COVID-19: The Internet of Things and Cybersecurity

Prepared by Fredrik Skippervold and Dr Catherine Wheller

The COVID-19 pandemic has inspired a range of Internet of Things (IoT) innovations to help stop the spread of the virus. This is the fourth edition of COVID-19: IoT and Cybersecurity and builds on the rapid advances in the issues surrounding contact tracing applications in the UK.

Past editions are found here.

The UK approach to contact tracing

A trial of the NHSX contact tracing app is taking place this week and should bring answers to outstanding usability questions

The NHSX contact tracing app is being tested this week on the Isle of Wight[1] before a UK-wide rollout into 'two or three weeks time' (17 May onwards).

The planned UK-wide implementation of contact tracing in the UK will incorporate a manual system will be used in tandem with a contact tracing app on smartphones.[2] For those without a smartphone, researchers have suggested simple Bluetooth wristbands could be worn to increase coverage.[3]

An opinion poll has found widespread support (65%) for the introduction of a contact tracing app in the UK, but 90% of respondents say it is important that any app protects civil liberties and privacy.[4]

A Data Protection Impact Statement (DPIA) for the app has not yet been released.

Overview

- Trials of the NHSX contact tracing app are taking place this week on the Isle of Wight
- The NHSX has not yet released the Data Protection Impact Statement
- Debates are continuing about centralised and decentralised approaches
- A split European approach will risk cross-border infection if different apps cannot talk to each other
- India has had a strong early uptake of their contact tracing system. However 550 million people in India use 'feature' phones which are not Bluetooth enabled.
- In Australia, although half the population are supportive of the government's app, only 16% have downloaded it. Many are waiting for temporary legislation to be made permanent.

The NHSX have said they are releasing their source code for the contact tracing app[5] soon (will be at this link if released after publication).

The EU GDPR introduced a new requirement in Article 35[6] for DPIAs to be conducted when data processing is likely to pose a 'high risk to the rights and freedoms of natural persons'. DPIAs have broader scope than Privacy Impact Assessments previously in use as they encompass all rights and freedoms.[7]

As of May 4, the NHSX has not released a DPIA to the ICO.[8] In an oral hearing made to the Science and Technology committee on 28 April, the CEO of NHSX committed to publishing the DPIA.

A second open letter (29 April) to the UK government has been signed by 177 cybersecurity and privacy experts warning about plans by NHSX to deploy a contact tracing application.[9] The letter calls for the DPIA and source code to be released immediately to ensure proper debate and scrutiny rather than just before deployment.

Updates to the Google and Apple API

Google and Apple have rebranded their technical solution to contact tracing as 'exposure notification' as the joint partnership is providing the framework for public health authorities to build their own applications that can manage the exposure notifications foundation for contact tracing apps, and not the apps themselves. As of 5 May, they have released the preliminary draft of the Exposure Notification API and beta release for iOS[46] (beta 3 of iOS 13.5) and Android. A new release on 4 May[47] includes sample source code, example user interfaces, and policies of use.

Of note, is that the companies plan to restrict access to a single application per country (however may support countries where a state or regional approach is undertaken).[48]

More information on what the framework will be able to provide is coming to light, including as a response to feedback, Google and Apple will allow use of information based on distance and duration of interactions to calculate exposure risk levels. This calculation will be done in a decentralised approach, on the user's device.[49]

The debate between centralised and decentralised approaches to contact tracing

The debate over using a centralised vs a decentralised approach to contact tracing is often framed as a tradeoff between preserving privacy and collecting useful epidemiological data.

As it stands, the NHSX app uses 'centralised' approach[10] which records the de-anonymised ID of an infected person in a central location, in addition to the IDs of all those whom the infected person has been in contact with. In the above letter, the experts state that solutions which allow reconstruction of individuals 'must be fully justified', and that they are especially 'unnerved by a declaration that...a social graph [of who someone has met over a period of time] is indeed aimed for by NHSX'.

