if that time came, it would likely only become so after a period of time with voluntary applications.

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<sup>74</sup> @tim\_cook, “Contact tracing can help slow the spread of COVID-19 and can be done without compromising user privacy. We’re working with @sundarpichai & @Google to help health officials harness Bluetooth technology in a way that also respects transparency & consent.” *Twitter*, April 10, 2020, [https://twitter.com/tim\\_cook/status/1248657931433693184](https://twitter.com/tim_cook/status/1248657931433693184).

<sup>75</sup> Team TraceTogether, “How does TraceTogether Work?,” *TraceTogether*, March 25, 2020, <https://tracetgether.zendesk.com/hc/en-sg/articles/360043543473-How-does-TraceTogether-work->.

<sup>76</sup> Dali Kaafar et al., “Joint Statement on Contact Tracing,” April 19, 2020, <https://drive.google.com/file/d/10Qg2dxPu-x-RZzETIpV3IFa259Nrpk1J/view>.

<sup>77</sup> Lena H. Suh, “CDC Director warns second wave of coronavirus is likely to be even more devastating,” *The Washington Post*, April 21, 2020, <https://www.washingtonpost.com/health/2020/04/21/coronavirus-secondwave-cdcdirector/>.

<sup>78</sup> Robert Chesney, “COVID-19 Contact Tracing We Can Live With: A Roadmap and Recommendations,” *LawFare*, April 14, 2020, <https://www.lawfareblog.com/covid-19-contact-tracing-we-can-live-roadmap-and-recommendations>.

<sup>79</sup> *Ibid.*

Therefore, analyzing what consent to BLE tracking should look like in a voluntary model is still important for developers and government officials to consider.

Beyond the potential of making a contact tracing app mandatory, there is still a spectrum of what level of consent should be required for a voluntary app to begin operating. Policy analysis above suggests that an OS update approach has the most promise. But what does it look like for such an OS update to be consented to so that the API can begin tracking? On one end of the spectrum, Apple and Google could automatically compel devices to update their OS and start running the API. Even though Google has said they would essentially do just that by automating a Google Play update,<sup>80</sup> Apple has said they won't and would be very unlikely do so under any circumstances absent a government mandate. Therefore, there will likely need to be some consent-obtaining process with any OS update including the API (which may be satisfied by the fact that new OS updates generally require users to accept the terms and conditions of the new software).

Consent for a contact tracing app through an OS update may be conceptualized in three parts: consent to the download of the OS update which includes the BLE capability, consent for BLE to begin operating in the background, and potentially consent to be included as a user of an application. The more explicit and numerous the expressions of consent required are, the more users may not end up having their device running BLE and signaling other devices. Striking a balance between acquiring informed and actual consent, and ensuring the most users who want to download the capability they are enabling will ultimately be a policy decision. Whether or not acceptance of an update with a disclaimer that states BLE contact tracing is included in it should result in the API operating immediately thereafter or if further manual consent or toggling is required, will ultimately be determined by Google and Apple. Essentially, the conspicuousness of any disclaimers and whether an update is opt-in or opt-out speak directly to users' awareness of what exactly is being collected. Giving users adequate notice of collection carries practical and normative considerations that must be weighed by advocates, tech companies, and government. Similar considerations hold true for a voluntarily downloaded, non-OS app.

### **3.4: Type of Data Collected**

Once an app is installed and running, a second question emerges: what kind of data will it collect and what will it be used for? The Apple/Google API is consciously developed in

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<sup>80</sup> Richard Nieva, Shara Tibken, and Alfred Ng, "How you'll get Apple and Google's contact tracing update for your phone," *CNET News*, April 14, 2020, <https://www.cnet.com/news/how-youll-get-apple-and-googles-contact-tracing-update-for-your-phone/>.

a way that preserves anonymity and decentralized storage of encrypted data. The data uploaded by those who test positive is composed of anonymized ID codes which end up being sent out on the back end to be checked against every device running the app's local storage. What kind of data is collected and run through this process and its level of encryption raise considerations of personal re-identification risk (if that is to remain a goal of the app) and workload.

With these tradeoffs in mind, what kinds of metadata should be collected alongside with the anonymized ID's during BLE connections with other devices should include duration? Date and time? User input about mask-wearing? These additional data components may be useful in contextualizing a contact in terms of its intensity and likelihood of transmission, and alleviate some concerns for over-inclusivity. But these benefits must be weighed against the further privacy concerns and risks of re-identification the data creates.

Developers working on BLE contact tracing apps note that privacy-preserving encryption can create a burden on devices' computing power.<sup>81</sup> Since BLE data alone is completely location-blind, a national app would need to be blasting out all data for the entire country's exposure alerts on its back-end. The bandwidth that this would require could be immense. This issue could be resolved by creating a proxy for users' location. This location proxy could be entering in your zip code, state, or geographic region when you enable the app. Requiring such inputs could increase the likelihood of re-identification and re-introduces privacy concerns which BLE solutions were developed to address, but apps covering large geographical areas will ultimately need a way to divide data by region.

### **3.5: Centralized Data vs. Decentralized Data**

There are a number of potential ways governments could utilize centralized BLE contact tracing data, though health authorities already have a number of tools to collect and analyze de-identified data separate from any contact tracing. While adding tracing data to these tools may amplify the benefits of centralized analytics, not everyone perceives these potential uses as positives, especially given Apple and Google's assertion that any tools they offer to one government, must be offered to all governments.<sup>82</sup> Centralizing

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<sup>81</sup> Carmela Troncoso et al., "Decentralized Privacy-Preserving Proximity Tracing," *Github*, April 12, 2020, <https://github.com/DP-3T/documents/blob/master/DP3T%20White%20Paper.pdf>.

<sup>82</sup> Alex Hern, "France urges Apple and Google to ease privacy rules on contact tracing," *The Guardian*, April 21, 2020, <https://www.theguardian.com/world/2020/apr/21/france-apple-google-privacy-contact-tracing-coronavirus>.

BLE data inherently also comes with increased privacy risks, including the potential for unwanted discrimination and surveillance.<sup>83</sup>

Apple and Google have publicly expressed their intent to limit the information that public health apps can gather from their BLE systems, insisting that data must be decentralized.<sup>84</sup> The British NHS<sup>85</sup> and French government<sup>86</sup> initially petitioned the companies to reconsider this policy (although the NHS may now be changing course). Apps could theoretically collect centralized BLE data on their own without the API, but this comes with a severe tradeoff: it would require the app to (a) have obtained the necessary user permissions for this function and (b) to be running in the foreground<sup>87</sup> - meaning the app is actively being used on an unlocked screen. This would cause debilitating participation problems. There are also a number of practical problems involved. Having the app open and running will quickly drain the phone's battery life and it could cause potential security issues if a user's phone is snatched while it's unlocked in order to run the app.<sup>88</sup>

As a note, even without Apple and Google's restraints, it's unclear how useful aggregate data from BLE contact tracing would be to public health authorities. A back-end design that gave authorities access to aggregated data would only provide them with a total count of contacts between people (along with a list of anonymous device IDs). Even if aggregated BLE data is supplemented with other forms of pre-existing data, it's not clear that it would be particularly helpful in making broader public health decisions,<sup>89</sup>

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<sup>83</sup> Alex Hern, "Digital contact tracing will fail unless privacy is respected, experts warn," *The Guardian*, April 20, 2020, <https://www.theguardian.com/world/2020/apr/20/coronavirus-digital-contact-tracing-will-fail-unless-privacy-is-respected-experts-warn>.

<sup>84</sup> Alex Hern, "NHS in standoff with Apple and Google over coronavirus tracing," *The Guardian*, April 16, 2020, <https://www.theguardian.com/technology/2020/apr/16/nhs-in-standoff-with-apple-and-google-over-coronavirus-tracing>.

<sup>85</sup> *Ibid.*

<sup>86</sup> Alex Hern, "France urges Apple and Google to ease privacy rules on contact tracing," *The Guardian*, April 21, 2020, <https://www.theguardian.com/world/2020/apr/21/france-apple-google-privacy-contact-tracing-coronavirus>.

<sup>87</sup> *Ibid.*

<sup>88</sup> Alex Hern, "NHS in standoff with Apple and Google over coronavirus tracing," *The Guardian*, April 16, 2020, <https://www.theguardian.com/technology/2020/apr/16/nhs-in-standoff-with-apple-and-google-over-coronavirus-tracing>.

<sup>89</sup> There is an argument that seeing aggregated Bluetooth data is useful in determining the extent to which people are bumping into each other in a space, which may be analytically different from how individuals are moving around in a space, which would require geolocation data. However, it's unclear how well aggregated Bluetooth contact tracing data could provide this information relative to traditional contact tracing.



especially in light of measures already in place to provide authorities with useful analytics.

## Section 4: General Implementation Considerations

After the design phase, decision makers must also take into account a variety of other important implementation considerations. Decision makers should examine the following when determining how to best utilize BLE technology (or whether to utilize it at all).

### 4.1: How Should Users Be Advised to Respond to an Alert?

While Bluetooth-enabled digital contact tracing technology offers tremendous promise, its implementation raises numerous potential concerns. In a hypothetical scenario, let's assume an individual has opted into a contact tracing app powered by the proposed Apple/Google BLE technology. She spends two weeks living her normal life, including going to work, grocery shopping, and visiting friends. One morning, she receives a notification on her phone with a message indicating she has recently been in the proximity of someone who has since tested positive for COVID-19. What happens next?

Having received a notification of potential exposure on your phone, we can imagine a range of possible responses from least intrusive to most intrusive:

- Do nothing
- Marginally modify daily behavior (e.g. be more likely to wear a mask, wash hands more frequently)
- Get tested by a healthcare provider
- Significantly modify daily behavior (e.g. work from home)
- Self-quarantine for two weeks

Whether BLE is underinclusive (i.e. false negatives), perfectly inclusive, or overinclusive (i.e. false positives) can inform which of these actions we take. If the app is significantly *underinclusive*, perhaps because of a high threshold of sensitivity, we may feel more comfortable encouraging invasive responses (like self-quarantining). If alerts are massively *overinclusive*, we may feel squeamish about asking people to self-quarantine; such a dramatic mismatch between infection risk and response could create general apathy or harm other societal normalization efforts.

In theory, the optimal response to an alert is to get tested. This would encourage people with a heightened risk of exposure to learn whether they actually contracted the virus. However, this path forward is again muddled by the false-positive problem. It is no

secret that testing is currently limited,<sup>90</sup> and this capacity could become completely overwhelmed with an influx of only marginally at-risk patients. Worse, this could crowd out people who need testing more, potentially spreading the virus further. This dynamic makes it all the more important that adequate testing is in place to support and effectuate BLE contact tracing technology. But until this occurs, public health authorities should be mindful of BLE's impact on limited resources.

## 4.2: How Can Authorities Encourage Alert Compliance?

Once we choose a path forward, what role should public health authorities play in encouraging alert compliance? We can again imagine a range of responses:

### *Do Nothing*

On one end of the spectrum, the government could choose not to seriously engage with BLE contact tracing at all. This technology could instead be more of a self-help mechanism for motivated individuals who can then respond to an alert however they see fit.

### *Education and Communication*

Next, public health authorities could use their platform to educate and nudge people to respond to alerts in particular ways. This could occur *external* to the app through health advisories, news articles, press conferences, and other communication mechanisms. It could also occur *internal* to the app, i.e. through specific instructions upon receiving an alert and potentially through follow-up alerts over subsequent days or weeks. Ideally, this communication would make it explicitly clear what actions, and in what order, people should take in response to an alert.

### *Resource Allocation*

Public health authorities could also consider allocating resources based on BLE contact tracing information. For example, testing could be prioritized for those who received an alert on their phone, or ventilators could be relocated to areas with substantial increases in overall alerts. That said, it is unclear if public health officials would want to prioritize resources based on potentially inaccurate and incomplete information, particularly if opt-in rates are low and false positives are high.

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<sup>90</sup> Abby Goodnough, Katie Thomas and Sheila Kaplan, "Testing Falls Woefully Short as Trump Seeks an End to Stay-At-Home Orders," *The New York Times*, April 20, 2020, <https://www.nytimes.com/2020/04/15/us/coronavirus-testing-trump.html>.

Using alerts to allocate resources also raises substantial equity concerns. As discussed earlier in this report, a disparity in mobile phone ownership and app opt-in (e.g. between young and old or between the wealthy and poor) could lead to unacceptable differences in healthcare access and disease outcomes.

### *Enforcement*

Finally, the government could consider using BLE contact tracing information to actively enforce certain behavior in response to alerts, possibly supported by criminal or civil penalties. That said, given the privacy and anonymity-focused construction of BLE contact tracing, it is unclear if the government could even *know* who received an alert, let alone take action to enforce certain behavior.

## **4.3: Supplementing vs. Replacing Traditional Contact Tracing**

As this report continuously illustrates, there are many unknowns surrounding digital contact tracing. However, given the technology's inevitable inaccuracy and likely insufficient participation rates, it is clear that BLE will *not* be able to fully replace traditional contact tracing. It will likely be safer and more effective as an aid to traditional contact tracing, and some authorities are using it as precisely that. Utah (while not currently using BLE) is relying on traditional tracers who, once a patient tests positive, can then get the patient's permission to pull location and other data from the patient's device.<sup>91</sup> And while Apple and Google have withheld their technology from apps that would blend BLE with location data, Utah's app is nonetheless a good example of possible combinations of traditional and digital tracing in mutually beneficial ways. Even without tracers actually using BLE data, the additional automatic notifications from a BLE system would amplify the effectiveness of a traditional system.

## **4.4: One App vs. Many Apps**

There's also the consideration of whether having one nation-wide app or many customized state apps is the better approach. The size and heterogeneity of the US lends some weight to a state-based approach, and many states have already begun to implement their own tech-enabled approaches. This state-driven approach may increase flexibility and the potential for customization--and fragmentation shouldn't be an issue as long as sufficient interoperability protocols are put into place. Even if under

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<sup>91</sup> Elliot Setzer, "Contact-Tracing Apps in the United States," *Lawfare*, May 6, 2020, <https://www.lawfareblog.com/contact-tracing-apps-united-states>.

the OS model any BLE data must be limited and decentralized, apps could still request voluntary, non-Bluetooth information from users. If each state had their own app, they could determine what additional information they would like to request based on a more tailored set of public health needs while being sensitive to privacy concerns. The same app used for contact tracing could also provide alerts about shelter-in-place orders, curfews, and other state-specific guidelines. A multi-app approach may also be more resilient: if one app proves unreliable or has implementation issues, authorities/users can more easily pivot to another app already in use.

However, there are many compelling reasons to utilize one nationwide app, whether using the OS model or the new app model:

- A nationwide app could still provide state-specific information, presuming users manually input their state.
- Millions of users near state borders or who must travel between states need only manually update their location in the app to ensure data accuracy (rather than downloading a new app for each state).
- Developing one app is likely to be far more time-efficient and cost-effective than developing 50+. It's also far easier to tweak the parameters of a single app. This additionally ensures that contact tracing alerts are based off of standardized protocols, rather than varying by state, which can help prevent confusion.
- Many healthcare workers are moving around the country<sup>92</sup> right now as coronavirus 'hot spots' pop up in new places - having one app prevents these traveling workers from having to learn a new system in each state.
- Having a single app will make marketing it easier. In a system where participation matters greatly, joint national and state public health campaigns and press announcements encouraging participation are going to be much more feasible if there's only one app.
- State budgets are already overloaded with purchases of PPE, ventilators, and other goods and services crucial to fighting the pandemic. This is exacerbated by

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<sup>92</sup> See, e.g., William Feuer, Dan Mangan, and Berkeley Lovelace Jr., "New York Gov. Cuomo issues nationwide call for doctors and nurses as state battles worst coronavirus outbreak in US," *CNBC*, March 30, 2020, <https://www.cnn.com/2020/03/30/coronavirus-fight-new-york-gov-cuomo-issues-nationwide-call-for-doctors-and-nurses.html>; Noah Higgins-Dunn, "Travel nurses race to New York and other coronavirus hot spots: 'They are literally in a war zone'," April 6, 2020, <https://www.cnn.com/2020/04/06/travel-nurses-race-to-new-york-and-other-coronavirus-hot-spots-they-are-literally-in-a-war-zone.html>.

the tax filing deadline being moved from April 15 to July 15.<sup>93</sup> A nationwide, federally funded app would circumvent state-level budget constraints.

- The federal government has more influence over tech companies than state governors do. Thus having a federal app rather than individualized state apps will make it easier for the federal government to compel tech companies to make changes or to remove the technology entirely

## 4.5: Promoting Equitable Access

Equitable access to digital devices is a very real concern if this tech is being used by the government to keep Americans safe and healthy. Any implementation of digital contact tracing should involve careful consideration of what populations may be excluded or marginalized and how to best remedy that potential consequence.

### *Low Income Populations*

As discussed in Section 2.2, 19% of U.S. adults do not own a smartphone.<sup>94</sup> Smartphone ownership in the U.S. directly correlates with educational attainment<sup>95</sup> and income levels.<sup>96</sup> This correlation does not translate to just a few percentage points difference: there is a gap of 24-25% in smartphone ownership between the highest and lowest income levels and educational attainment levels.<sup>97</sup> In addition, older smartphones may not be compatible with Apple and Google's OS update or even have BLE capability. The companies have reportedly said that every phone using iOS 13 (all iPhones including and after the iPhone 6) and Android Marshmallow (all Android phones including and after the Android 6) should be able to use this technology - but even the older phones included here like the iPhone 6 may have limited battery life to run background Bluetooth contact tracing over the entire day (though this concern is likely mitigated

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<sup>93</sup> For example, New York has had to institute cash spending controls due to the delays in the tax filing dates. The number of New Yorkers who filed their taxes by April 15th this year is 30% lower than usual (7 million this year, as compared to 10 million on average in previous years). "New York Gov. Cuomo holds a briefing on the coronavirus outbreak," *CNBC Television*, April 17, 2020, <https://www.youtube.com/watch?v=amPhqHy4fVw&feature=youtu.be&t=4313>.

<sup>94</sup> "Mobile Fact Sheet," *Pew Research Center*, June 12, 2019, <https://www.pewresearch.org/internet/fact-sheet/mobile/>.

<sup>95</sup> 66% of those with less than a high school graduate education reported owning a smartphone: there was a 6% increase for high school graduates (72%); a 19% increase for those with some college (85%); and a 25% increase for college graduates (91%). *Ibid.*

<sup>96</sup> 71% of those making less than \$30,000 annually reported owning a smartphone: there was a 7% increase for those making between \$30,000-\$49,999 (78%); a 19% increase for those making between \$50,000-\$74,000 (90%); 24% increase for those making \$75,000+ (95%). *Ibid.*

<sup>97</sup> The striking similarities between the smartphone-education correlation and the smartphone-income correlation may be due to the additional corollary relationship between education and income.

somewhat by the system running on Bluetooth Low Energy).<sup>98</sup> For individuals and families that currently do not own smartphones, even buying an iPhone 6 is cost prohibitive with Amazon search results listing that model at over \$100. This is especially true in a time when unemployment rates have skyrocketed<sup>99</sup>, with occupations concentrated among lower wage workers being disproportionately impacted.<sup>100</sup>

The implications of these asymmetries are that lower-income Americans will not be able to access Bluetooth contact tracing technology at the same rate as their wealthier counterparts, which is problematic if access to that technology leads to disparate health outcomes. This has the potential to impact not only low-income individuals, but entire communities. Low and high-income Americans are not evenly distributed across neighborhoods: rather, the spatial inequality<sup>101</sup> inherent in the US housing market and the nation's history of housing segregation<sup>102</sup> has tended to congregate communities along both economic and racial lines.

Entire communities may be threatened due to a larger percentage of their members' inability to afford smartphones that would allow them to participate in Bluetooth contact tracing. This is deeply concerning given that: (a.) low income rates are already strongly associated with higher rates of certain comorbidities such as asthma, diabetes and hypertension that are predicted to increase the mortality rates of coronavirus<sup>103</sup>; (b.)

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<sup>98</sup> David Phelan, "COVID-19 Contact Tracing: Apple & Google Reveal New Intriguing Details," *Forbes*, April 14, 2020, <https://www.forbes.com/sites/davidphelan/2020/04/14/covid-19-google-and-apple-reveal-more-intriguing-details-of-contact-tracing/#320ab6683d20>.

<sup>99</sup> Lance Lambert, April 9, 2020, "Real unemployment in the United States has likely hit 14.7%, the highest level since 1940," *Fortune*, <https://fortune.com/2020/04/09/ureal-unemployment-rate-jobless-claims-this-week/>.

<sup>100</sup> Besart Avdiu and Gaurav Nayyar, "When face-to-face interactions become an occupational hazard: Jobs in the time of COVID-19," *Brookings*, March 30, 2020, [https://www.brookings.edu/blog/future-development/2020/03/30/when-face-to-face-interactions-become-an-occupational-hazard-jobs-in-the-time-of-covid-19/?utm\\_campaign=Global%20Economy%20and%20Development&utm\\_source=hs\\_email&utm\\_medium=email&utm\\_content=85884339](https://www.brookings.edu/blog/future-development/2020/03/30/when-face-to-face-interactions-become-an-occupational-hazard-jobs-in-the-time-of-covid-19/?utm_campaign=Global%20Economy%20and%20Development&utm_source=hs_email&utm_medium=email&utm_content=85884339).

<sup>101</sup> Ann Owens, "Building Inequality: Housing Segregation and Income Segregation," *Sociological Science* 6: 497-525, August 7, 2019, [https://www.sociologicalscience.com/download/vol-6/august/SocSci\\_v6\\_497to525.pdf](https://www.sociologicalscience.com/download/vol-6/august/SocSci_v6_497to525.pdf).

<sup>102</sup> Sam Fulwood III, "The United States' History of Segregated Housing Continues to Limit Affordable Housing," *Center for American Progress*, December 15, 2016, <https://www.americanprogress.org/issues/race/reports/2016/12/15/294374/the-united-states-history-of-segregated-housing-continues-to-limit-affordable-housing/>.

<sup>103</sup> See, e.g., Ed Pilkington and Ankita Rao, "A tale of two New Yorks: pandemic lays bare a city's shocking inequities," *The Guardian*, April 10, 2020, <https://www.theguardian.com/us-news/2020/apr/10/new-york-coronavirus-inequality-divide-two-cities>; Dhruv Khullar and Dave A. Chokshi, "Health, Income, & Poverty: Where We Are & What Could Help," *Health Affairs*, Oct 4, 2018, <https://www.healthaffairs.org/doi/10.1377/hpb20180817.901935/full/>.

lower income communities already face greater barriers to accessing medical care and resources<sup>104</sup>; and (c.) lower income individuals comprise an enormous amount of the nation's 'essential workers,' who face higher risks of coronavirus infection<sup>105</sup>. Bluetooth contact tracing has the potential to add to the litany of disparities and government policies threatening the health of poor Americans, and particularly poor black Americans.<sup>106</sup>

Though groups like Covid Watch are exploring ways to develop inexpensive Bluetooth devices<sup>107</sup> that could be used in a contact tracing alert system, access to technology is not the only issue. First, it's crucial that these devices are designed to be worn or carried unobtrusively, so as to not serve as a marker singling out lower income Americans. Second, convincing the very populations that have been historically abused, lied to, and spied on by the U.S. government<sup>108</sup> to start carrying around contact tracing devices seems like a significant challenge to overcome. Barriers to both access and adoption among low income communities - and especially among low income black communities - must be addressed by any government institution seeking to implement digital contact tracing.

### *Indigenous Peoples*

Indigenous peoples also face an increased risk of being excluded from digital contact tracing. While smartphone penetration rates among different indigenous groups in the U.S. are unclear, the 'digital divide' between tribal lands and the rest of the country is stark<sup>109</sup>. Tracking the exact number of COVID-19 cases affecting U.S. indigenous

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<sup>104</sup> *Ibid.*

<sup>105</sup> Molly Kinder, "COVID-19's essential workers deserve hazard pay. Here's why—and how it should work," *Brookings*, April 10, 2020, <https://www.brookings.edu/research/covid-19s-essential-workers-deserve-hazard-pay-heres-why-and-how-it-should-work/>.

<sup>106</sup> Jamelle Bouie, "Why Coronavirus Is Killing African-Americans More Than Others," *The New York Times*, April 14, 2020, <https://www.nytimes.com/2020/04/14/opinion/sunday/coronavirus-racism-african-americans.html>.

<sup>107</sup> Sydney Von Arx et al., "Slowing the spread of infectious diseases using crowdsourced data," *Covid Watch*, March 20, 2020, <https://www.covid-watch.org/article>.

<sup>108</sup> See, e.g., Barton Gellman and Sam Adler-Bell, "The Disparate Impact of Surveillance," *The Century Foundation*, Dec 21, 2017, <https://tcf.org/content/report/disparate-impact-surveillance/?session=1>; Dia Kayyali, "The History of Surveillance and the Black Community," *Electronic Frontier Foundation*, Feb 13, 2014, <https://www.eff.org/deeplinks/2014/02/history-surveillance-and-black-community>; Francie Diep, "Police Are Most Likely to Use Deadly Force in Poorer, More Highly Segregated Neighborhoods," *Pacific Standard Magazine*, Jan 24, 2019, <https://psmag.com/news/police-are-most-likely-to-use-deadly-force-in-poorer-more-highly-segregated-neighborhoods>; Peter Edelman, "How it became a crime to be poor in America," *The Guardian*, Nov 6, 2017, <https://www.theguardian.com/commentisfree/2017/nov/06/how-poverty-became-crime-america>.

<sup>109</sup> For example, rural Indian reservations have the lowest broadband coverage in the entire U.S.: 35% of people living within tribal lands lack broadband access. In certain states, like Idaho, that rate is much



populations is difficult, as Native peoples have been left out of data counts.<sup>110</sup> However, indigenous populations also face health disparities and other structural factors<sup>111</sup> (e.g. overcrowded housing, lack of medical resources and inadequate healthcare facilities, communal cultural practices) that increase their risk of both contracting coronavirus and developing serious or fatal complications if infected.

Many tribes are also struggling financially given that revenue streams from tourism and tribal casinos have dried up<sup>112</sup> and some of the government funding meant to help certain tribes deal with the impact of coronavirus has been going to Native corporations rather than tribal governments<sup>113</sup>. Finally, indigenous peoples have also faced a long history of abuse by the U.S. government, which creates another barrier to the acceptance and use of digital contact tracing.<sup>114</sup>

### *Older Adult Populations*

Older Americans are also at risk of having inequitable access to the benefits of digital contact tracing. Only 53% of U.S. adults age 65+ own a smartphone<sup>115</sup>, yet people in that age group face a higher risk of dying or developing serious complications if infected by coronavirus<sup>116</sup>. Other age-related factors may impede even those who do own smartphones from benefiting fully from BLE contact tracing. Diminishing eyesight,

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lower, with 83% of the state's tribal population unable to access broadband. Margaret Harding McGill, "The least connected people in America," *Politico*, Feb 7, 2018, <https://www.politico.com/agenda/story/2018/02/07/rural-indian-reservations-broadband-access-000628>

<sup>110</sup> Rebecca Nagle, "Native Americans being left out of US coronavirus data and labelled as 'other'," *The Guardian*, April 24, 2020, <https://www.theguardian.com/us-news/2020/apr/24/us-native-americans-left-out-coronavirus-data>.

<sup>111</sup> Dana Hedgpeth, Darryl Fears, and Gregory Scruggs, "Indian Country, where residents suffer disproportionately from disease, is bracing for coronavirus," *The Washington Post*, April 4, 2020, <https://www.washingtonpost.com/climate-environment/2020/04/04/native-american-coronavirus/>.

<sup>112</sup> *Ibid.*

<sup>113</sup> Sean Maguire, "Alaska tribes join lawsuit to block Alaska Native corporations from receiving COVID-19 aid," *Ktuu News*, April 17, 2020, <https://www.ktuu.com/content/news/Three-Alaska-tribes-join-lawsuit-to-stop-Alaska-Native-corporations-from-receiving-COVID-19-aid-569742851.html>.

<sup>114</sup> See, e.g., Tom Perez, "Op-Ed: Trump is breaking the federal government's promises to Native Americans," *The Los Angeles Times*, Aug 7, 2017, <https://www.latimes.com/opinion/op-ed/la-oe-perez-native-american-indians-trump-20170807-story.html>; Eliza Racine, "Native Lives Matter: The Overlooked Police Brutality Against Native Americans," *Lakota People's Law Project*, Nov 21, 2017, <https://www.lakotalaw.org/news/2017-11-21/native-lives-matter-the-overlooked-police-brutality-against-native-americans>.

<sup>115</sup> "Mobile Fact Sheet," *Pew Research Center*, June 12, 2019, <https://www.pewresearch.org/internet/fact-sheet/mobile/>.

<sup>116</sup> Sarah Elizabeth Adler, "Why Coronaviruses Hit Older Adults Hardest," *AARP*, March 14, 2020, <https://www.aarp.org/health/conditions-treatments/info-2020/coronavirus-severe-seniors.html>.

hearing, and fine motor skills<sup>117</sup> may impact older Americans ability to receive and understand notifications and alerts sent out by a contact tracing app. A lack of digital skills and experience with technology<sup>118</sup> may also impede older smartphone users from benefiting from Bluetooth contact tracing - for example, this population may be less likely to keep their phone's OS routinely updated.

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<sup>117</sup> MedlinePlus, "Aging changes in the senses," *United States National Library of Medicine*, <https://medlineplus.gov/ency/article/004013.htm>.

<sup>118</sup> Jessica Fields, "We are leaving older adults out of the digital world," *TechCrunch*, May 5, 2019, <https://techcrunch.com/2019/05/05/we-are-leaving-older-adults-out-of-the-digital-world/>.

## Section 5: Privacy: Rights, Principles & Concerns

This section provides three key ways in which to consider privacy concerns in a BLE contact tracing system: what *can* be, what *ought* to be, and what *will* be. To the first end of what *can* be, we provide an overview of the ongoing discussion surrounding potential constitutional limitations on BLE contact tracing, with a focus on Fourth Amendment privacy rights and states' police powers. In the normative context of what *ought* to be, we next present a summary of three proposed data rights frameworks designed to maximize privacy protection in a BLE contact tracing system. Finally, we describe the capacity for private sector privacy invasion (and the potential for subsequent discrimination) that *will* be inherently created by individuals' receipt of BLE contact tracing exposure notifications.

### 5.1: Constitutional Privacy Rights Related to Digital Contact Tracing

Three unalienable rights sparked the founding of this nation: life, liberty, and the pursuit of happiness. The use of Bluetooth contact tracing inevitably raises a COVID-19 catch-22. In order to preserve lives, individuals must sacrifice some civil liberties, and vice versa. But what civil liberties can U.S. citizens constitutionally forfeit?

Law Professor Alan Z. Rozenshtein grapples with this question in his article "Disease Surveillance and the Fourth Amendment."<sup>119</sup> Focusing on the Fourth Amendment's prohibition against unreasonable searches and seizures, Rozenshtein asserts the Fourth Amendment does not impose any restrictions on the information that can voluntarily be shared with the government, either by the surveilled individual or third parties who have lawfully obtained information about a surveilled individual (e.g., an app authorized to track one's location can hand that data over to the government).<sup>120</sup> If the government requires individuals to download a Bluetooth contact tracing app, however, that mandate may constitute a Fourth Amendment violation under the *United States v. Jones* trespass test, since the requirement interferes with a property interest by asserting control over individuals' devices.<sup>121</sup> A court will likely evaluate any disease surveillance program under the Fourth Amendment's often incoherent and still unsettled "special needs doctrine," which sometimes permits "warrantless surveillance with less than probable cause if getting a warrant would be impracticable; the search is aimed at something other than a traditional law enforcement purpose; and the search is, all

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<sup>119</sup> Alan Z. Rozenshtein, "Disease Surveillance and the Fourth Amendment," *Lawfare*, April 7, 2020, <https://www.lawfareblog.com/disease-surveillance-and-fourth-amendment>.

<sup>120</sup> *Id.*

<sup>121</sup> *United States v. Jones*, 565 U.S. 400, 409 (2012).

things considered, reasonable.”<sup>122</sup> However, broad and constant surveillance through a required app to enforce quarantine orders would almost certainly fail to pass constitutional muster, unless the app only disclosed when individuals left the quarantine zone (possibly constitutional under the “binary search doctrine”).<sup>123</sup>

The CDC also acknowledges limitations to a state’s public health police powers.<sup>124</sup> In order to avoid violating the due process clauses of the Fifth and Fourteenth Amendments, a state must use the least restrictive method of contact tracing while maintaining effectiveness.<sup>125</sup> Under *Jacobson v. Massachusetts*, a court evaluates the appropriateness of a state’s exercise of its police powers by examining the necessity and reasonableness of the government action as well as the harm avoided through the government response.<sup>126</sup> However, the fact remains that while public health investigations usually rely on voluntary cooperation, federal and state laws provide the use of compulsory measures when necessary to protect public health and safety.

## 5.2: Potential Data Privacy Frameworks

Harvard Law Professor Laurence H. Tribe cautions against adoption of data-driven coronavirus tracing programs, warning, “As trying as this virus is, we mustn’t hastily barter away our enduring liberties for fleeting relief. At stake is nothing less than the soul of our society and the character of the future we’re toiling so tirelessly to ensure.”<sup>127</sup> Indeed, in times of crisis, history has shown that governments often implement more extreme surveillance measures that do not get entirely rolled back once the threat has ceased.<sup>128</sup> Aware of the backdrop of ever-increasing privacy encroachment, Google and Apple have given the plethora of privacy concerns serious consideration in the development of their Bluetooth tracing technology. In an interview with Wired, Apple,

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<sup>122</sup> Alan Z. Rozenshtein, “Disease Surveillance and the Fourth Amendment,” *Lawfare*, April 7, 2020, <https://www.lawfareblog.com/disease-surveillance-and-fourth-amendment>.

<sup>123</sup> *Id.*

<sup>124</sup> James D. Holt, Sudevi Navalkar Ghosh, and Jennifer R. Black, “Legal Considerations,” *Centers for Disease Control and Prevention*, December 13, 2018, <https://www.cdc.gov/eis/field-epi-manual/chapters/Legal.html#ref5>.

<sup>125</sup> *Id.*

<sup>126</sup> *Jacobson v. Massachusetts*, 197 U.S. 11, 25 (1905).

<sup>127</sup> Laurence H. Tribe, “Digital Coronavirus Data Tracing Would Barter Away American Liberties,” *USA Today*, April 22, 2020, <https://www.usatoday.com/story/opinion/todaysdebate/2020/04/21/coronavirus-data-tracing-barter-away-liberties-laurence-tribe-editorials-debates/3000576001/>.

<sup>128</sup> See, e.g., Daniel Klau, “Privacy, Security, and the Legacy of 9/11,” *UConn Today*, September 10, 2015, <https://today.uconn.edu/2015/09/privacy-security-and-the-legacy-of-911/>.

Google, and a variety of other experts weighed in on some of the most pressing privacy questions.<sup>129</sup>

Can Bluetooth tracking be used to identify Covid-19 positive individuals?	• <b>Unlikely.</b> While it's technically possible for people to pair contact notifications with separate methods of surveillance, such correlation attacks would be difficult to do on a large scale.
Can the app itself identify Covid-19 positive individuals?	• <b>Possibly.</b> An app may collect users' phone IP addresses if they report themselves positive. While Google and Apple say servers should refrain from collecting that data, the companies will ultimately will leave this privacy choice up to the app developer.
Will a contact-tracing app collect location data?	• <b>Possibly, but only with user consent.</b> Though the app only needs regional location data to run efficiently, health care organizations may seek more specific location data to better track infections.

Figure 4: Summary of key privacy questions and answers related to Google and Apple's BLE contact tracing plans. Source: <https://www.wired.com/story/apple-google-contact-tracing-strengths-weaknesses/>

All apps will require approval by Google and Apple, and every app will be judged independently on how it implements a privacy-focused framework before the companies allow government health agencies to run an app utilizing its technology.<sup>130</sup> Many organizations have shared data rights and principle frameworks that should guide the design of contact tracing apps, including:

- "Individual Data Rights for Exposure Notification" initially published by the TCN Coalition, a global coalition for privacy-first digital contact tracing protocols to fight COVID-19.<sup>131</sup> Six signatories have since co-sponsored the framework: Apheris AI, CoEpi, CovidWatch, ito, OpenMined, and U.S. Digital Response.
- "10 Requirements for the Evaluation of 'Contact Tracing' Apps" published by the Chaos Computer Club, Europe's largest association of hackers dedicated to providing information about technical and societal issues.<sup>132</sup> This framework places a particularly strong emphasis on privacy.

<sup>129</sup> Andy Greenberg, "Does Covid-19 Contact Tracing Pose a Privacy Risk? Your Questions, Answered," *Wired*, April, 17, 2020, <https://www.wired.com/story/apple-google-contact-tracing-strengths-weaknesses/>.

<sup>130</sup> *Id.*

<sup>131</sup> Harper Reed, Cari Spivack, and Andrew Trask, "Individual Data Rights for Exposure Notification," *Data Rights for Exposure Notification*, <https://exposurenotification.org/>.

<sup>132</sup> Linus, "10 Requirements for the Evaluation of 'Contact Tracing' Apps," *Chaos Computer Club*, April 6, 2020, <https://www.ccc.de/en/updates/2020/contact-tracing-requirements>.

- COVID-19 Contact Tracing Privacy Principles published by a team of academics, researchers, and practitioners at MIT.<sup>133</sup> This framework emphasizes accuracy and efficacy.

While each framework offers a unique perspective on the incorporation of privacy principles into a contact tracing app, they do share many values, including a sunset clause provision which would help ensure that the privacy encroachments will only remain for the duration of the crisis.

### Three Evaluations of Privacy Principles and Data Rights in Digital Contact Tracing

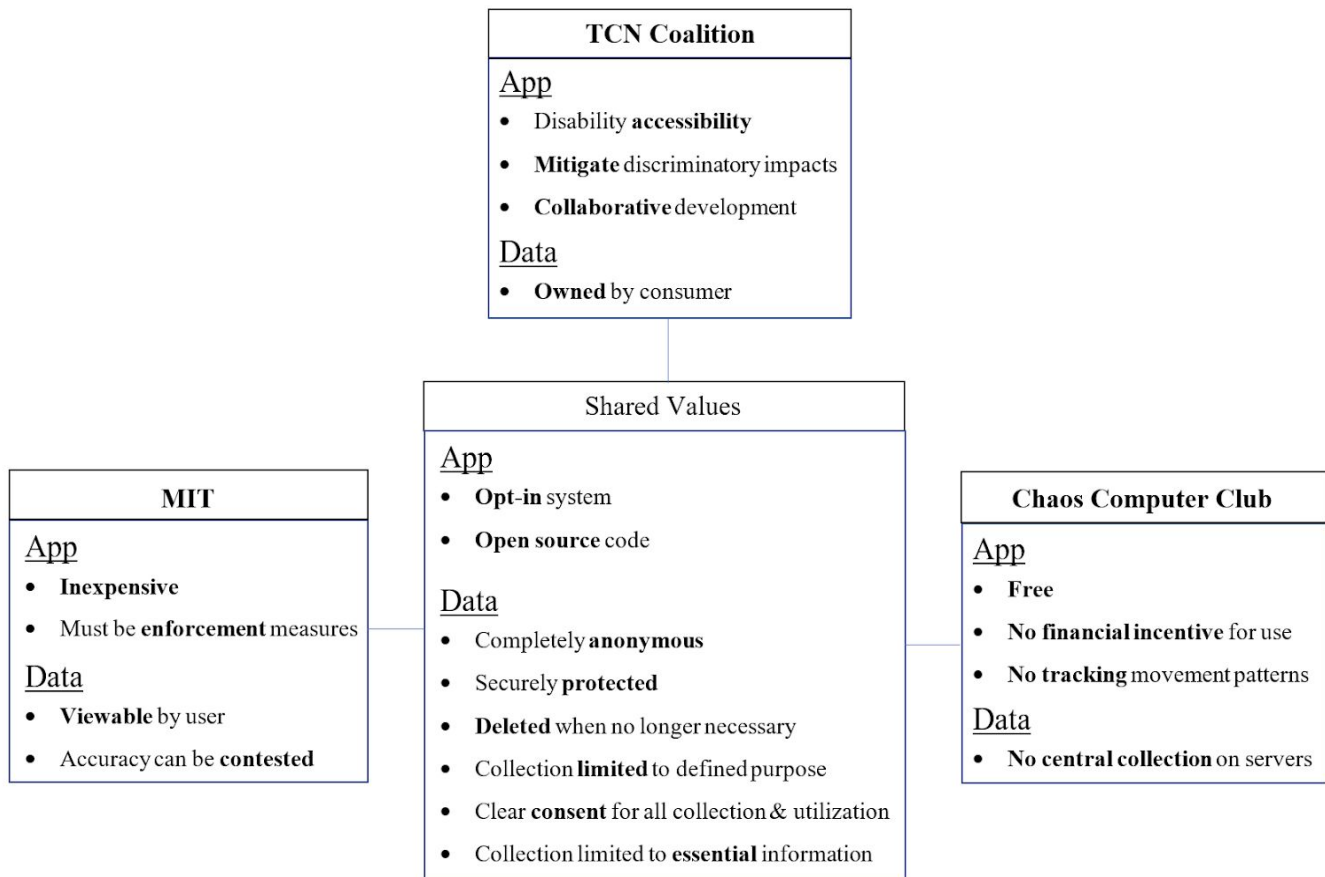


Figure 5: Comparison of the values identified in the different data rights frameworks proposed by MIT, the TCN Coalition, and Chaos Computer Lab for use in governing BLE contact tracing.

<sup>133</sup> Dazza Greenwood, Gregory Nadeau, Pagona Tsormpatzoudi, Bryan Wilson, Jeffrey Saviano, and Alex "Sandy" Pentland, "COVID-19 Contact Tracing Privacy Principles," *MIT Computational Law Report*, April 5, 2020, <https://law.mit.edu/pub/covid19contacttracingprivacyprinciples>.

However, ultimately the app developers will decide which principles to incorporate with Google and Apple placing some restrictions on which values *must* be incorporated.<sup>134</sup> The digital rights framework explored in “Individual Data Rights for Exposure Notification” lays out fourteen digital rights that its signatories feel an app must, should, or may include in its design.<sup>135</sup>

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<sup>134</sup> Andy Greenberg, “Does Covid-19 Contact Tracing Pose a Privacy Risk? Your Questions, Answered,” *Wired*, April, 17, 2020, <https://www.wired.com/story/apple-google-contact-tracing-strengths-weaknesses/>.

<sup>135</sup> Harper Reed, Cari Spivack, and Andrew Trask, “Individual Data Rights for Exposure Notification,” *Data Rights for Exposure Notification*, <https://exposurenotification.org/>.

# Individual Data Rights for Digital Contact Tracing and Alerting

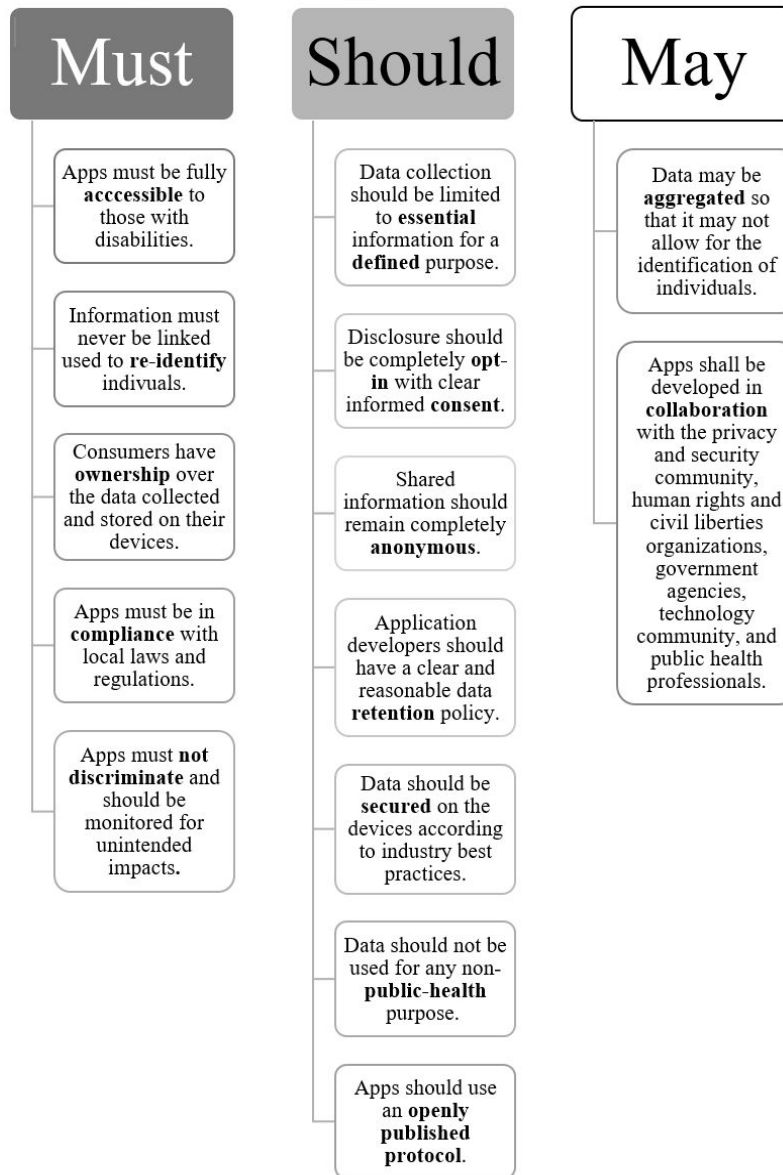


Figure 6: Summary of individual data rights for BLE contact tracing proposed by the TCN Coalition. Source: <https://exposurenotification.org/>.

## 5.3: Privacy Concerns Surrounding Private Industry’s Use of Digital Contact Tracing Results

Even if app developers adopt one of the privacy-focused data rights frameworks, private actors may attempt to undermine the anonymity of exposure alerts. Employers may require employees to report any contact notifications and instruct exposed employees to stay home for a certain number of days. While employers generally cannot obligate



their staff to disclose if they test positive for the virus, they can legally compel employees to have their temperatures taken at work and ask if they are experiencing any symptoms.<sup>136</sup> Federal and state laws recognize that employees have a right to privacy in matters related to their health, but that right must be balanced against an employer's "obligation to provide employees with a workplace 'free from recognized hazards that are causing or are likely to cause death or serious physical harm' under the General Duty Clause of OSHA."<sup>137</sup> Thus, an app designed for anonymous notification of potential coronavirus exposure may be lawfully misappropriated as a tool for assessing the health of a workforce. As a result, employees, worried about a potential reduction in the hours they work, may intentionally leave their phones at home when heading to public places in order to limit the number of notifications they receive without limiting their actual exposure. Though such workplace requirements may ultimately limit the efficacy of BLE contact tracing, employers concerned about their own liability may not care. Indeed, the country has already seen private actors prioritize their self-interest at the expense of the larger community time and time again.<sup>138</sup>

Unlike the uproar caused by previous private actor malfeasance during the pandemic, a company asking for private virus exposure information in an effort to ease the transition into reopening the economy may not spark such outrage, which may limit enforcement of anonymity. However, such loss of anonymity should not be taken lightly. If anonymity is not protected, COVID-positive patients may experience public shaming, as seen in South Korea.<sup>139</sup> Indeed, even individuals simply known to have been *exposed* to the virus may experience harassment if seen in public spaces or disparate treatment at work. Employers at "essential" workplaces may be hesitant to schedule shifts for employees who report potential exposure, which would further exacerbate wealth disparities seen along racial lines given the disproportionate amount of black Americans categorized as

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<sup>136</sup> "Coronavirus FAQs for US Employers," McDermott, Will & Emery, April 20, 2020, <https://www.mwe.com/insights/coronavirus-faqs-for-us-employers/#are-employees-obligated-to-disclose-if-they-have-tested-positive-for-covid-19>.

<sup>137</sup> Justine Phillips, Paul Cowie and Kelly Hensley, "Employee Privacy Forecast: Temperature Checks," *Sheppard Mullin*, March 25, 2020, <https://www.laboremploymentlawblog.com/2020/03/articles/coronavirus/employee-privacy-forecast-temperature-checks/>.

<sup>138</sup> See, e.g., Jody Barr, "Company That Wanted Its Workers' Stimulus Checks Apologizes for 'Ill-Advised' Plan," *KXAN*, March 30, 2020, <https://www.kxan.com/news/company-that-wanted-its-workers-stimulus-checks-apologizes-for-ill-advise-d-plan/>; Kate Taylor, "America's Richest Fast-Food Giants Qualify for \$10 Million Coronavirus Stimulus Loans, Revealing a Disturbing Loophole in a Program Designed to Help Struggling Small Businesses," *Business Insider*, April 21, 2020, <https://www.businessinsider.com/coronavirus-stimulus-loan-restaurant-loophole-explained-2020-4>.

<sup>139</sup> Max S. Kim, "Seoul's Radical Experiment in Digital Contact Tracing," *The New Yorker*, April 17, 2020, <https://www.newyorker.com/news/news-desk/seouls-radical-experiment-in-digital-contact-tracing>.

essential workers<sup>140</sup> and the disproportionate likelihood black Americans will receive more exposure notifications (discussed below). If employers limit the number of hours a potentially exposed employee can work, then individuals who most need their paychecks may be the least likely to receive them.

In addition to employment-based privacy concerns, there is also the potential for BLE contact tracing exposure alerts to be used by landlords as a factor in denying tenancy or evicting tenants. Exposure alerts could also provide an excuse for landlords to delay maintenance requests, though real estate attorney Scott Alagood has asserted that “residential landlords must address their tenants’ emergency requests regardless of health status.”<sup>141</sup> Housing-rights lawyers have asserted that coronavirus will likely fall under the Fair Housing Act provision that safeguards against housing discrimination based on disability, which would make it illegal for landlords to discriminate against COVID-positive people or to even inquire about a tenant’s COVID status.<sup>142</sup> However, even if such discrimination is illegal, that doesn’t prevent it from happening – and evictions can be very difficult to fight.<sup>143</sup> There have already been reports of landlords attempting to evict and co-ops refusing to accept healthcare workers potentially exposed to the virus.<sup>144</sup> Having BLE contact tracing creates the possibility that landlords may illegally demand to see tenants’ and potential tenants’ exposure notifications, opening up an avenue for housing discrimination.

These potential forms of private actor discrimination based on BLE contact tracing exposure notifications are likely to disproportionately harm black and Latinx

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<sup>140</sup> Eugene Scott, “4 Reasons Why the Coronavirus is Hitting Black Communities So Hard,” *The Washington Post*, April 10, 2010, <https://www.washingtonpost.com/politics/2020/04/10/4-reasons-coronavirus-is-hitting-black-communities-so-hard/>.

<sup>141</sup> *Id.*

<sup>142</sup> See, e.g., Jeffrey Young, “No, Your Landlord Can’t Evict You For Having The Coronavirus,” *The Huffington Post*, April 15, 2020, [https://www.huffpost.com/entry/rent-landlord-cannot-evict-coronavirus\\_15e94b545c5b6ff1965994864](https://www.huffpost.com/entry/rent-landlord-cannot-evict-coronavirus_15e94b545c5b6ff1965994864); Simone Carter, “Can my landlord ask if I am sick with coronavirus?,” *The Denton-Record Chronicle*, March 23, 2020, [https://dentonrc.com/coronavirus\\_outbreak/can-my-landlord-ask-if-i-am-sick-with-coronavirus/article\\_a8f4a325-b993-5284-9b50-287ea20047a7.html](https://dentonrc.com/coronavirus_outbreak/can-my-landlord-ask-if-i-am-sick-with-coronavirus/article_a8f4a325-b993-5284-9b50-287ea20047a7.html).

<sup>143</sup> Jeffrey Young, “No, Your Landlord Can’t Evict You For Having The Coronavirus,” *The Huffington Post*, April 15, 2020, [https://www.huffpost.com/entry/rent-landlord-cannot-evict-coronavirus\\_15e94b545c5b6ff1965994864](https://www.huffpost.com/entry/rent-landlord-cannot-evict-coronavirus_15e94b545c5b6ff1965994864).

<sup>144</sup> See, e.g., Libertina Brandt, “The Co-Op Board of an Upper West Side Building Turned Away a Doctor Who Came to NYC to Treat Coronavirus Patients, and It Highlights Yet Another Challenge the Healthcare Professionals on the Front Lines of the Pandemic are Facing,” *Business Insider*, April 3, 2020, <https://www.businessinsider.com/healthcare-workers-coronavirus-challenges-housing-apartments-2020-4>; Emily Shugerman, “Coronavirus Heroes Are Getting Tossed From Their Homes by Scared Landlords,” *Daily Beast*, March 27, 2020, <https://www.thedailybeast.com/coronavirus-nurses-face-eviction-housing-discrimination-from-scared-landlords>.

populations. African Americans are overrepresented compared to the overall population in the foodservice industry and “are more likely to work in jobs that put workers in close contact with others who might be in poor health and that make engaging in social distancing more difficult,” which increases the likelihood of receiving an exposure notification.<sup>145</sup> Additionally, housing disparities often force African Americans to live in densely packed areas, and “[b]lack and Latinx families in urban centers tend to double and triple up when rent is unaffordable, making distancing in the home impossible.”<sup>146</sup> Thus, black and Latinx people may be more likely to receive potential exposure notifications if they come in frequent contact with others in a densely populated community or housing situation.

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<sup>145</sup> Eugene Scott, “4 Reasons Why the Coronavirus is Hitting Black Communities So Hard,” *The Washington Post*, April 10, 2020, <https://www.washingtonpost.com/politics/2020/04/10/4-reasons-coronavirus-is-hitting-black-communities-so-hard/>.

<sup>146</sup> *Id.*

## Section 6: Who Should Make These Decisions?

Designing and implementing any Bluetooth contact tracing system requires making a series of decisions that are technologically, politically and ethically complex. Selecting the right group of decision makers is pivotal, not only to ensure an outcome based on expertise and thoughtful deliberation but also to increase the likelihood that the chosen system will be accepted by the American public. This section explains why we believe the ‘Process Era’<sup>147</sup> digital governance framework is best suited for the current context, and suggests looking beyond government and big tech when imagining what contact tracing governance in a Process Era framework could look like.

### 6.1: Digital Governance Frameworks

Digital governance has historically been centered around one of two major frameworks: rights or public health.<sup>148</sup> As outlined by Harvard Law Professor and Co-Founder of the Berkman Klein Center for Internet & Society Jonathan Zittrain, ‘Rights Era’ proponents rallied around a libertarian-esque vision of digital rights, attempting to limit online regulation and deflect government and corporate invasions into a fledgling online world.<sup>149</sup> On the other hand, ‘Public Health Era’ advocates began to consider the normative standpoint of what *ought to be* in the digital world, rather than just what *can be*, recognizing the growing power and impact of digital technology and the importance of intermediary responsibility in ensuring this power was used appropriately.<sup>150</sup> While these two frameworks don’t have to inherently conflict, they often do - and they are likely to oppose each other in any debate over digital contact tracing, where increased intrusions on individual privacy can directly improve critical public health outcomes.

Zittrain proposes that we may be entering a third era of digital governance: the Process/Legitimacy Era, a systems-focused framework that prioritizes constructing institutions with high levels of public trust that can build consensus and help bridge the disjunct between the Rights and Public Health Eras.<sup>151</sup> The key to the Process Era framework is the manner in which disputes are settled, rather than the outcomes of those settlements: was the process used to reach a decision inclusive and deliberative?

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<sup>147</sup> Jonathan L. Zittrain, “Three Eras of Digital Governance,” Sept 23, 2019, [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3458435](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3458435).

<sup>148</sup> Jonathan L. Zittrain, “Three Eras of Digital Governance,” Sept 23, 2019, [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3458435](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3458435).

<sup>149</sup> Rights Era digital governance was dominant from approximately 1995-2010; CDA 230 represents a classic example of this governance framework. *Ibid.*

<sup>150</sup> The Public Health Era has been prominent from around 2010-2020. *Ibid.* FOSTA-SESTA would be an example of this model of digital governance.

<sup>151</sup> *Ibid.*

Zittrain theorizes that even those who may disagree with a given result will still respect and abide by that result if they see the process that led to it as legitimate, analogous to the widespread acceptance of legal rulings in the intrinsically adversarial U.S. justice system.<sup>152</sup>

Given that (a) mass participation is extremely important to the efficacy of BLE contact tracing and (b) this tech will operate in a polarized political environment where protestors<sup>153</sup> are already asserting that their rights are being infringed upon by public health measures,<sup>154</sup> it is crucial that any process deciding upon and implementing BLE contact tracing is viewed as legitimate. We recommend the Process Framework as the best way to balance both the protection of individual rights and public health outcomes, while increasing the likelihood of system acceptance and participation.

## 6.2: Process-Based Governance for Digital Contact Tracing

### *Decision Makers Must Plan for the Future Now*

While policymakers and the public continue to focus on battling the first wave of coronavirus cases, increasing attention is being paid to the possibility of subsequent waves of infection. A modeling study from Harvard's Chan School of Public Health has indicated that COVID-19 will not die out after this initial wave ends, as SARS did in 2002-2003.<sup>155</sup> The study suggests that repeated periods of social distancing may be necessary without additional interventions. CDC Director Robert Redfield has indicated that a second wave of the novel coronavirus could be even deadlier than the first wave if it came this winter and coincided with flu season, which would further overwhelm hospital capacities.<sup>156</sup>

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<sup>152</sup> *Ibid.*

<sup>153</sup> Manny Fernandez, "Conservatives Fuel Protests Against Coronavirus Lockdowns," *The New York Times*, April 18, 2020, <https://www.nytimes.com/2020/04/18/us/texas-protests-stay-at-home.html>.

<sup>154</sup> However, there have been allegations that demonstrations against social distancing measures have been 'astroturfed' (meaning that well-funded and connected organizations have organized these protests behind the scenes while attempting to make them look like a grassroots movement). Igor Derysh, "'Astroturf': Gun rights activists and prominent GOP donors push protests of coronavirus restrictions," *Salon*, April 20, 2020, <https://www.salon.com/2020/04/20/astroturf-gun-rights-activists-and-prominent-gop-donors-push-protests-of-coronavirus-restrictions/>.

<sup>155</sup> "Intermittent social distancing may be needed through 2022 to manage COVID-19," *Harvard T.H. Chan School of Public Health*, 2020, <https://www.hsph.harvard.edu/news/hsph-in-the-news/intermittent-social-distancing-may-be-needed-through-2022-to-manage-covid-19/>.

<sup>156</sup> Lena H. Sun, "CDC director warns second wave of coronavirus is likely to be even more devastating," *The Washington Post*, April 21, 2020, <https://www.washingtonpost.com/health/2020/04/21/coronavirus-secondwave-cdcdirector/>.

If a subsequent wave of the virus does turn out to be worse than the first, either due to external factors such as coinciding with flu season or due to some mutation in the virus, then there may be an increased desire to implement even privacy-invasive tech solutions in order to stop the spread. While it's unsettled exactly where the line is when people are forced to decide between privacy or security<sup>157</sup>, it seems safe to theorize that most people do indeed have a line that represents the point where they perceive a threat as so significant that they are willing to trade away various privacy rights to protect either themselves or something else they care deeply about (e.g. their children, the nation, etc.).<sup>158</sup> Americans are almost evenly divided on whether it's okay for the government to track the location of either people known to have tested positive for coronavirus or people who may have been in contact with an infected person<sup>159</sup>: this balance could easily shift as other freedoms remain restricted by social distancing measures or if a second wave occurs and people continue to die.

The point is that if we can imagine a realistic circumstance within the next year where more invasive forms of BLE contact tracing could become acceptable, we need to start making certain preparations *now*. The complicated choices involved in any potential BLE contact tracing system must be evaluated before a second wave hits, and this involves determining who - if anyone - should be empowered to make decisions about utilizing more privacy invasive or compulsory digital contact tracing measures.

### *Looking Beyond Government & Big Tech in Governing BLE Contact Tracing*

As Zittrain's Process Era theory explains, who makes decisions and how decisions are made are crucial parts of a system's perceived legitimacy, which in turn impacts how well outcomes from that system are subsequently accepted.<sup>160</sup> Decision makers must retain the public trust, be perceived as having the public's best interest in mind, and be viewed as either impartial (such as judges) or as an accountable and democratic

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<sup>157</sup> As a caveat, privacy and security do not always have to stand in opposition to each other. For example, historian and philosopher Yuval Noah Harari has argued that making people choose between privacy and health is a false choice. See Yuval Noah Harari, "Yuval Noah Harari: the world after coronavirus," *The Financial Times*, March 20, 2020, <https://www.ft.com/content/19d90308-6858-11ea-a3c9-1fe6fedcca75>.

<sup>158</sup> This 'line' is better conceived of as a spectrum, where individuals will be increasingly willing to give up more and more privacy protections as their perception of a threat grows if they believe such privacy sacrifices can mitigate the threat (as opposed to individuals giving away all of their privacy protections at once when the threat hits a certain danger threshold that crosses their personal 'line').

<sup>159</sup> Monica Anderson and Brooke Auxier, "Most Americans don't think cellphone tracking will help limit COVID-19, are divided on whether it's acceptable," *Pew Research Center*, April 16, 2020, <https://www.pewresearch.org/fact-tank/2020/04/16/most-americans-dont-think-cellphone-tracking-will-help-limit-covid-19-are-divided-on-whether-its-acceptable/>.

<sup>160</sup> Jonathan L. Zittrain, "Three Eras of Digital Governance," Sept 23, 2019, [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3458435](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3458435).

authority (such as elected representatives). Decision makers must be able to evaluate both the short- and long-term consequences of any system they implement, including the potential for abuse of that system if safeguards are unsuccessful. They must also question whether privacy vs health trade offs are actually necessary or whether alternatives which align privacy and health goals are possible.

While government and tech companies have been presumed by many to be the natural executors of any digital contact tracing system, both of these actors face severe limitations. Partisan divides would likely prevent consensus on any given system<sup>161</sup> in the U.S. and a politicized approach could result in a variety of backlashes, including lower participation rates, increased trolling and mass protest. Public trust in the government remains near historic lows<sup>162</sup>, and America's sordid history of illicit citizen surveillance<sup>163</sup> further indicates that entrusting potentially invasive tech decisions to Uncle Sam may not be the greatest idea. Beyond just general distrust, a majority of citizens (61%) believe that governments do not understand emerging technologies enough to be able to regulate them effectively.<sup>164</sup> Finally, there's a question over *which* government(s) can or should make decisions about this sort of tech: based on Apple and Google's assertion that any tools they offer to one government must be offered to all governments,<sup>165</sup> purportedly national decisions about BLE contact tracing may have international ramifications.

Tech companies face many of the same issues: they retain little public trust,<sup>166</sup> have a history of privacy violations,<sup>167</sup> and may disagree on where the line should be drawn when it comes to building potentially invasive tech. Further, while governments may go too far when it comes to trading privacy rights for public health outcomes, there's at least some concern that big tech companies won't go far enough, even if more invasive measures are needed. Thus far, Apple and Google have held firm that they will only offer

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<sup>161</sup> Though there may be some room for Democrats and Republicans to work on bipartisan contact tracing solutions, as recently demonstrated by Senator Kyrsten Sinema (D-AZ) and Senator Ted Cruz (R-TX).

"Cruz, Sinema back portal for airline passenger data," March 11, 2020, <https://www.sinema.senate.gov/cruz-sinema-back-portal-airline-passenger-data>.

<sup>162</sup> "Public Trust in Government: 1958-2019," *Pew Research Center*, April 11, 2019, <https://www.people-press.org/2019/04/11/public-trust-in-government-1958-2019/>.

<sup>163</sup> "NSA Timeline 1791–2015," *Electronic Frontier Foundation*, <https://www.eff.org/nsa-spying/timeline>.

<sup>164</sup> "Edelman Trust Barometer 2020," *Edelman*, 2020, <https://edl.mn/2NOwltm>.

<sup>165</sup> Alex Hern, "France urges Apple and Google to ease privacy rules on contact tracing," *The Guardian*, April 21, 2020, <https://www.theguardian.com/world/2020/apr/21/france-apple-google-privacy-contact-tracing-coronavir-us>.

<sup>166</sup> Sanjay Nair, "In Technology We Trust(ed)," *Edelman*, Feb 25, 2020, <https://www.edelman.com/research/trend-eroding-trust-tech-continues>.

<sup>167</sup> See, e.g., Michael Grothaus, "How our data got hacked, scandalized, and abused in 2018," *Fast Company*, Dec 13, 2018, <https://www.fastcompany.com/90272858/how-our-data-got-hacked-scandalized-and-abused-in-2018>.

completely decentralized BLE contact tracing tech and their squeamishness at offering anything more invasive is warranted: tech companies have faced serious political and public backlash for privacy violations over the last few years.<sup>168</sup> Even if these companies had full public and governmental support in a moment of crisis, building invasive tech can lead to critique and censure down the road. This should serve as a warning to those assuming tech companies should be the default decision makers in this arena: if we are depending on tech companies to call the shots and companies like Apple and Google are only willing to offer fragmented solutions, we may see less scrupulous and less transparent groups step up to the plate instead - which would arguably be even worse for privacy interests.

While any group empowered to make decisions about BLE contact tracing needs buy-in from both the government and from tech companies, this doesn't mean that the decision makers inherently have to be the government and tech companies. Other potential models include the appointment or election of an independent executive board, or the formation of a stakeholders board that includes government and tech representatives but also encompasses a broad array of other stakeholders (such as pro-privacy advocates, healthcare workers, epidemiologists, civil liberties organizations, legal experts, and representatives of disenfranchised groups who may disproportionately impacted by a BLE contact tracing system and/or disproportionately impacted by the coronavirus). In a manner similar to the European Commission,<sup>169</sup> these boards could publish guidance on developing and implementing digital contact tracing tools.

It is clear that any such board would need sufficient authority, public trust, expertise, and ethical guidance in order to operate effectively. While we do not provide specific recommendations on how an independent executive or stakeholder board might be formed and operationalized,<sup>170</sup> we believe that one of these options may better align

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<sup>168</sup> See, e.g., Andrew Perrin, "Americans are changing their relationship with Facebook," *Pew Research Center*, Sept 5, 2018, <https://www.pewresearch.org/fact-tank/2018/09/05/americans-are-changing-their-relationship-with-facebook/>.

<sup>169</sup> Natasha Lomas, "EU lawmakers set out guidance for coronavirus contacts tracing apps," *TechCrunch*, April 16, 2020, <https://techcrunch.com/2020/04/16/eu-lawmakers-set-out-guidance-for-coronavirus-contacts-tracing-apps/>.

<sup>170</sup> Other groups have provided some generalized suggestions for any entity charged with governing contact tracing. The Electronic Frontier Foundation recommends an 'inclusive and transparent advisory board, which includes members of the public' to oversee the implementation of any contact tracing app, and they further advise that the ethical principles of any such intervention should be both agreed upon and published. "COVID-19 and Digital Rights," *Electronic Frontier Foundation*, 2020, [https://www.eff.org/issues/covid-19?mod=article\\_inline](https://www.eff.org/issues/covid-19?mod=article_inline). The Oxford contact tracing study suggests that an effort should be made to engage communities and involve key community members and stakeholders



with the Process Era digital governance framework than defaulting to government and tech company decisions. More research should be conducted on how best practices for independent and/or stakeholder governance models could be applied to construct an executive board in this context.

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in response planning processes. Luca Ferretti et al., "Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing," *Science*, March 31, 2020, <https://science.sciencemag.org/content/early/2020/04/09/science.abb6936>. And an WHO incident management guide for Ebola suggests that incident managers within that virus response framework 'must have the authority to make *immediate* decisions, *immediately* allocate resources and funds,' and coordinate other involved parties. Benedetta Allegranzi et al., "Implementation and management of contact tracing for Ebola virus disease," *World Health Organization*, Sept 2015, [https://webcache.googleusercontent.com/search?q=cache:v\\_rcEWinjPkJ:https://apps.who.int/iris/bitstream/10665/185258/1/WHO\\_EVD\\_Guidance\\_Contact\\_15.1\\_eng.pdf%3Fua%3D1+&cd=8&hl=en&ct=clnk&gl=us&client=firefox-b-1-d](https://webcache.googleusercontent.com/search?q=cache:v_rcEWinjPkJ:https://apps.who.int/iris/bitstream/10665/185258/1/WHO_EVD_Guidance_Contact_15.1_eng.pdf%3Fua%3D1+&cd=8&hl=en&ct=clnk&gl=us&client=firefox-b-1-d).