



COVID-19 Contact Tracing Solutions

April 2020



Introduction



Contact tracing solutions



Case study: COVIDSafe App for Australia



Appendix: Contact tracing case studies



Introduction

Countries need to re-start their economies

- Prior to COVID-19, 160 countries expected to have positive income growth; now, 170 are expected to have negative growth¹
- 81% of global workforce of 3.3bn people have had their workplace fully or partly closed²
- Equivalent of 195 million full time workers losing their jobs due to reduction in working hours²
- Demand for oil has shrunk, leading to the lowest prices in 21 years³
- Forecast drop of ~35% in global travel and tourism revenue compared with 2019⁴
- ~\$8 trillion USD in fiscal measures undertaken by governments⁵
 - Higher spending and foregone revenues: \$3.3 trillion
 - Public sector loans and equity injections: \$1.8 trillion
 - Guarantees: \$2.7 trillion

Note: Data as at 26/4/2020

1. IMF; 2. [BBC/ILO](#); 3. [BBC/Bloomberg](#); 4. [Statista](#); 5. [IME](#)

Contact tracing will play a critical role in re-starting economies

Three phases to the crisis



Contact tracing is a critical lever

-  Efficient access to testing
-  Rapid diagnostic
-  Comprehensive contact tracing
-  Hospitalise and treat the infection
-  Clear and timely communications and health advice

Source: BCG analysis

Contact tracing is the process of identifying positive and at-risk people and deploying measures to reduce spread of infections

The traditional contract tracing process:

An investigative process which involves:

1. Identifying people who have been in contact with infected patients within the incubation period (e.g. through interviews)
2. Contacting and alerting people who may have been exposed to the virus
3. Assessing risk, and implementing quarantine measures to contain further spread

Key Challenges:

1. *Highly manual and labour intensive* to identify contacts, and conduct outreach activities
2. Prone to error due to *lapses in memory*, and *inability to identify contacts with strangers* (e.g. contacts on public transport or in grocery stores)

How Digital Tools can Improve Outcomes:



Identification of strangers with whom there has been close contact



Serving as memory aid to improve effectiveness



Enable scalability through automation, and reduction of manual process steps

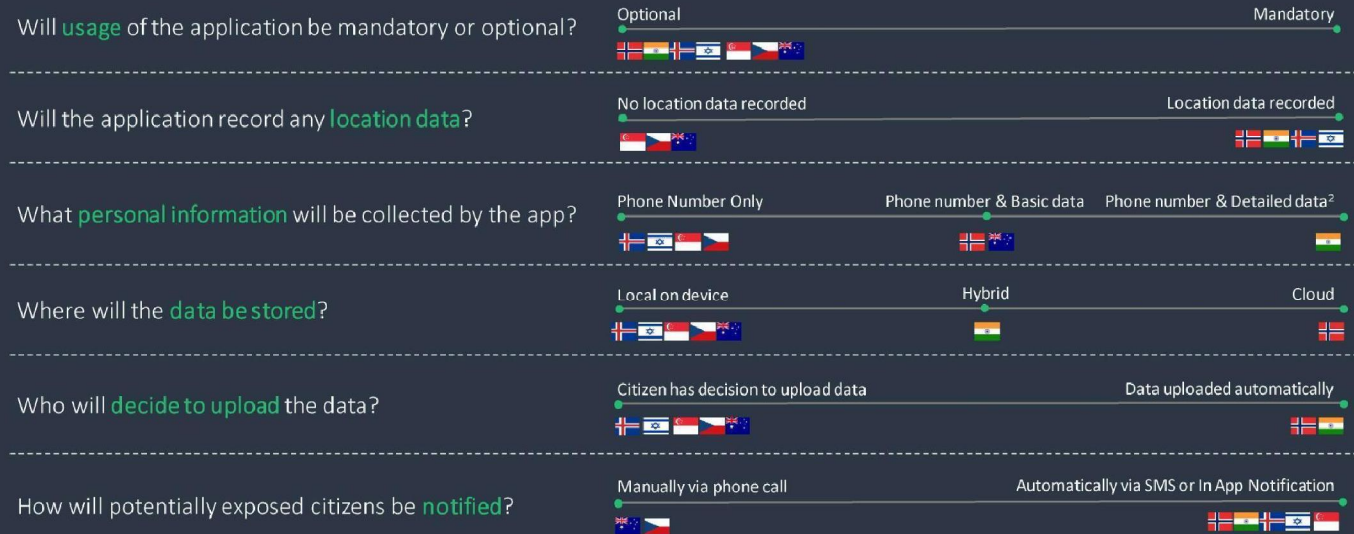
Several countries are using digital tools for contact tracing



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Note: 1. * Denotes case study included within this document, 2. Multiple apps available in South Korea developed and launched by the public, not government (e.g. Corona 100 and Corona Map).⁷
Source: Publicly available media and government websites as at 24th April 2020

Some key design decisions needed for deploying contact tracing solutions



1. For example name, age and/or post code 2. For example DOB, address and/or travel history in addition to basic demographics;
Source: Publicly available media and government websites as at 24th April 2020

Approach adopted varies across countries, with main differentiators being approach to data and privacy

Country	App name	Application Usage	Location tracking	Personal Data Collected	Data Storage Location	Upload decision	Notification System
 Norway	SmitteStopp	Optional	Yes	Phone Number and Age	Cloud	Automatic	SMS
 India	Aarogya Setu	Optional	Yes	Name, Phone Number, Gender, Profession and Travel History	Location local on device, Cloud other	Automatic	In App
 Iceland	Rakning C-19	Optional	Yes	Phone Number	Local on device	Voluntary	In App
 Israel	HaMagen	Optional	Yes	Phone Number	Local on device	Voluntary	In App
 Singapore	TraceTogether	Optional	No	Phone Number	Local on device	Voluntary	In App
 Czech Republic	eRouška	Optional	No	Phone Number	Local on device	Voluntary	Phone call
 Australia	COVIDSafe	Optional	No	Full Name, Post Code, Age Range and Phone Number	Local on device	Voluntary	Phone Call, then In App

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Source: Publicly available media and government websites as at 24th April 2020

While solutions are driving significant public impact, apps are voluntary and relatively new, and adoption levels still low

Country	Application name	Launch date	Downloads (millions)	% of population
 Iceland	RakningC-19	April	0.15	40%
 Norway	SmitteStopp	April	1.4	26%
 Singapore	TraceTogether	March	1.1	20%
 Israel	HaMagen ("The Shield")	March	1.5	17%
 India	Aarogya Setu	April	75	6%
 Czech Republic	eRouška ("E-Facemask")	March	0.1	1%

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Note: Australia excluded as insufficient time from launch date to leverage availability data; numbers based on last available updates in public
 Source: [Norway](#), [India](#), [Belgium](#), [Singapore](#), [Israel](#), [Czech Republic](#)



Lessons learned in contact tracing solutions

Developing a contact tracing solution requires three things: product, operations and go-to-market

Build of E2E MVP product

- Design & user experience
- Privacy
- Development
- Testing

Data & Technology platform

- Data management
- Algorithms and analytics
- Security
- Hosting

Future product roadmap

- Target state (e.g. additional use cases)
- Initiatives and sequencing



Marketing campaign

- Branding and design assets
- Marketing plan
- Launch

Launch plan & execution

Impact tracking

- Metrics definition
- Dashboard

Process, workflow, and change management

- Citizen and govt users
- Integration with existing operations

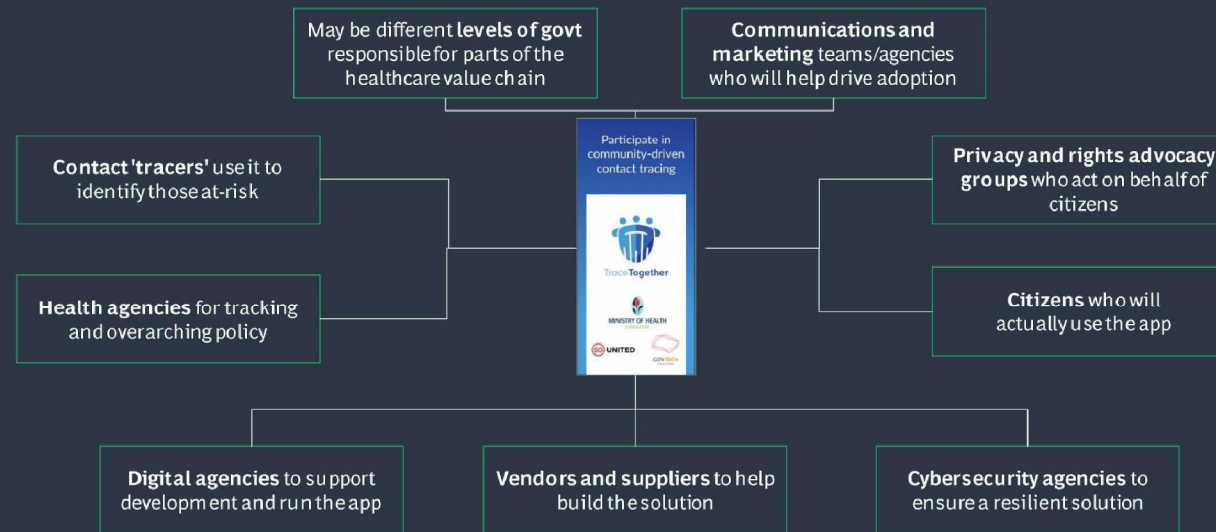
Support model

- Define model
- Train L1 and L2 support

Governance and structure

- Define governance forum and meeting cadence
- Confirm ongoing product ownership

Managing a complex stakeholder environment is essential



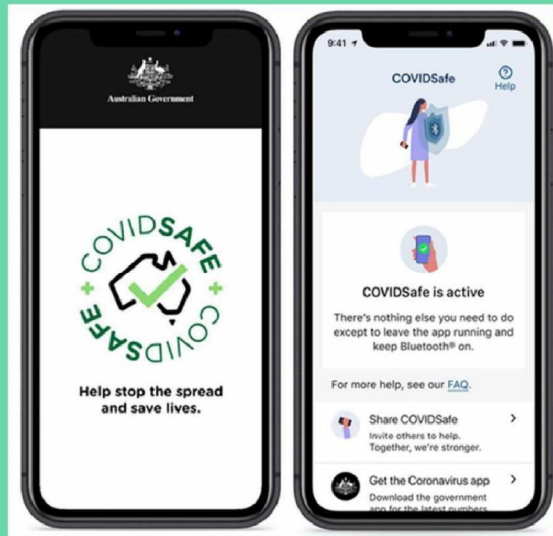
Eight success factors for a successful contact tracing solution

Product	Make the front-end app design clear, simple and easy to use to spur adoption (e.g. only ask for minimal registration information) Develop an algorithm to interpret Bluetooth 'ping data' and determine whether close contact has likely taken place. The algorithm needs to help identify all potential close contacts while avoiding false positives Ensure security and encryption are focused on from the start, including both at a device and back-end level
Operations	The approach to product and operations need to match a country's specific situation – for example, the number and rate of infections; the size of the population; and, the capacity of healthcare operations Remember that health officials are the other major user. Make the solution easy for health officials to use, and support easy integration with their existing workflows A highly-scalable operations and support model needs to be put in place to handle a major increase in the numbers of users and associated requests for support
Go-to-market	Messaging around the benefits of using the app and addressing concerns related to (for e.g. privacy) to be clear, approachable, and avoid jargon A data-driven adoption plan needs to be rolled out and actively monitored to ensure take up of the app

An abstract graphic on the left side of the slide. It features a dark blue background. On the left, there is a curved, segmented structure resembling a DNA helix or a data stream, composed of many small, light blue squares. To the right of this structure, there is a network of nodes and lines. The nodes are represented by circles of various sizes and colors, including light blue, green, and white. Some nodes are connected by thin, light blue lines, forming a web-like structure. The overall aesthetic is technological and data-driven.

Case study: **COVIDSafe** Australia

COVIDSafe is Australia's contact tracing solution to support health officials with coronavirus containment efforts



Key features:

The use of the app is completely **voluntary**

The **data captured** includes a name, age range, postcode and mobile number

Infected citizens have a double consent **option not to share** the data from the app when liaising with health officials

Bluetooth **data is stored on the app**, with only anonymous reference identifiers and data only kept for **21 days**

The app is not leveraging the recently announced **APIs from Google and Apple**

COVIDSafe is designed to be an easy to use 'single purpose' product



9:41

←



Registration and privacy

It is important that you read the COVIDSafe [Privacy Policy](#) before you register for COVIDSafe.

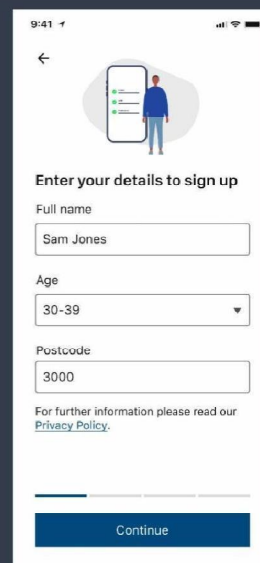
If you are under 16 years of age, your parent/guardian must also read the [Privacy Policy](#).

Use of COVIDSafe is completely voluntary. You can install or delete the application at any time. If you delete COVIDSafe, you may also ask for your information to be deleted from the secure server.

To register for COVIDSafe, you will need to enter a name, mobile number, age range and postcode.

Next

Easy to understand language for privacy information



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Enter your details to sign up

Full name

Sam Jones

Age

30-39

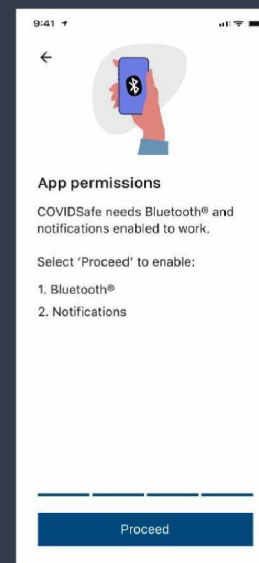
Postcode

3000

For further information please read our [Privacy Policy](#).

Continue

Simple forms to fill out and registration progress indicator



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App permissions

COVIDSafe needs Bluetooth® and notifications enabled to work.

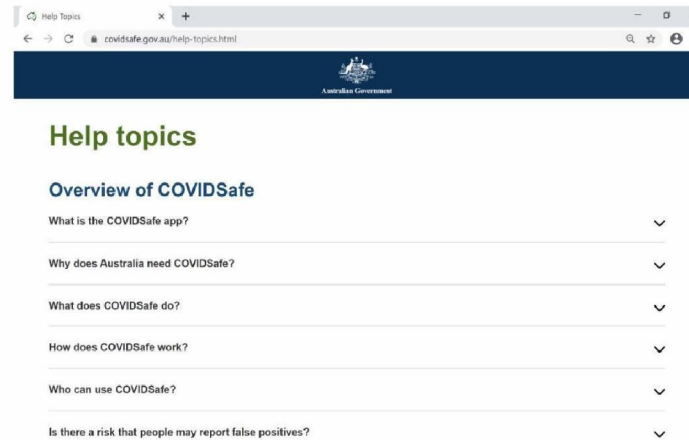
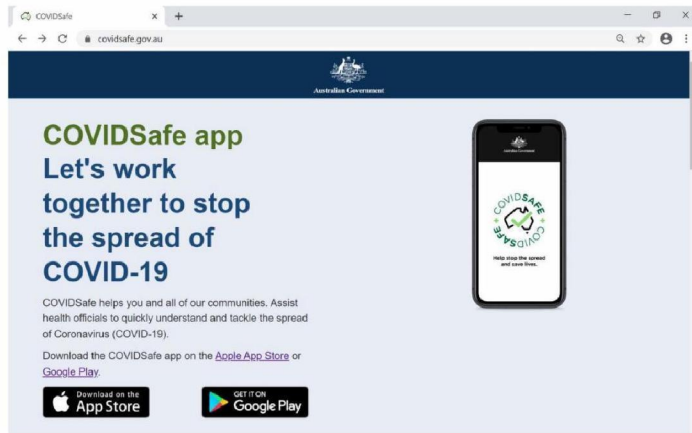
Select 'Proceed' to enable:

1. Bluetooth®
2. Notifications

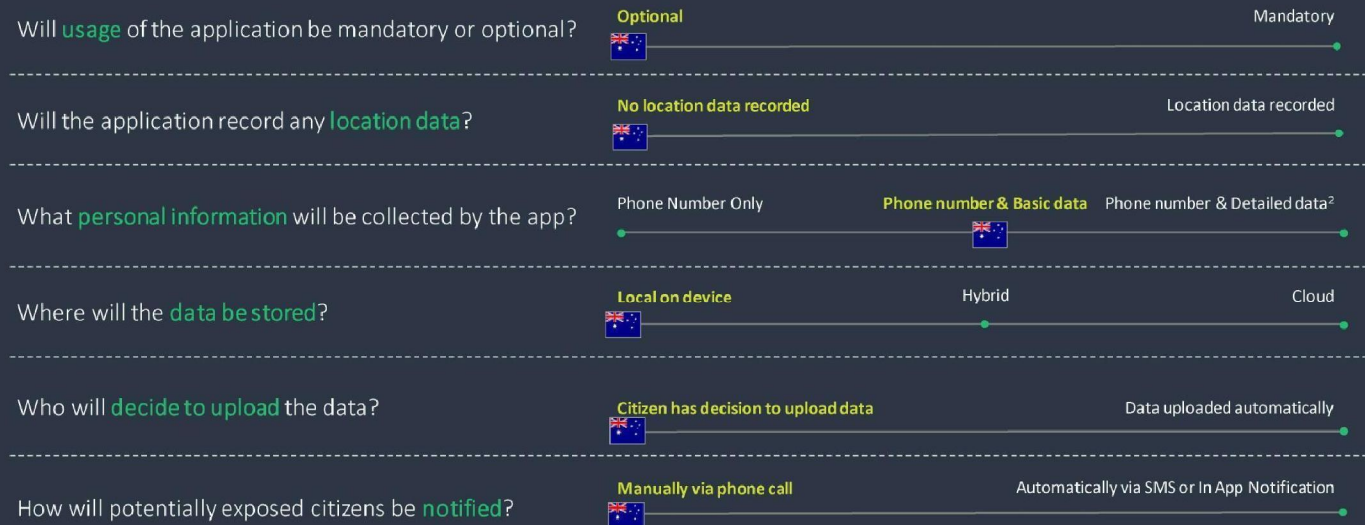
Proceed

Clear, easy to follow instructions

A website provides links to download the apps and FAQs



Australia's approach to key design decisions is privacy centric, and apps functions as memory aid only

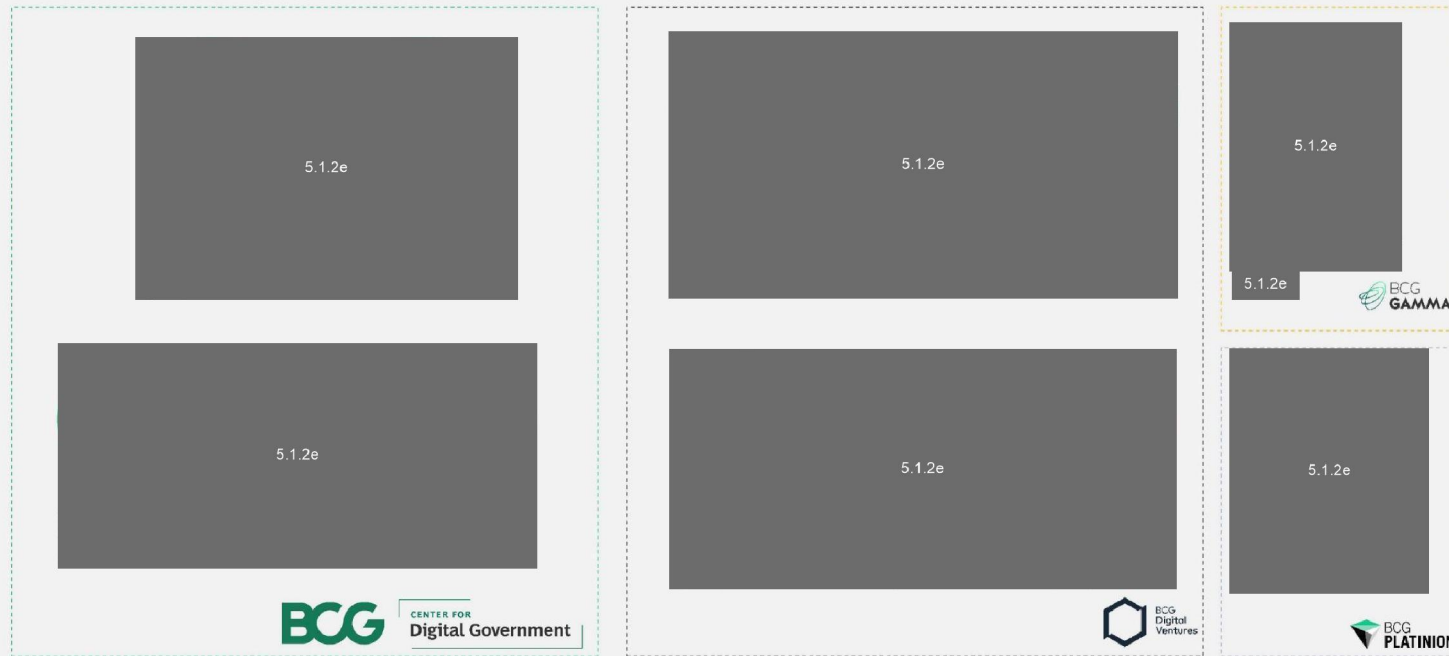


1. For example name, age and/or post code 2. For example DOB, address and/or travel history in addition to basic demographics;
Source: Publicly available media and government websites as at 24th April 2020

BCG was part of a joint team with government agencies and industry partners



A multi-disciplinary BCG team supported the COVIDSafe launch



The full suite of DigitalBCG capabilities has been involved



Strategy and operating model, stakeholder management, and adoption strategy



User interface design for the app and admin portal and integration across product build team (e.g. AWS, Shine)

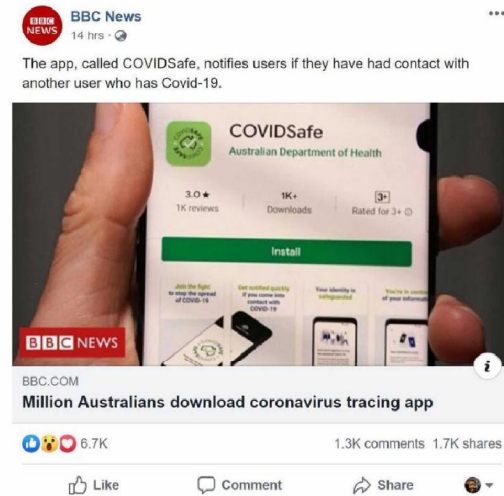


Mapped user flows, and integration with existing contact tracing processes



Supporting development of the Bluetooth® proximity algorithm

More than 2M people downloaded and registered in ~24 hours



COVIDSafe Contact Tracing App



Australian Government



Context

Australian Government wanted to introduce a mobile app that improves the effectiveness of COVID-19 contact tracing



Objective

Design, develop and release a contact tracing app for Australia and achieve at least 40% take-up



Strategic Value

Help reduce the spread of COVID-19 by improving the accuracy and speed of contact tracing

Approach

- BCG, DV, Gamma, and Platinion were engaged as part of a multi-disciplinary team comprising technical specialists from world-leading technology companies including AWS, Shine Solutions and GoSource to develop the app over short timeframe (~4 weeks)
- BCG played a critical role coordinating delivery between the design, build and testing teams, as well as defining the overall operating model and resourcing requirements to support the app after go-live
- BCG also worked on the design, overall user experience, user stories, and screen designs; and the analytics required to support Bluetooth® based contact tracing

Outcome

Australia's COVIDSafe contact tracing app was built in a rapid pace after the delivery team was mobilized. The app:

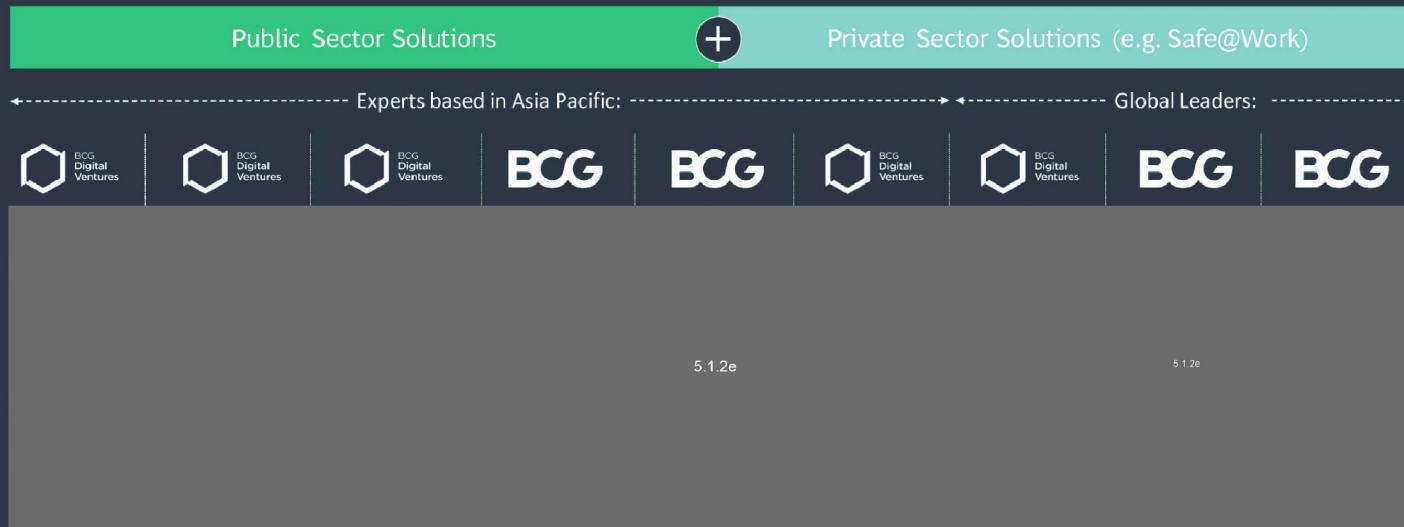
- Was thoroughly tested from a usability and performance perspective
- Was subject to a rigorous independent cybersecurity evaluation which analyzed how user data is stored, secured and used
- Was subject to an independent privacy impact assessment
- Solved significant technical challenges associated with interoperability between Android and iOS

In addition:

- A supporting microsite and marketing materials were developed to help drive app adoption
- A privacy statement, consent model were developed
- A support model was defined and an instance of Jira was deployed to support ongoing operation & improvements to the app
- An Administration Portal was set for Government officials to administer the app

The app was launched at 6PM on Sunday 27th April 2020 and over 2M people downloaded and registered for COVIDSafe in ~24 hours

BCG can design, build and launch COVID-19 contact tracing platforms for both public and private sector organisations





Appendix: Contact tracing app case studies

Approaches to digital contact tracing in six countries



Singapore
TraceTogether



Norway
SmitteStopp



India
Aarogya Setu



Israel
HaMagen



Czech Republic
eRouška



Iceland
Rakning C-19

TraceTogether

Case study of contact tracing app to help prevent the spread of COVID-19 in Singapore



What Singapore did

GovTech launched a smart phone app called TraceTogether as a preventive measure against the COVID-19 through community driven contact tracing.

Once downloaded from the app store, it assigns unique identifiers to citizens devices, and uses Bluetooth technologies to detect and log details of all other users who come within 2-5 meters proximity.

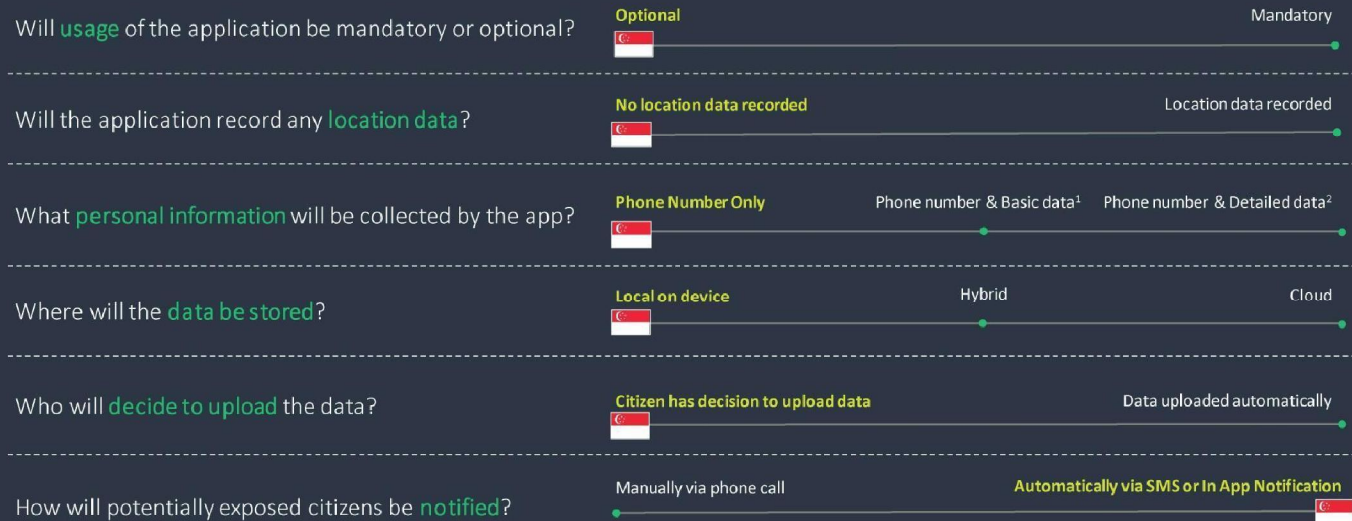
If a citizen tests positive for the COVID-19 virus, the Ministry of Health provides them with a code to enable them to authorise sharing their logs with the Ministry. These are decoded by the Ministry, and any close contacts alerted anonymously.

Usage of the app is voluntary, and to protect user privacy the only data provided is a mobile number. The Ministry of Health is the only authority who can decrypt app logs.

Source: [GovTech](#)

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Singapore's approach to the 6 key design decisions is privacy focused, and enables scalability through automated outreach



1. For example name, age and/or post code 2. For example DOB, address and/or travel history in addition to basic demographics;
 Source: Publicly available media and government websites as at 24th April 2020

Backup: What is TraceTogether and how does it work?

TraceTogether is a contact-tracing smartphone app that enables the Ministry of Health (MOH) to quickly track people who have been exposed to confirmed coronavirus cases.

- 1** Users here can download the app on the Apple App Store or the Google Play Store.



- 2** Users have to input their mobile phone number for MOH to be able to contact them quickly. The number is the only data collected by the Government through the app.

Enter your mobile number to be contacted

+65

We'll text you a One-Time Pin (OTP).
Setting up for your family? Use their number instead of yours.

Enter OTP that was sent to +65

Wrong number?

Your code will expire in 1:57. [Resend Code](#)

- 3** During the initial set-up, users have to give their explicit consent to be able to use the app.

Your consent is needed for the following:

- ☐ To store your mobile number in a secured TraceTogether registry
- ☒ For TraceTogether users who are COVID-19 cases to share information about their possible encounters with you — so that we can call your mobile phone about next steps.

[I agree](#)

- 4** Users will then have to enable push notifications and location permissions, and keep the Bluetooth function on their phones turned on.

Set up app permissions

Select "Yes" for the next 2 screens to set up:

1. Bluetooth
2. Push notifications

Both are needed for the app to work. Your battery usage may increase.

[Proceed](#)

- 5** This is because the app uses short-distance Bluetooth signals that are exchanged between phones to detect other TraceTogether users in close proximity.



- 6** Official contact tracers who call users will provide a code that users can match with a corresponding verification code on their app.
- Once authenticated, users will be given a PIN number that allows submission of logs when entered.
 - Official contact tracers will not ask for personal financial details or transfer of money.



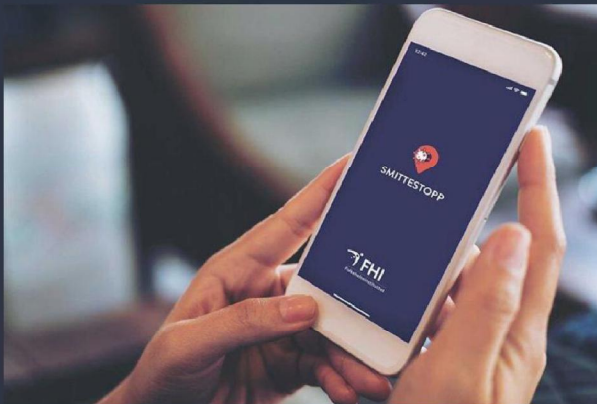
Sources: GOVTECH, MINISTRY OF HEALTH PHOTOS: GOVTECH STRAITS TIMES GRAPHICS

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Source: <https://www.straitstimes.com/singapore/coronavirus-spore-government-to-make-its-contact-tracing-app-freely-available-to>

SmitteStopp (Infection Stop)

Case study of contact tracing app to help prevent the spread of COVID-19 in Norway



What Norway did

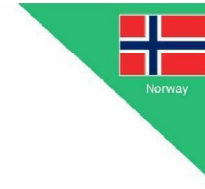
The Norwegian Institute of Public Health's (FHI) COVID-19 contact tracing application was launched in April, and was downloaded >1.4m times in the first week of launch¹.

The application uses phone Bluetooth and location capabilities to record close interactions with other application users; looking specifically for incidents where a user was closer than 2 meters for >15 minutes to a person that has been diagnosed with the infection.

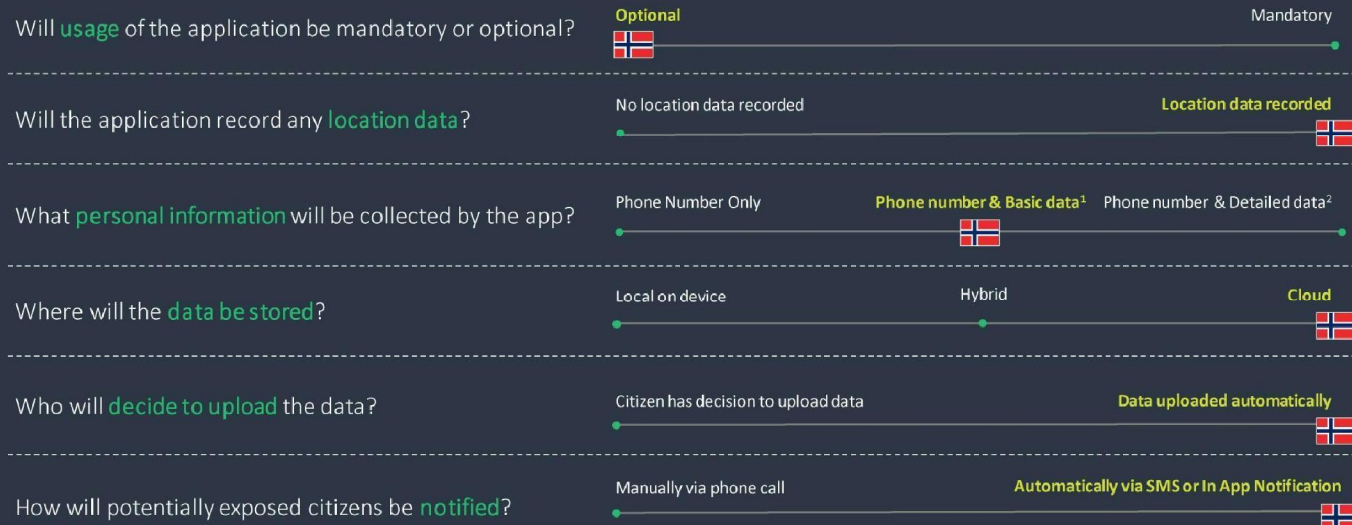
If a user is confirmed to be infected with COVID-19, the data is used in the contact tracing process and the Health Authorities will send an anonymous notification via SMS with advice on appropriate health measures to all close contacts identified.

Location and close contact data is retained for 30 days before deletion. Personal demographics data recorded is limited to Phone Number and Age. Users can delete their data by deleting the application, or via delete functionality in the app.

Through the SmitteStopp app, the Norwegian Institute of Public Health receives anonymised data about movement patterns in society to aid in research on the effect of changes to the measures in fighting the virus.



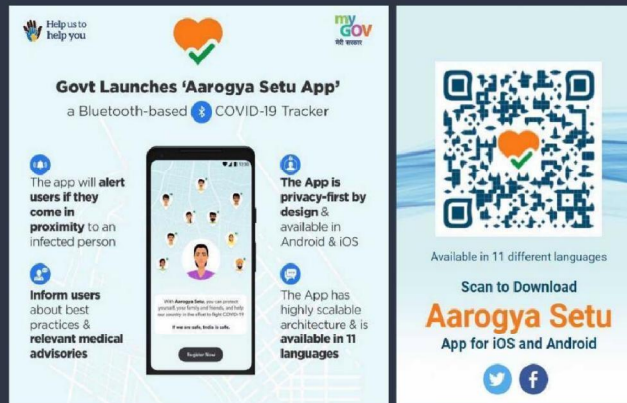
Norway's approach to the 6 key design decisions enables a data led approach to contact tracing leveraging location and Bluetooth functionality



1. For example name, age and/or post code 2. For example DOB, address and/or travel history in addition to basic demographics;
Source: Publicly available media and government websites as at 24th April 2020

Aarogya Setu

Case study of contact tracing app to help prevent the spread of COVID-19 in India



Help us to help you

Govt Launches 'Aarogya Setu App'
a Bluetooth-based COVID-19 Tracker

The app will alert users if they come in proximity to an infected person

Inform users about best practices & relevant medical advisories

The App is privacy-first by design & available in Android & iOS

The App has highly scalable architecture & is available in 11 languages

Available in 11 different languages

Scan to Download
Aarogya Setu
App for iOS and Android



What India did

AarogyaSetu is a mobile application developed by the Government of India to augment the initiatives of the Government (particularly the Department of Health) to proactively reach out to the citizens of India to provide information on best practice and health guidance for the containment of COVID-19.

The application acts as a one-stop solution for spreading awareness about Covid-19, helping self diagnose users, provide latest updates and even to store and display e-pass. In addition, it includes functionality to aid in contact tracing.

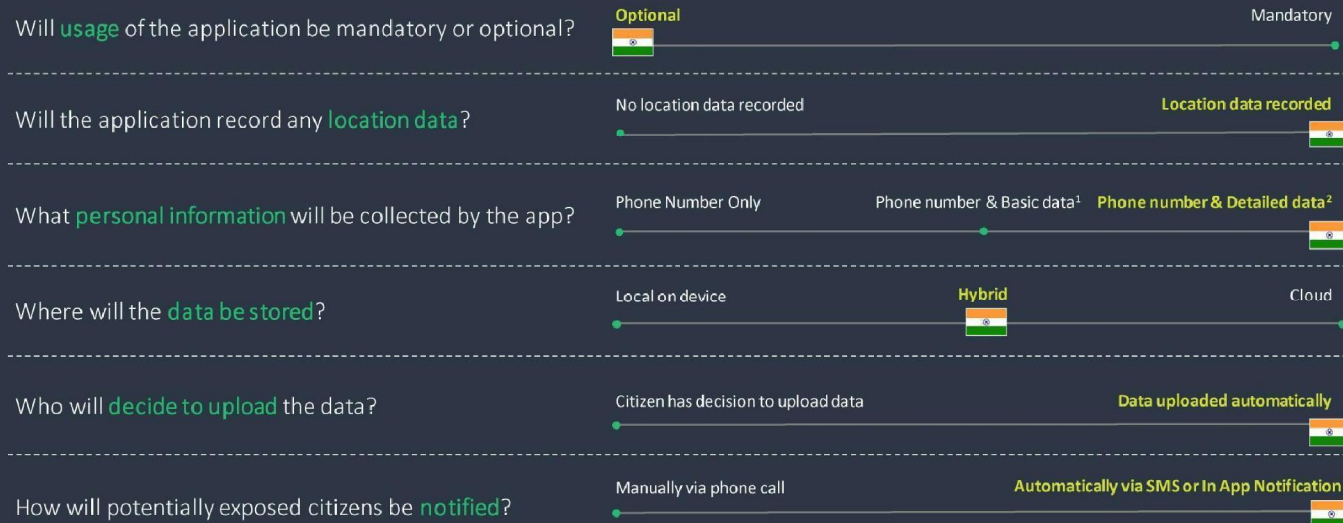
During the registration process, users are asked to provide detailed demographic data including name, phone number, gender, recent travel history and details pertaining to profession. Users are also asked to provide health data and progress through symptom self-assessment.

Once downloaded the app leverages phone location and Bluetooth capabilities to identify potential close contacts, and automatically alerts users if they have been in close proximity with an infected person. It then proactively offers information on appropriate next steps (e.g. isolation). All of the information provided is vetted by the government's Department of Health.

Source: <https://www.livemint.com/technology/tech-news/aarogya-setu-app-how-bluetooth-helps-in-identifying-covid-19-suspects-11587730877077.html>

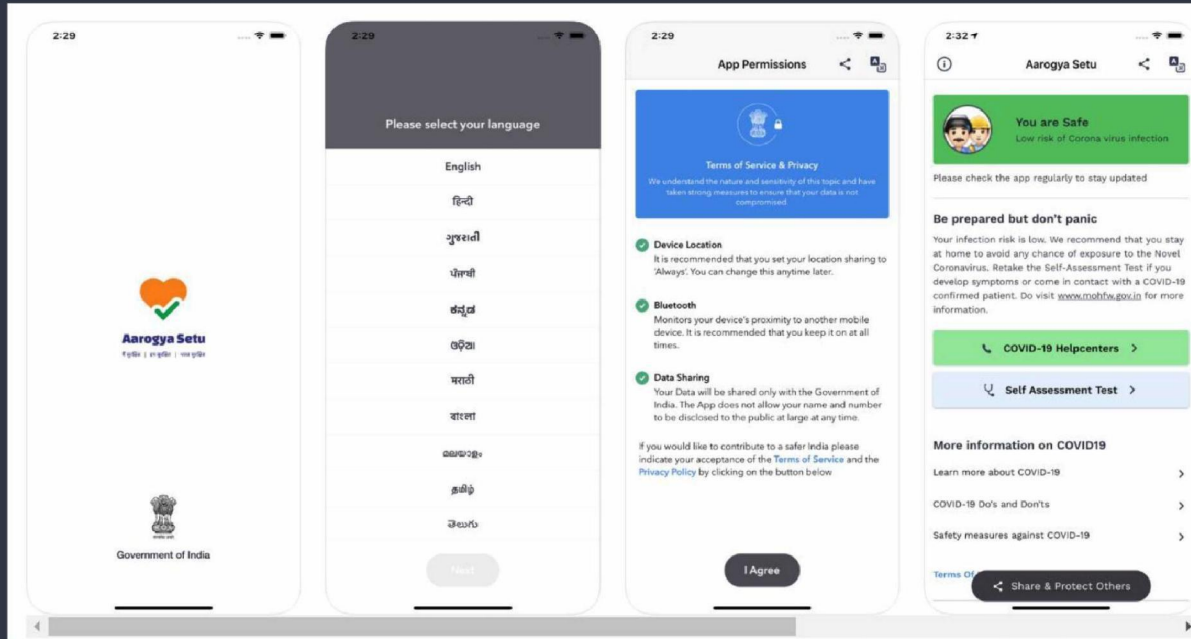
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India's approach to the 6 key design decisions reflects one-stop-shop approach for self-assessment, outreach and contact tracing



1. For example name, age and/or post code 2. For example DOB, address and/or travel history in addition to basic demographics;
Source: Publicly available media and government websites as at 24th April 2020

Screenshots from Aarogya Setu iPhone mobile app



Source: apps.apple.com/in/app/aarogyasetu/id1505825357

Rakning C-19 (Tracking C-19)

Case study of contact tracing app to help prevent the spread of COVID-19 in Iceland



<https://www.youtube.com/watch?v=8lvpVW7n0o4>



What Iceland did

Rakning C-19 was launched by the Icelandic Government (Icelandic Directorate of Health and Department of Civil Protection and Emergency Management) to help mitigate the Covid-19 pandemic in Iceland. It facilitates the contact tracing process.

The app collects GPS location data and stores it locally on the device both when the app is in use, and when it is in the background (via a plugin called React Native Background Geolocation). Data is retained for 14 days before deletion.

If the user is diagnosed with COVID-19, they are asked via push notification by the Directorate of Health to share the location data for contact tracing in order to identify individuals that might need to go into quarantine. Users agree by entering their National ID number (if available), and accepting on the screen. If the user agrees, data is sent to the Contact Tracing Teams database where it is then used, together with information gathered through traditional interview based contact tracing methodologies, to identify the individuals and places that have potentially been exposed to the virus.

Users are authenticated by their phone numbers, which is the only personally identifying information collected upon registration. Usage of the application is voluntary.

The application is now Open Source with a view to enabling cooperation across countries, facilitating contributions for app improvement, and providing transparency on how the app works. It is still under evaluation if APIs will be made open source.

Source: <https://github.com/aranja/rakning-c19-app/blob/master/README.md>

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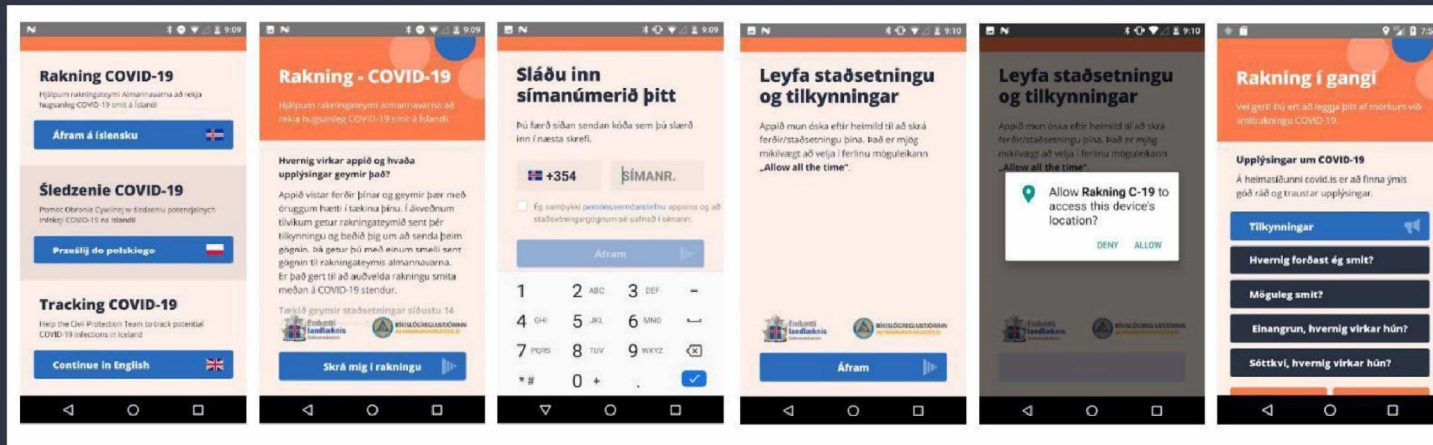
Iceland

Iceland's approach to the 6 key design decisions focusses on leveraging location history as a memory aid to augment contact tracing process



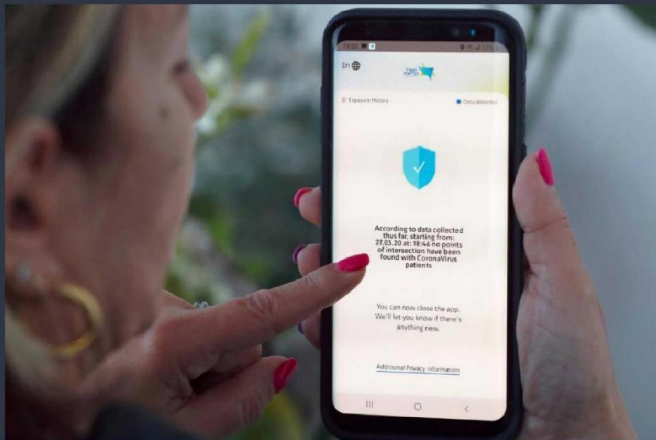
1. For example name, age and/or post code 2. For example DOB, address and/or travel history in addition to basic demographics;
 Source: Publicly available media and government websites as at 24th April 2020

Screenshots from Rakning C-19 mobile application



HaMagen (The Shield)

Case study of contact tracing app to help prevent the spread of COVID-19 in Israel



What Israel did

Ministry of Health launched an app to support contact tracing through identification of close contacts of COVID-19 patients using location data.

The application is voluntary, and uses mobile device location data to track a user's location. It then compares this with the Ministry's data on infected person's paths, notifies users of matches and provides them with instructions on what to do next via referral to the Ministry of Health Website.

The cross-referencing of your GPS history with the locations of COVID-19 patients happens on your phone; your GPS data does not leave your mobile phone, and is not sent to any third party. The data from the Ministry of Health is sent to your mobile phone for cross-referencing, no data is sent back to the Ministry of Health. The app allows users to decide whether to report their exposure to the coronavirus to the ministry.

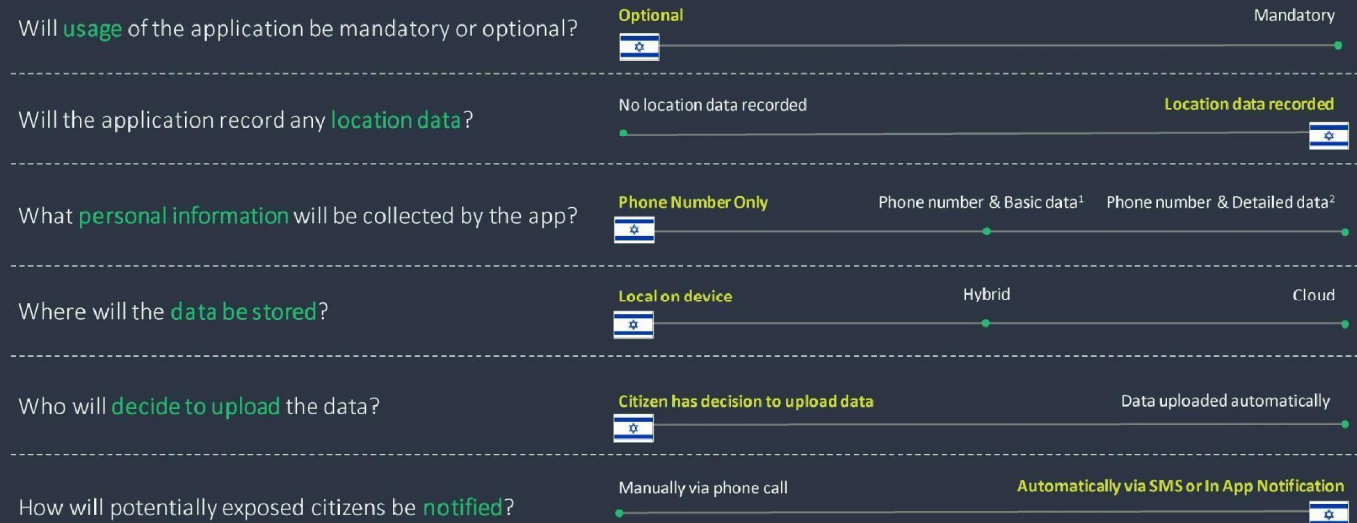
The application was developed in Israel on the basis of Open Source code to enable transparency with the public, and to make it possible for programmers in Israel and around the world to contribute to improvement of the app.

The application replaced the practice of publishing Ministry of Health data for citizens to review and identify close contacts.

Source: 1. <https://latamiraal.com/english/hamagen-is-a-app-for-fighting-the-spread-of-coronavirus/> 2. <https://govextra.gov.il/ministry-of-health/hamagen-app/download-en/> 3. <https://medium.com/proferosec-osm/hamagen-application-fighting-the-coronavirus-4ecf55eb4f7c>

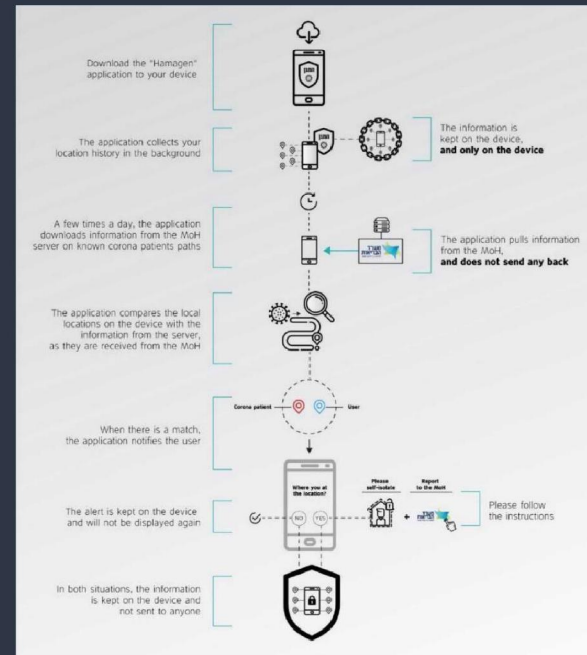
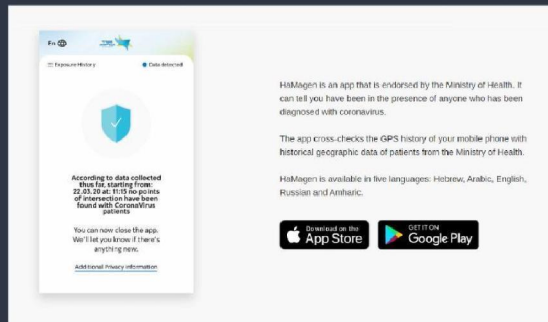
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Israel's approach to the 6 key design decisions



1. For example name, age and/or post code 2. For example DOB, address and/or travel history in addition to basic demographics;
 Source: Publicly available media and government websites as at 24th April 2020

How does HaMagen work?

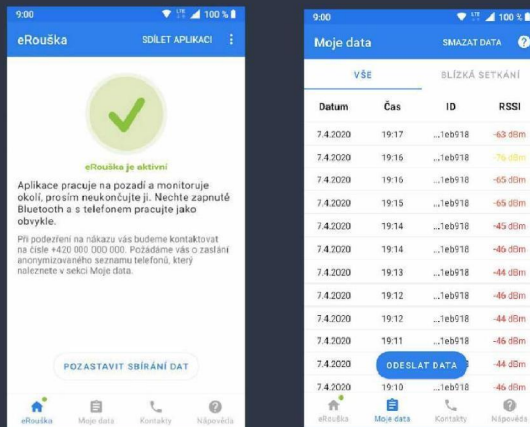


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Source: 1. <https://latamisrael.com/english/hamagen-is-an-app-for-fighting-the-spread-of-coronavirus/> 2. <https://govextra.gov.il/ministry-of-health/hamagen-app/download-en/> 3. <https://medium.com/proferosec-osm/hamagen-application-fighting-the-corona-virus-4ecf55eb4f7c>

eRouška

Case study of contact tracing app to help prevent the spread of COVID-19 in the Czech Republic



What Czech Republic did

The Czech Republic recently launched its tracing app on both iOS and Android platforms as a part of its broader Smart Quarantine project, a broader initiative that also seeks to link payment card data

As in other countries, the app leverages Bluetooth technology to identify contact with others. It only collects data related to Bluetooth pings, including the duration of the contact as well as the signal strength, in an attempt to avoid false positives. Only a phone number is required to register the app, and indeed this does not have to match the app device's actual number, further helping provide assurance on privacy

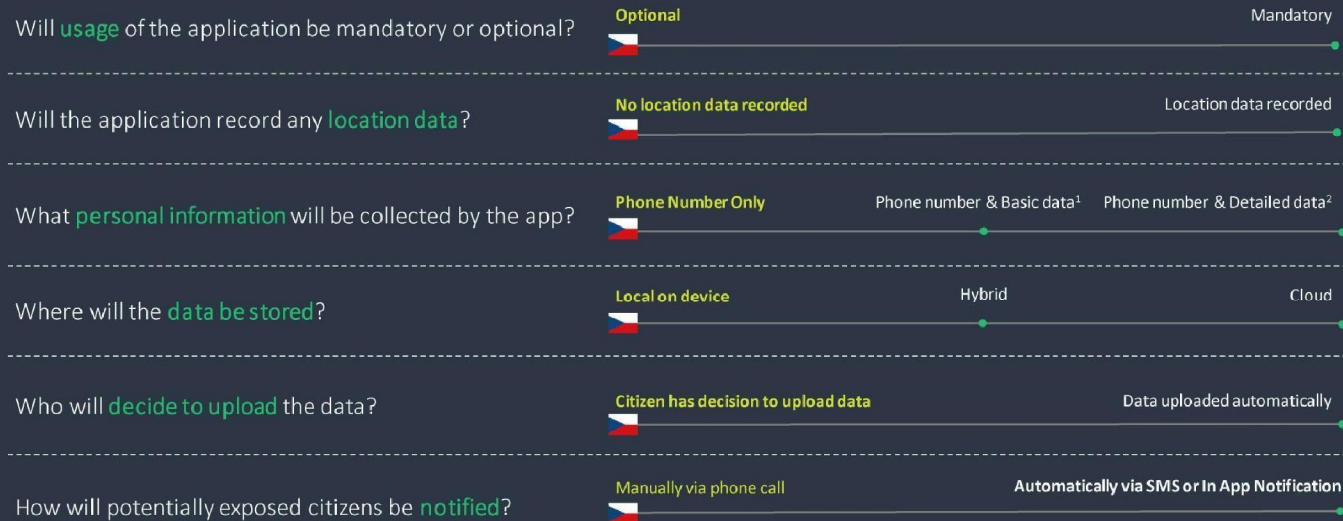
Should a citizen become infected with covid-19, they have the option to send the anonymized data from their devices to health officials who in turn will contact those potentially at risk via phone.

Usage of the app is entirely voluntary

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Source: <https://erouska.cz/>; <https://news.expats.cz/weekly-czech-news/smartphone-app-erouska-will-track-potential-contacts-with-coronavirus-carriers/>

The Czech Republic have prioritized privacy in order to try and drive adoption



1. For example name, age and/or post code 2. For example DOB, address and/or travel history in addition to basic demographics;
Source: Publicly available media and government websites as at 24th April 2020

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