The NHSX believes that the centralised approach allows them to see hotspots in where the disease is spreading, optimise the algorithm to decide whether someone should be told to self-isolate or request a test, and to gain insights into the spread of the

virus.[11]

The NHSX claims that a centralised app can make use of people self-diagnosing themselves before they can obtain test results, by being able to spot 'anomalous patterns of activity' and therefore dissuade people from lying to the app for malicious reasons. However, advocates for the decentralised protocol say that holding people to account for submitting false reports would require identification - which is a 'slippery slope'.[12]

The National Cyber Security Centre have published a technical paper[13] and a blog[14] on the security and privacy characterists of the app and infrastrure and describe the epidemiological and clinical aspects of the system, to provide context for technical decisions and trade-offs. This includes explanation of the importance of self-diagnosis in the UK model. A review of these assertions[15] has been provided this morning (5 May), noting several points that require greater transparency.

On 4 May, the Joint Committee on Human Rights took evidence from the Information Commissioner, academics and the CEO of NHSX to explore how the right to privacy (Article 8 ECHR) can be protected if a contact tracing app is rolled out in the UK.

The question was raised on whether it is possible for the NHSX to change the approach from centralised to decentralised. One of the developers of the decentralised protocol DP-3T believes that it would not be much of an upheaval to start from scratch. However, this would be much more difficult once the app has been rolled out. The CEO of the NHSX has been forthcoming and says that 'if we need to shift then we will', and that 'just because we have started down one route, doesn't mean we are locked into it'.[16]

Legal experts are calling for a decentralised solution as questions on the legality of a centralised system are raised

A legal opinion on the human rights impacts of the UK's government's proposals published on 4 May sets out that a centralised system would require significant justification to be lawful.[17] In contrast, a decentralised system would likely comply with both human rights and data protection laws. Attempts to introduce 'immunity passports' would be a dramatic measure and would need clear scientific basis and to address the significant impact on fundamental

rights including the risk of indirect discrimination.

Recommendations and guidelines on how to make an app trustworthy and developed within best practice have been published

On 4 May, the ICO published expectations on how contact tracing solutions may be developed in line with the principles of data protection by design and some best practice recommendations.[18] The ICO is there to help technical teams build data protection by design and default into their service to promote trust and confidence in any solution.

Building on the well-received Ada Lovelace rapid evidence review[19], the Ada Lovelace Institute have outlined the steps needed to make an app trustworthy before it's deployed in a new publication Provisos for a Contact Tracing App (4 May). They recommend that 'there is not yet the evidence and justification for an imminent national roll out [of the app]'.[20]

The transcript (28 April) from the Science and Technology Committee oral hearing on the potential use of immunity certificates and contact tracing apps in the UK has now been released.

Reactions to the NHSX app from Scotland

The Scottish Government has released their approach to implement "test, trace and isolate, support" on May 4.[21] Contact tracing will be expanded, and will be supported by digital tools. A web-based tool[22] is being developed by the Digital Health and Care Institute where infected individuals can input details of people that they have been in close contact with, and for these to be sent to contact tracing teams.

In regards to the NHSX app, Scotland's approach reads 'we do consider that an app of this type can be an important enhancement to contact tracing, but it is also important not to see it as a substitute for the approach to contact tracing we describe here. It is also important that the public have confidence in the use of such technology and in the use of data.'

Enhanced COVID-19 contact tracing is intended to be in place by the end of May 2020.

International approaches to contact tracing

Ireland has announced the development of their own decentralised app. This has raised questions about how it would interoperate with the NHSX app, which will be used in Northern Ireland.

With its centralised approach, the NHSX app does not appear to be compatible with the HSE app being developed in Ireland, which is adopting the decentralised privacy preserving approach[23] that is popular in continental Europe. This has brought concerns over the nature of the border with Northern Ireland, which will presumably be using the NHSX app.

A split European approach will risk cross-border infection if different apps cannot talk to each other

Europe is increasingly split in its approach in using virus contact-tracing applications.[24] Countries such as France and Norway, who are opting for the centralised approach, argue that this facilitates the work of health officials. The decentralised approach is now being embraced by much of Europe with countries such as Austria, Switzerland, Germany and now Ireland choosing to adopt it.

Although the European Data Protection Board (EDPB) guidelines on the use of location data and contact tracing tools in the context of the COVID-19 outbreak[25] suggest that both a centralised and decentralised approach are viable options, the European Institute of Innovation and Technology has stated that a 'fragmented approach of individual European countries is doomed to fail'. Such an approach would 'lack scale' and thus be 'more expensive and less powerful'.[26]

EU member states have developed an EU toolbox[27] for the use of mobile applications for contact tracing. This toolbox was released just five days after Apple and Google's announcement[28] to partner on COVID-19 contact tracing technology. An updated and unified contact tracing standard may be necessary. A split Europe will risk different apps not being able to talk to each other[29] when users cross Europe's borders.

