133 Molesworth Street
PO Box 5013
Wellington 6140
New Zealand
T+64 4 496 2000

[redacted]

By email: [redacted]
Ref: H202008240

Dear [redacted]

Response to your request for official information

Thank you for your request under the Official Information Act 1982 (the Act) on 16 November 2020 for:

> *"I request all original communications including briefings, reports, memos, aides memoirs, cabinet papers and texts regarding the following information:*
> *·Around the development of smartphone Bluetooth technology using the Apple/Google Exposure Notification Framework"*

On 1 December 2020 you were contacted in accordance with section 15A of the Act to refine your request to exclude all correspondence, as a substantial amount of collation would be required to fulfil this part of your request. As we have not yet received a response to date, please be advised that your request has been partially refused under section 18(f) of the Act and consequently, all correspondence has been excluded from this response.

The New Zealand COVID Tracer app was developed with the potential to include Bluetooth tracing functionality at a later date, as the Ministry of Health (the Ministry) was aware that other jurisdictions, such as Singapore were using or investigating Bluetooth-based tools to support contact tracing. Apple and Google announced in May that they were working in partnership to develop the Exposure Notification Framework (ENF), and the Ministry was provided information early on about the framework and how it would work. The Ministry also closely monitored the use of non-ENF solutions, such as TraceTogether/BlueTrace used in Singapore and Australia and noted, through discussions with overseas counterparts and media coverage, the range of issues with device support and reliability. The Ministry commenced proof of concept work in August 2020 through to October 2020 to inform how ENF would work within the New Zealand contact tracing process. This work formed the basis of the decision made by the Minister for COVID-19 Response on 20 November 2020 to roll out the ENF in the NZ COVID Tracer app.

The Ministry is continuing to consider how Bluetooth tracing technology can be used to best support contact tracing, in addition to the incorporation of the Apple/Google Exposure ENF within the New Zealand COVID Tracer app.

Given the approach described above, there are a limited number of documents that come within the scope of your request. These documents are outlined in Appendix One with copies enclosed. The table in Appendix One also lists the specific grounds under which information has been withheld.

Please note that documents numbered 1, 2, 3 and 6 were prepared for internal discussion within the Ministry. As is clear from the dates of documents 1, 2 and 3, they reflect early thinking and exploration. Some of the suggested actions did not proceed, and the timelines for others changed. One example of this is the indication in document 1 that Bluetooth might be included in a release in May. This was based on a possible release of Google and Apple Application Programming Interfaces that did not occur. Also, please be advised that Ministers were not briefed on some of this early work that did not proceed any further.

I trust this information fulfils your request. Under section 28(3) of the Act you have the right to ask the Ombudsman to review any decisions made under this request. The Ombudsman may be contacted by email at: info@ombudsman.parliament.nz or by calling 0800 802 602.

Please note that this response, with your personal details removed, may be published on the Ministry website at: www.health.govt.nz/about-ministry/information-releases/responses-official-information-act-requests.

Yours sincerely

Gaynor Bradfield
Manager, Office of the Deputy Director-General
Data and Digital

Appendix 1: List of documents for release

#	Date	Title	Decision on release
1	22 April 2020	COVID-19 Strategic Response Data and Digital: Business Design Council	Released in full
2	20 July 2020	Bluetooth Exposure Notifications Framework	Released in full
3	25 August 2020	NZ COVID Tracer Release 5 platform decision – Decision Pack	Released with some information withheld under section 9(2)(c) of the Act, to avoid prejudice to measures protecting the health or safety of members of the public.
4	25 September 2020	HR20201730: NZ COVID Tracer app roadmap and timeline	Released with some information withheld under section 9(2)(a) of the Act, to protect the privacy of natural persons.
5	30 October 2020	HR20201889: NZ COVID Tracer app roadmap update	Released with some information withheld under the following sections of the Act: • Section 9(2)(a) of the Act, to protect the privacy of natural persons, • Section 9(2)(c) of the Act, to avoid prejudice to measures protecting the health or safety of members of the public and • Section 9(2)(f)(iv) of the Act, to maintain the constitutional conventions for the time being which protect the confidentiality of advice tendered by Ministers of the Crown and officials.
6	2 November 2020	Using Bluetooth technology in contact tracing	Released in full
7	15 December 2020	Rush Digital report to the Ministry	Released with some information withheld under section 9(2)(a) of the Act, to protect the privacy of natural persons
8	22 December 2020	Cabinet Paper: COVID-19 Resurgence – Improving Public Health Measures at Level One	Excerpt provided under section 16(1)(e) of the Act, with information deemed out of scope excluded.
9	NA	Note from Rush Digital to the Ministry	Released in full.

Document 1

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COVID-19 Strategic Response Data & Digital

Business Design Council

Jon Herries
GM – Emerging Health Technology and Innovation
+64 21 548 251
jon.herries@health.govt.nz

22nd April 2020 - Final

Document 1

Agenda – 22nd April 2020 16:00-16:45

Item	Required from Group
Previous Minutes	Confirm
Review Release timelines for Release 1 and 2	Discussion and agreement on direction
Bluetooth options	For Discussion

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Document 1

Contact tracing – consumer facing web and mobile solution

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Consumer App - Scope and releases

Functionality will be delivered across 4 releases between now and the end of May 2020. This is sequenced to start with web only, with mobile apps landing in the second release on May 1st.

Release 1 – 24th April	Release 2 – 1st May	Release 3 – 15th May	Release 4 – 29th May
Web only: • Consent and privacy • Registration and signup • Personal info (phone, email, etc) • Address information • News feed	*Mobile & Web:* • All web functionality from Release 1 • Close contacts by manual entry • Location tracking through native OS functionality (education only, no data)	*Mobile & Web:* • Self-isolation reminders and symptom reporting • Guidance for health changes • Additional browser support	*Mobile & Web:* • Additional browser support and accessibility • Linking NHI Number (through ID verification) • Vaccination status and test status • Automatic close contact logging (TraceTogether)

QR Code Scanner

Released under the Official Information Act 1982

Manual Close Contact Collection

Released under the Official Information Act 1982

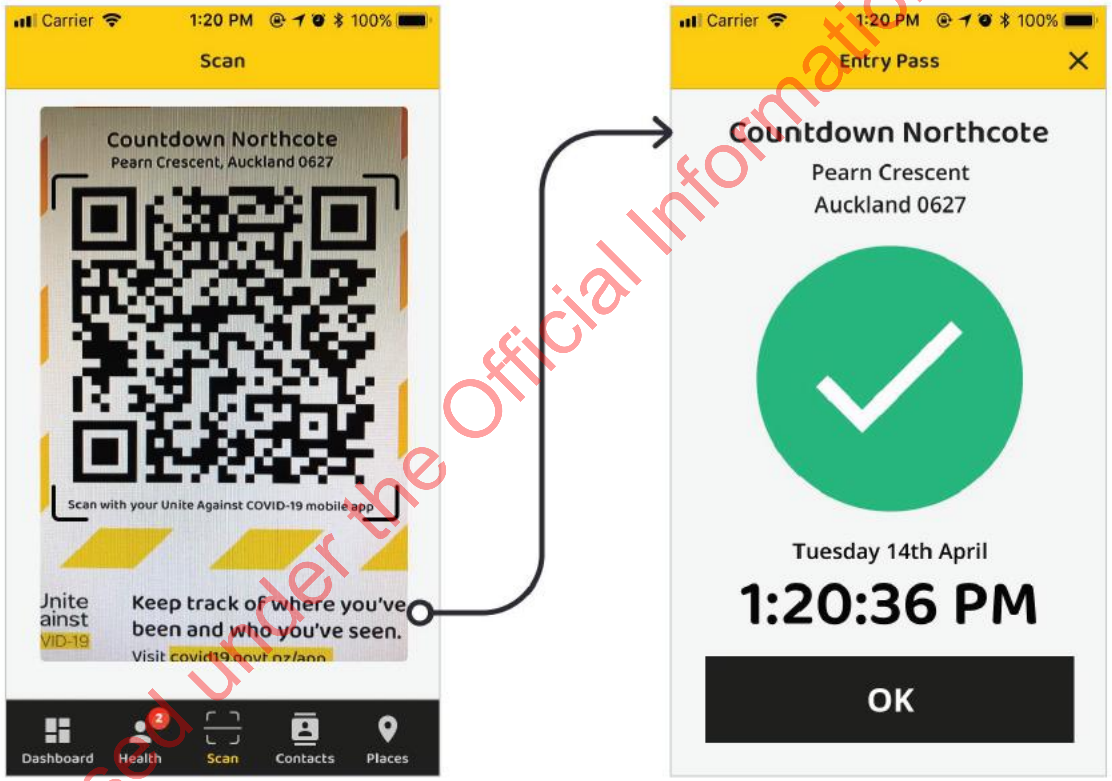
Document 1

MBIE Business Portal - Location Check-in Concept

Released under the Official Information Act 1982

Document 1

Consumer – QR Code scanner



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Document 1

Isolation/Quarantine Follow up

Hello testignore
These are your Daily Follow Up Questions to check whether you become unwell

Please answer all questions

Have you been within a metre (3ft) of the person COVID-19 in the past 24 hours?

Yes
No
reset

Have you got or still have

Tick all that apply.

- Cough
- Fever / chills
- Shortness of breath
- Wheezing or difficulty breathing
- Sore throat
- Runny nose
- Muscle aches / pains
- Nausea / vomiting / diarrhoea
- Rash
- Any other symptoms (please specify)

Other symptoms

Since the last survey, have you recorded your temperature with a thermometer?

Yes
No
reset

If you start having a fever greater than 38 degrees Celsius after completing your daily follow up survey, please call your District Health Board Public Health Unit at _____.

Are any other household members now showing symptoms?

Yes
No
reset

Have you left your house in the past 24 hours?

Yes
No
reset

Have there been visitors to your house in the past 24 hours?

Yes
No
reset

Do you have any problems with being in self-quarantine / isolation and need help with these?

Yes
No
reset

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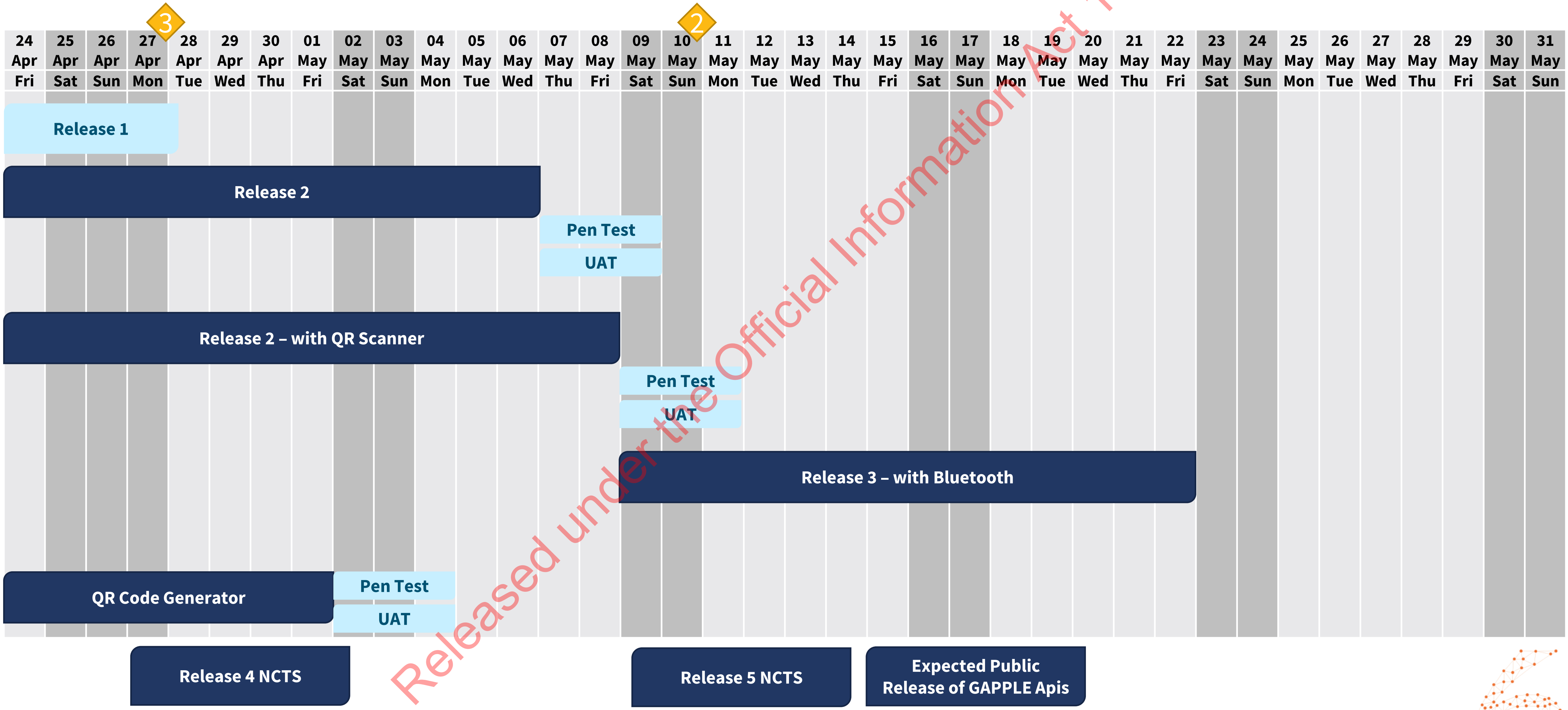
Document 1

Timeline



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Automated Tracing

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Document 1

Principles for Consumer Data collection for Contact Tracing

1. The information collected will be voluntarily provided by the user
2. The information collected will only be used for the COVID-19 Pandemic Public Health Response
3. The user will be able to choose whether their contact information can be retained by the Ministry of Health in order to update the National Enrolment Service, for the purpose of delivering health services.
4. Any information relating to the users close contacts or locations, will expire on a rolling 14 day period (consistent with the incubation period of the virus). This information will remain on the users device until it is requested to be shared by a Contact Tracer – using the Public Health provisions under the Health Act 1956.

Released under the Official Information Act 1982

Automated Close Contact Technology Choices

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Bluetooth

Background

- Low power peer-to-peer network connectivity built into most phones and a number of other peripheral and other devices
- Has the ability to broadcast and receive IDs from nearby to "identify" other devices
- Doesn't capture the location of the user or others – just proximity

Known Issues/Risks

- Security has been an issue for Bluetooth historically – with NZISM recommending government agencies disable this functionality if possible
- Different chipsets, antennas, phone operating systems and interference from the environment and other Bluetooth devices reduce the effectiveness of any algorithm measuring the distance between phones
- Significant power is required to continually broadcast and receive Bluetooth IDs in the local proximity
- Any extraction of data from the device runs the risk of removing privacy provisions

Benefits

- Improves accuracy of Contract Tracing (eg. reliability and automation of data capture).
- Augments patient memory
- Speed - Get ahead of the curve
- Scalability – creates flexibility under pressure

GPS/Network Location Data

Background

- Low power solution, information can be retained on the phone, there are services already on the phone that gather and store this data.
- There are analytical tools available that have the ability to view devices in near to real-time as well as historical location

Known Issues/Risks

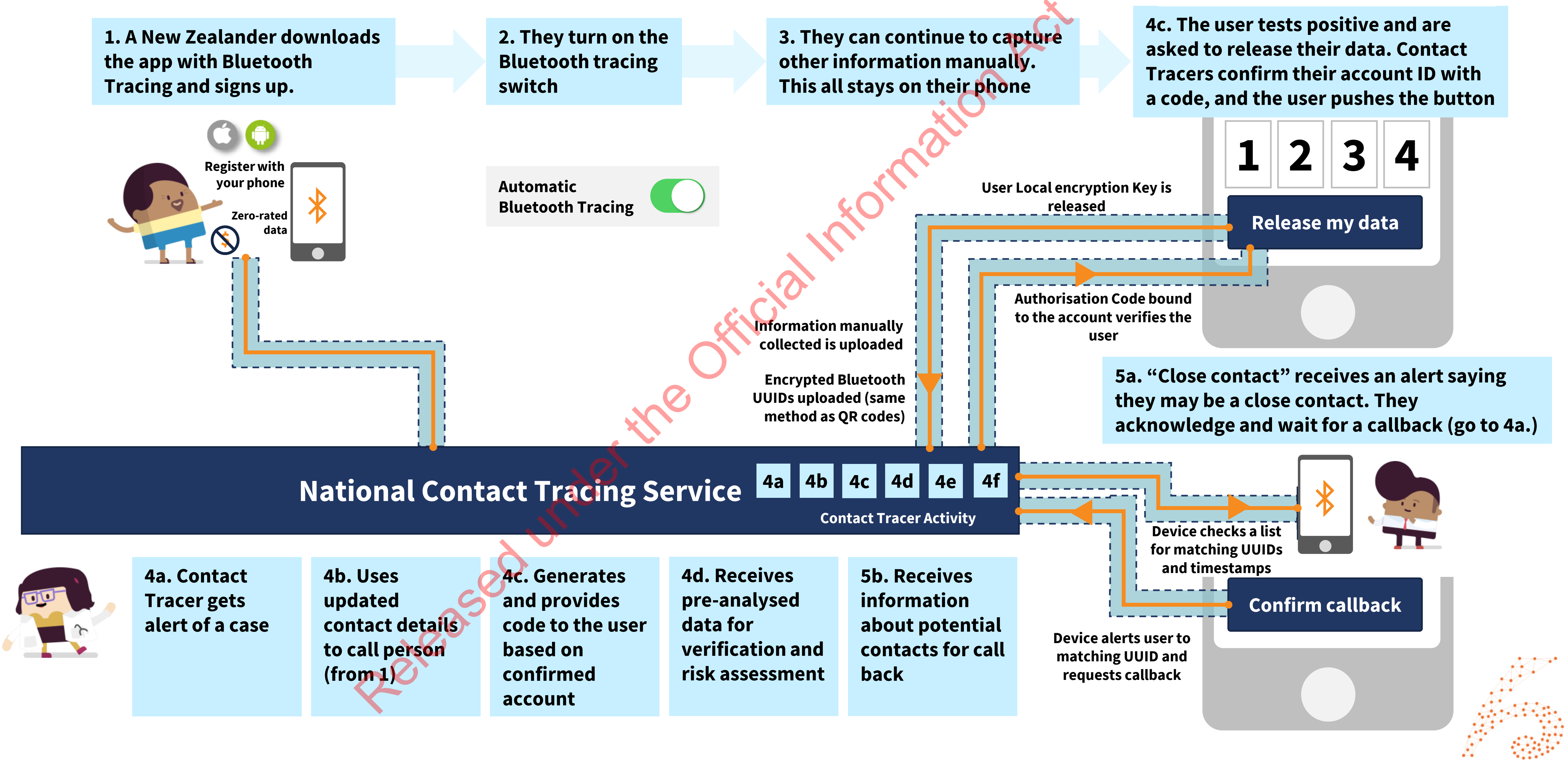
- This information is not particularly useful for contact tracing (ie. our problem statements) for the reason that location is much less useful than proximity
- Location information captured by GPS is too low resolution to identify conclusively that individuals are close enough together for a period to transmit the virus
- There are significant privacy concerns relating to this approach as location is a useful proxy for de-identifying data particularly when examining commonly visited locations and/or with time stamps (eg. a persons residence is somewhere they are regularly and at well understood times).

Benefits

- May be useful for location related to "places" an individual has visited, at a specified time

Document 1

How would a Bluetooth component work (Gapple)?



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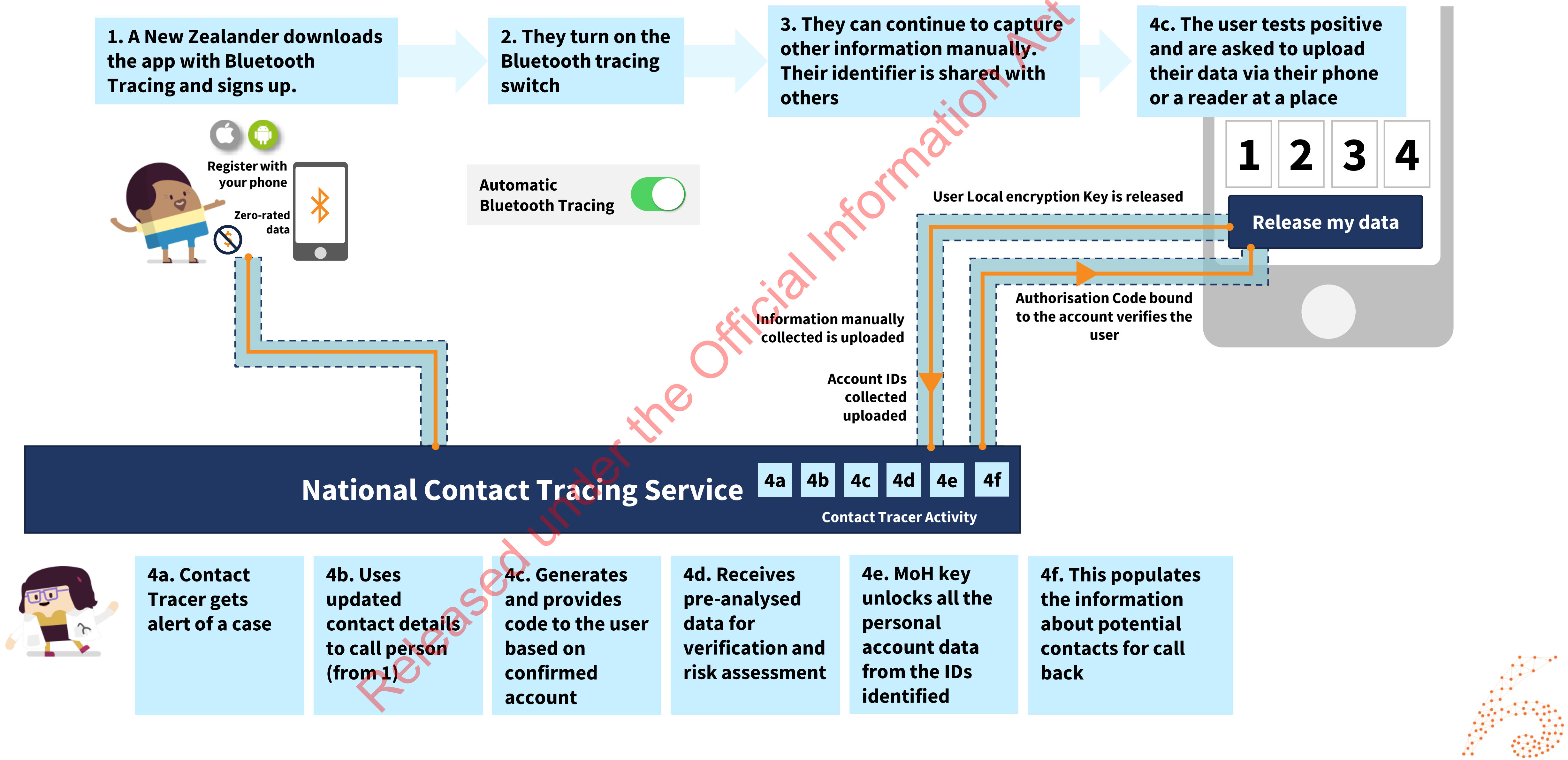
Document 1

How would a Bluetooth component work (Singapore)?



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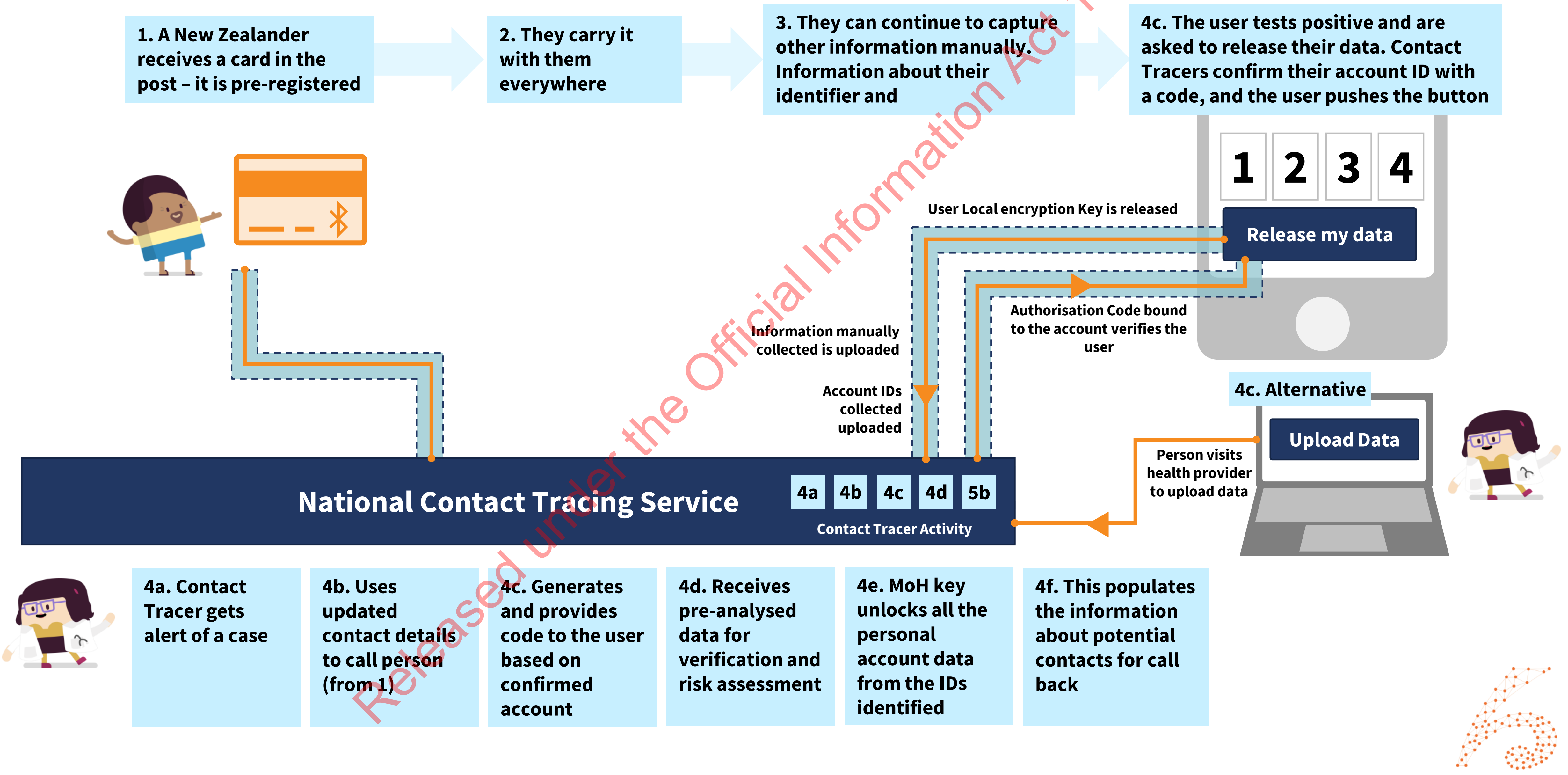
How would a Bluetooth card work?



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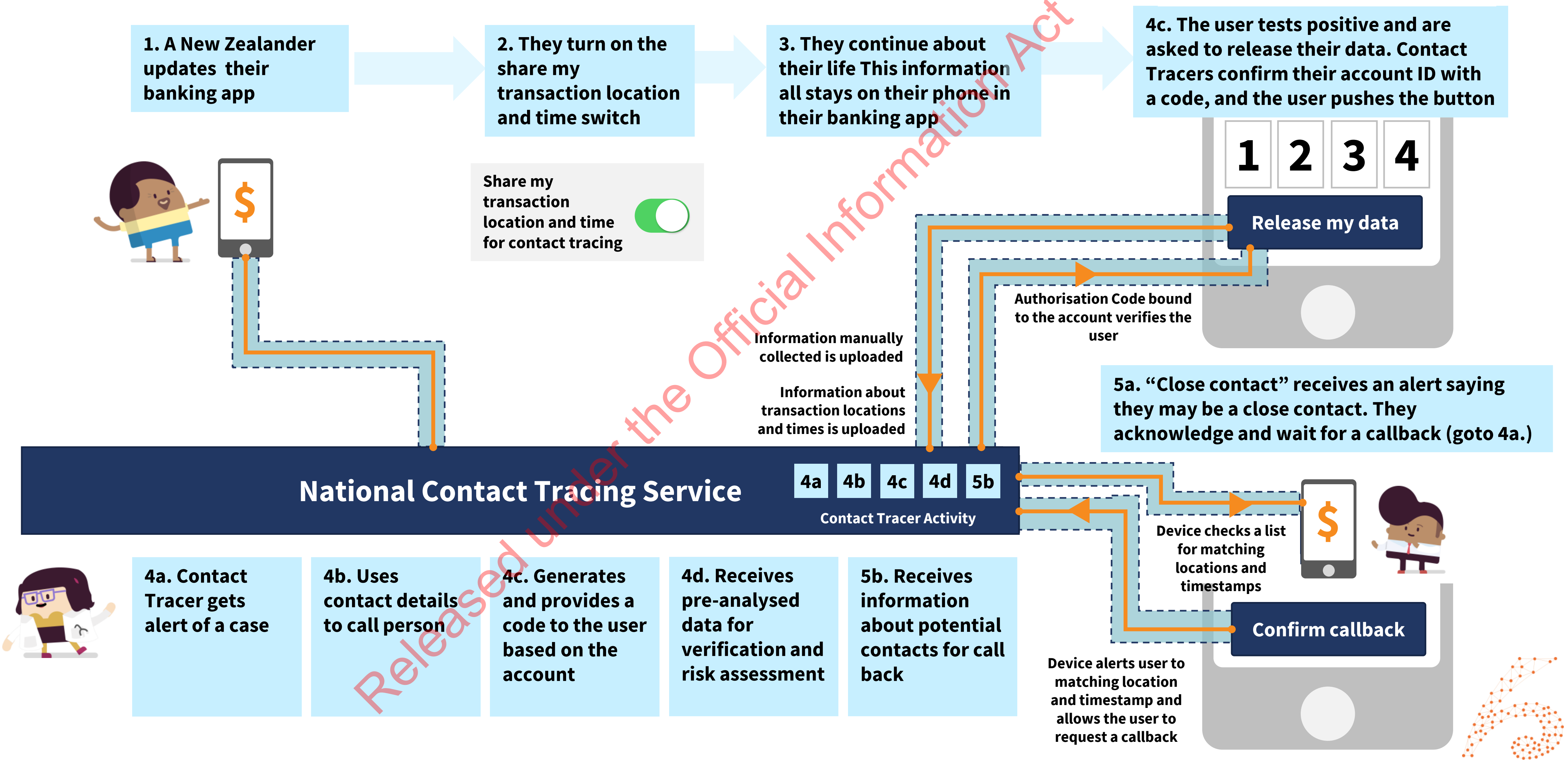
Document 1

How would a Bankcard component work?



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Comparison of automated options for collecting information

	Bank Transactions	Bluetooth Card	TraceTogether Model	Apple / Google / EU model
Public Health Efficacy	Would provide location and timing of the positive case and contact making a transaction.	Would identify close contacts Could identify locations using iBeacons.	Would identify close contacts Could identify locations using iBeacons	Would identify close contacts Could identify locations using iBeacons. Close contacts unknown to the case would be alerted but would have to self-identify
Respect for Privacy	Could use either the Trace Together or GAEU model There is likely to be a perception that this is invasive due to the nature of the data the information we require is extracted from	The Ministry would see who the close contacts are when the data is uploaded. The public would need to trust the Ministry to keep this data safe.	The Ministry would see who the close contacts are when the data is uploaded. The public would need to trust the Ministry to keep this data safe.	The Ministry wouldn't see this information until self-identification
Freedom of Movement	Allows freedom of movement and doesn't require app development	People will need to carry an additional item This may be seen as a "poor persons" item No way to measure use in the population	Requires app development – may not run Use in the population can be monitored by use of the app	Requires app development Use in the population can be monitored by use of the app
Technical Feasibility and data access	This is within the scope and plans for open banking there is already significant app penetration in the market	There is a need to confirm that the hardware will do what is required	It is not clear this model is feasible on Apple phones (~51% of NZ market)	This will be supported by >80% of the phone market in New Zealand and the developers of the phone OS.

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Document 1

User Stories - Consumer

#	User Story	Notes	Data Sharing & Privacy
1.1	As a user I want to be able to collect close contact information without any ongoing effort		
1.2	As a user I want to be alerted if I have been in close contact with a positive case		
1.3	As a user I want to be able to share my information with the contact tracers only if I test positive		

User Stories – Contact Tracer

#	User Story	Notes	Data Sharing & