Privacy-preserving contact tracing probably isn't

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But the centralised models are a lot worse for privacy than the decentralised ones.

BLE-based Covid Apps - can they be used to track people?

- Assume they don't upload GPS & other absolute location
- But BLE beacons are a long-established means of location tracking
- The beacon's owners know where it is and try to identify who has come nearby
- *If your BLE message doesn't change frequently enough, they can track you*
- Most systems try to change their random messages frequently
- but there can be bugs that make them persist longer
- or overlap so tracking can be staggered

Talk outline

- Main design questions
- The UK's centralised NHS app
- Australia's centralised COVIDSafe app
- Where to from here?

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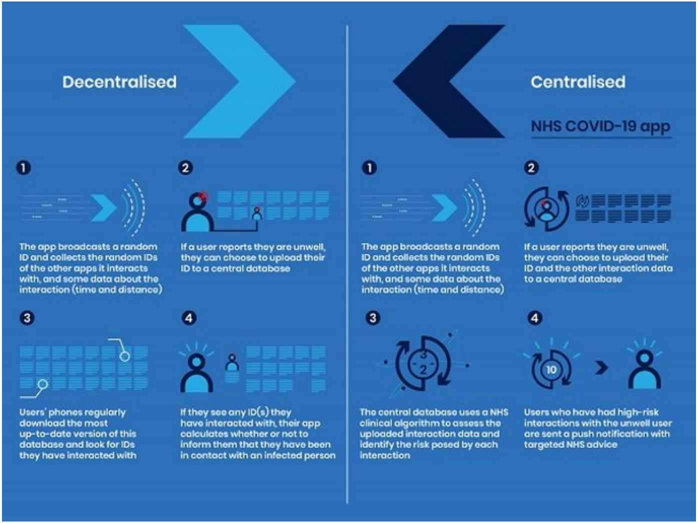
- In *centralised* designs, your BLE ping is an encryption of your ID
  - If you test positive for COVID19, you send your list of *received* encrypted IDs to a central database
- In *decentralised* designs
  - If you test positive for COVID19, your app uploads (seeds for) the BLE pings it has *sent*
  - other people's apps detect their exposure without the information going through a central authority

Centralised vs Decentralised designs



Decentralised

1. The app broadcasts a random ID and collects the random IDs of the other apps it interacts with, and some data about the interaction (time and distance)
2. If a user reports they are unwell, they can choose to upload their ID to a central database
3. Users' phones regularly download the most up-to-date version of this database and look for IDs they have interacted with
4. If they see any ID(s) they have interacted with, their app calculates whether or not to inform them that they have been in contact with an infected person

Centralised

NHS COVID-19 app

1. The app broadcasts a random ID and collects the random IDs of the other apps it interacts with, and some data about the interaction (time and distance)
2. If a user reports they are unwell, they can choose to upload their ID and the other interaction data to a central database
3. The central database uses a NHS clinical algorithm to assess the uploaded interaction data and identify the risk posed by each interaction
4. Users who have had high-risk interactions with the unwell user are sent a push notification with targeted NHS advice

from `https://www.ncsc.gov.uk/blog-post/security-behind-nhs-contact-tracing-app`

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  - France, Australia ...

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    - UK
    - Australia

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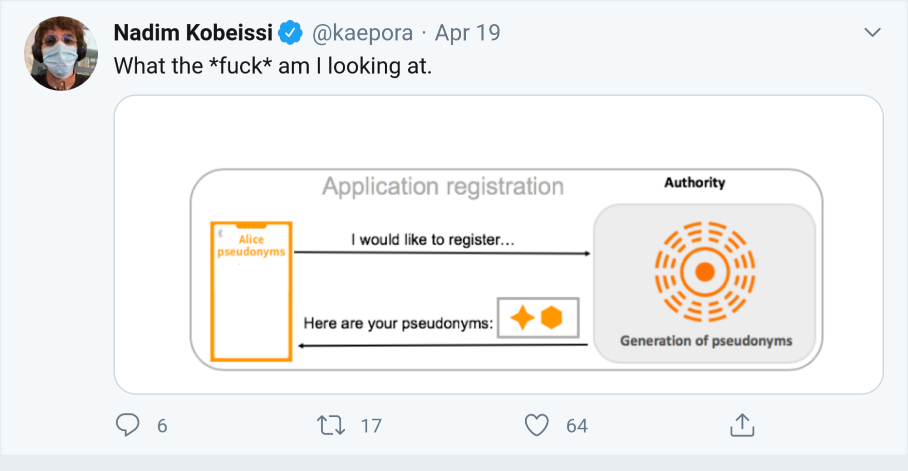
- *e.g.* In the Singaporean, Australian, and some European designs, the device didn't generate its own BLE ping, but downloaded it from a central server
- I wrote a blog post about why that wasn't such a great idea

How should you generate your BLE pings?



Nadim Kobeissi @kaepora · Apr 19

What the *fuck* am I looking at.

6 17 64

The main bug/feature of the centralised design

- That a central authority can build a database of face-to-face contacts, including who was near whom, when they got infected, how long they were close for *etc.*
- **feature:** data analytics, epidemiology
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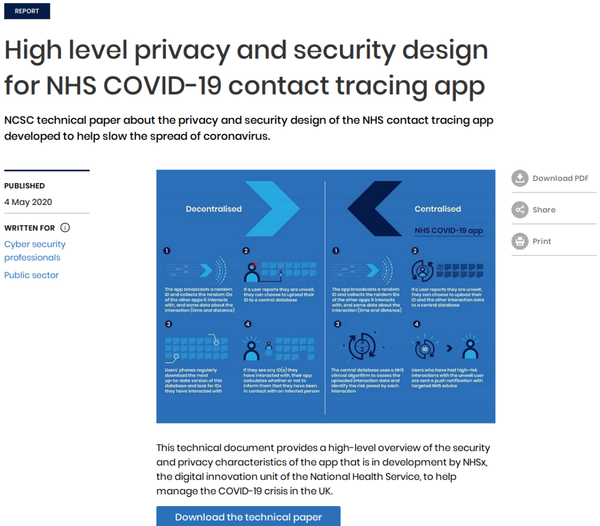
- **feature:** data analytics, epidemiology
- **risk:** that the database is leaked or abused
- Aus and the UK both (at first) adopted centralised designs
    - Aus promised (and legislated) not to use the data for anything but contact tracing
    - The UK put out a white paper explaining (among other things) how great the data analytics were going to be

The UK’s NHS app

A transition to the GAEN API after learning the centralised app didn’t work

They put out a lot of information about their design decisions



REPORT

High level privacy and security design for NHS COVID-19 contact tracing app

NCSC technical paper about the privacy and security design of the NHS contact tracing app developed to help slow the spread of coronavirus.

PUBLISHED
4 May 2020

WRITTEN FOR ⓘ
Cyber security professionals
Public sector

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This technical document provides a high-level overview of the security and privacy characteristics of the app that is in development by NHSx, the digital innovation unit of the National Health Service, to help manage the COVID-19 crisis in the UK.

The UK’s NHS app

The centralised design

- detailed crypto spec
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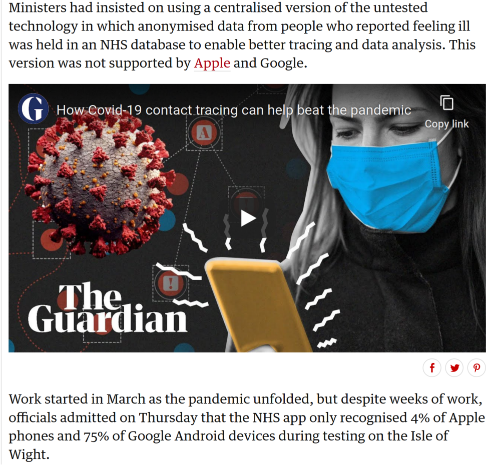
- Chris Culnane and I found some issues
- `https://stateofit.com/UKContactTracing/`
- which NCSC wrote up nicely and undertook to fix
- `https://www.ncsc.gov.uk/blog-post/nhs-covid-19-app-security-two-weeks-on`

The UK's NHS app

The centralised design

- The new one was an opportunity to use a KeepAlive Counter for tracking across the different 24hr periods

The UK's NHS app: Transition to a decentralised design



Ministers had insisted on using a centralised version of the untested technology in which anonymised data from people who reported feeling ill was held in an NHS database to enable better tracing and data analysis. This version was not supported by Apple and Google.

Work started in March as the pandemic unfolded, but despite weeks of work, officials admitted on Thursday that the NHS app only recognised 4% of Apple phones and 75% of Google Android devices during testing on the Isle of Wight.

https://www.theguardian.com/world/2020/jun/18/uk-poised-to-abandon-coronavirus-app-in-favour-of-apple-and-google-models

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- Australia's COVIDSafe does both!

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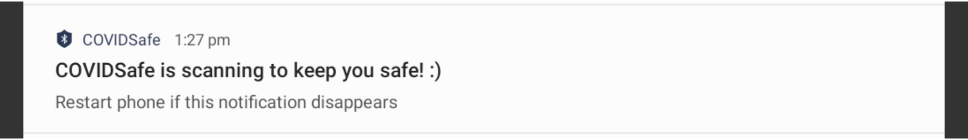
- Australia
  - shipped the app (April)
  - opened the app code (May)
  - published the crypto protocol (yesterday)

Australia's COVIDSafe App - does it work?



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COVIDSafe is scanning to keep you safe! :)

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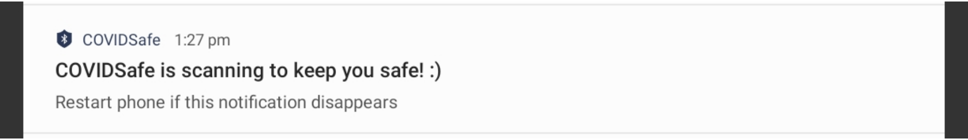

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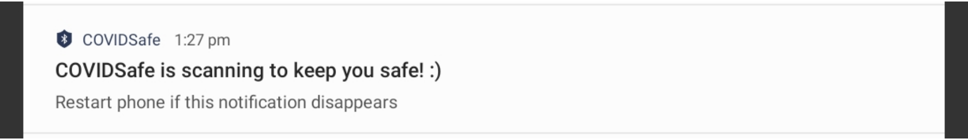

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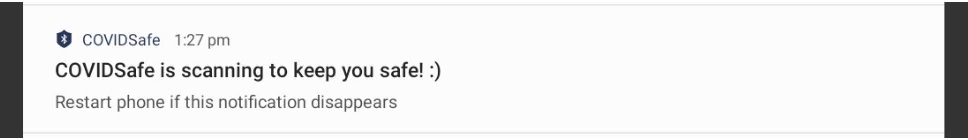

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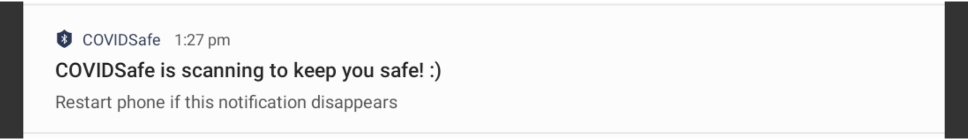

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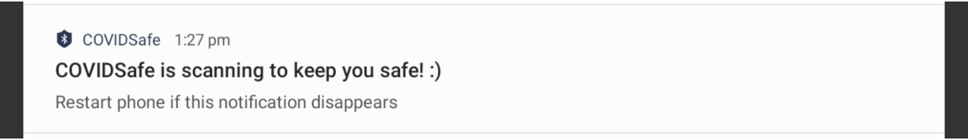

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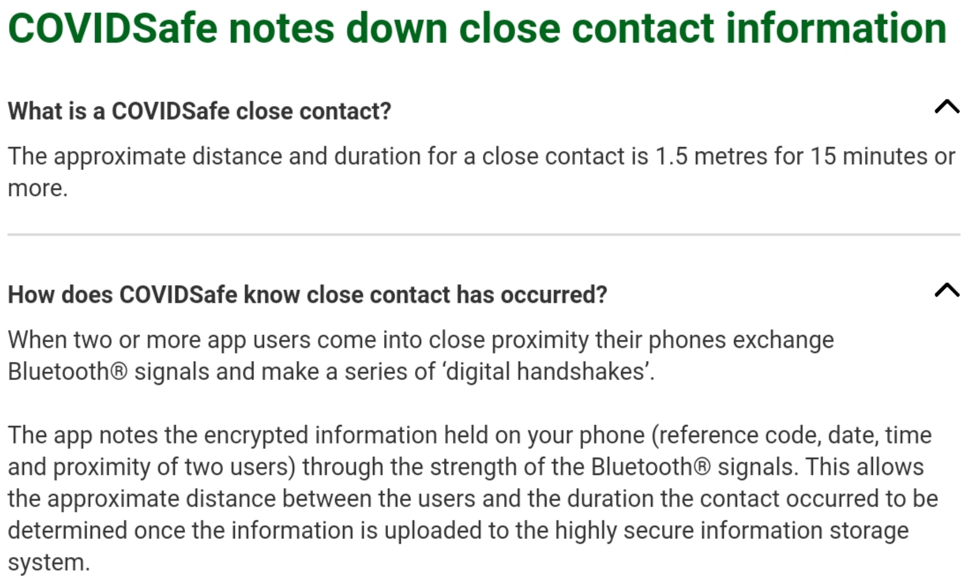
- Not so well on iPhones, especially when backgrounded
- Some of the updates introduced more bugs
- Some of which *completely* stopped it working in some situations
- These are gradually being fixed (or at least changed) after discoveries by Australians examining the code.

Australia's COVIDSafe App - what does it collect?



COVIDSafe notes down close contact information

What is a COVIDSafe close contact?

The approximate distance and duration for a close contact is 1.5 metres for 15 minutes or more.

How does COVIDSafe know close contact has occurred?

When two or more app users come into close proximity their phones exchange Bluetooth® signals and make a series of 'digital handshakes'.

The app notes the encrypted information held on your phone (reference code, date, time and proximity of two users) through the strength of the Bluetooth® signals. This allows the approximate distance between the users and the duration the contact occurred to be determined once the information is uploaded to the highly secure information storage system.

Australia's COVIDSafe App - really, what does it collect?

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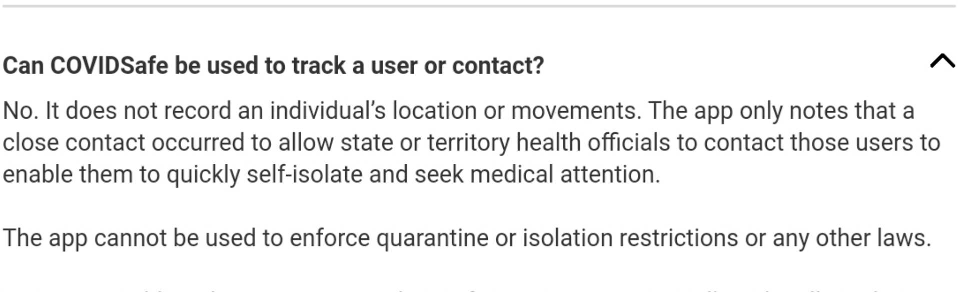
From the FAQ again:



Can COVIDSafe be used to track a user or contact?

No. It does not record an individual's location or movements. The app only notes that a close contact occurred to allow state or territory health officials to contact those users to enable them to quickly self-isolate and seek medical attention.

The app cannot be used to enforce quarantine or isolation restrictions or any other laws.

Australia's COVIDSafe App - is it working yet?

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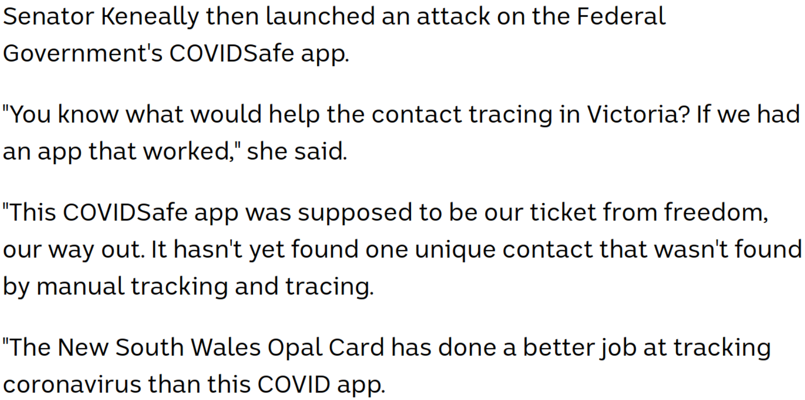

Senator Keneally then launched an attack on the Federal Government's COVIDSafe app.

"You know what would help the contact tracing in Victoria? If we had an app that worked," she said.

"This COVIDSafe app was supposed to be our ticket from freedom, our way out. It hasn't yet found one unique contact that wasn't found by manual tracking and tracing.

"The New South Wales Opal Card has done a better job at tracking coronavirus than this COVID app.

https://www.abc.net.au/news/2020-09-08/mccormack-under-fire-over-borders-blm-covid-link-q+a-keneally/12638756

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- but the centralised architecture is a lot worse than the decentralised ones
- We still don't really know whether they're doing anything useful
- How would we test that?

Thanks to

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Chris Culnane
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Robert Merkel
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Hubert Seiwert
Yaakov Smith
Alwen Tiu