A proposal on the Interoperability of decentralised proximity tracing solutions across regions has been released by the DP-3T team.[30]

Useability issues that could affect uptake on iPhones has been reported in Australia.

Apple and Google have imposed conditions to allow apps to access the device's Bluetooth systems while phone screens are locked. These include using a decentralised system. Apps that do not adhere to those conditions, will not be able to transmit identifiers over Bluetooth while the screen is inactive.

This has been seen most recently in Australia where the iPhone must have the screen on and the app running in the foreground in order for the phone's Bluetooth to work.[31]

There has been no information yet supplied[32] from the NHSX on whether they have developed a useable workaround for this issue.

India has had a strong early uptake of their contact tracing system, however privacy experts have concerns about issues surrounding potential mandatory use

The Indian Government's contact tracing 'Aarogya Setu' launched on April 2 and became the fastest app to reach 50 million downloads in India since Pokemon Go.[33] At the end of April, the app had 75 million downloads.

However, India's International Data Corporation (*IDC)* estimates that while India has around 450 million smartphone uses, it also has 550 million people using non-smart ('feature') phones, the majority of which do not have data, Bluetooth or GPS capability.[34]

A government minister has indicated that a similar contact tracing solution for feature phones is being developed.[35] Developments in this area will be watched closely, as close to 2 billion mobile (feature phone and incompatible smartphones) users globally will not benefit from smartphone based contact tracing apps.[36]

The app is currently voluntary, however for some sectors it is already mandatory.There are plans to make it mandatory public transport as a way of easing the national lockdown. Digital rights experts have warned of privacy risks, which are high as India does not have a data protection authority.

Half of Australians support their government's app, but only 16% have downloaded it. Many are waiting for temporary legislation to be made permanent, and there are also fears the data could be accessed by the United States government.

More than 4 million people have downloaded 'COVIDSafe', the centralised contact tracing app developed by the Australian government.[37]

Australia[38], and other countries[39] have had issues with fake SMS messages being sent to mimic public health responses.

On May 4, the Australian Government published draft legislation titled draft legislation to support the COVIDSafe app and provide ongoing privacy protections. The Australian Government intends to introduce this draft legislation in Parliament in the week of 11 May 2020.[40] Of note, the legislation will make data abuses a criminal offence punishable by five years in prison and/or a fine.[41]

Legal analysis on the previous determination under the Biosecurity act (2015) [42] which is largely reproduced by the new draft legislation concludes that although it does a 'creditable job in addressing privacy concerns', there are a 'variety of legal risks that remain'.[43] This is echoed in another analysis[44], which identifies five transparency deficiencies and nine legal improvements that are needed.

The ABC News in Australia have reported on the concerns that giving Amazon the contract for data storage could mean COVIDSafe data is obtainable by the US under CLOUD Act subpoena. While a protection exists, Australia has not yet been designated a 'qualifying foreign government' for this to be valid. Special legislation[45] is required for this to happen. The earliest that this legislation could pass, and indeed make permanent the temporary legal framework accompanying the app, is mid May, when Federal Parliament returns.

Endnotes

1 https://news.sky.com/story/nhs-contact-tracing-app-to-be-trialled-on-isle-of-wight-this-week-cabinet-minister-reveals-11982408
2 https://www.bbc.co.uk/news/explainers-52442754
3 https://www.bbc.co.uk/news/technology-52409893
4 https://blog.okfn.org/2020/05/04/new-opinion-poll-uk-contact-tracing-app-must-take-account-of-human-rights/
5 https://github.com/nhsx
6 https://www.privacy-regulation.eu/en/article-35-data-protection-impact-assessment-GDPR.htm
7 https://www.cambridge.org/core/journals/data-and-policy/article/data-protection-impact-assessments-as-rule-of-law-governance-mecha-nisms/3968B2FBFE796AA4DB0F886D0DBC165D/core-reader
8 https://twitter.com/ICOnews/status/1257326726377541632
9 https://drive.google.com/file/d/1uB4LcQHMVP-oLzIIHA9SjKj1uMd3erGu/view
10 https://www.ncsc.gov.uk/blog-post/security-behind-nhs-contact-tracing-app
11 https://www.bbc.co.uk/news/technology-52532435
12 https://www.bbc.co.uk/news/world-52470472
13 https://www.ncsc.gov.uk/files/NHS-app-security-paper%20V0.1.pdf
14 https://www.ncsc.gov.uk/blog-post/security-behind-nhs-contact-tracing-app
15 https://www.theregister.co.uk/AMP/2020/05/05/uk_coronavirus_app/
16 https://parliamentlive.tv/event/index/6f0f52cf-9fda-4785-bf63-af156d18b6c7
17 https://www.awo.agency/covid-19-legal-opinion.pdf
18 https://ico.org.uk/media/for-organisations/documents/2617676/ico-contact-tracing-recommendations.pdf
19 https://www.adalovelaceinstitute.org/our-work/covid-19/covid-19-exit-through-the-app-store/
20 https://www.adalovelaceinstitute.org/wp-content/uploads/2020/05/Ada-Lovelace-Institute-Provisos-for-a-Contact-Tracing-App-4-May-2020.pdf
21 https://www.gov.scot/publications/coronavirus-covid-19-test-trace-isolate-support/
22 https://www.gov.scot/publications/coronavirus-covid-19-test-trace-isolate-support/pages/11/
23 https://www.irishtimes.com/business/technology/hse-covid-19-tracing-app-data-will-be-stored-on-individual-devices-1.4240304
24 https://www.bbc.co.uk/news/technology-52532435
25 https://edpb.europa.eu/sites/edpb/files/files/file1/edpb_guidelines_20200420_contact_tracing_covid_with_annex_en.pdf
26 https://eit.europa.eu/news-events/news/european-struggle-covid-19-contact-tracing-apps
27 https://ec.europa.eu/health/sites/health/files/ehealth/docs/covid-19_apps_en.pdf
28 https://www.apple.com/uk/newsroom/2020/04/apple-and-google-partner-on-covid-19-contact-tracing-technology/
29 https://www.nytimes.com/aponline/2020/05/04/business/bc-virus-outbreak-europe-app-privacy.html
30 https://drive.google.com/file/d/1mGfE7rMKNmc51TG4ceE9PHEggN8rHOXk/edit
31 https://twitter.com/phocks/status/1256354615051730944
32 https://www.theregister.co.uk/AMP/2020/05/05/uk_coronavirus_app/
33 https://www.freepressjournal.in/india/go-aarogya-setu-go-modi-govts-app-pushes-aside-pokmon-go-to-become-fastest-growing-mobile-app-with-50-million-users
34 https://www.theregister.co.uk/2020/04/30/india_to_develop_contact_tracing_for_feature_phones/
35 https://twitter.com/rsprasad/status/1255070654795091968
36 https://www.ft.com/content/271c7739-af14-4e77-a2a1-0842cf61a90f
37 https://www.smh.com.au/politics/federal/half-of-us-say-we-support-the-covidsafe-app-but-only-16-per-cent-have-downloaded-it-20200501-p54p53.html
38 https://factcheck.afp.com/hoax-text-message-circulated-online-about-australias-coronavirus-contact-tracing-app
39 https://nrkbeta.no/2020/04/20/sa-enkelt-er-det-a-forfalske-sms-er-fra-smittestopp/
40 https://www.ag.gov.au/RightsAndProtections/Privacy/Pages/COVIDSafelegislation.aspx
41 https://www.theguardian.com/australia-news/2020/may/04/government-releases-draft-legislation-for-covidsafe-tracing-app-to-allay-priva-cy-concerns
42 https://www.legislation.gov.au/Details/F2020L00480/Download
43 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3591622
44 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3589317
45 https://www.aph.gov.au/Parliamentary_Business/Bills_Legislation/Bills_Search_Results/Result?bId=r6511
46 https://9to5mac.com/2020/04/29/ios-13-5-beta-covid-19-contact-tracing/
47 https://techcrunch.com/2020/05/04/apple-and-google-release-sample-code-and-detailed-policies-for-covid-19-exposure-notification-apps/
48 https://www.theverge.com/2020/5/4/21246512/apple-google-code-sample-ui-ios-android-contact-tracing-exposure-notification
49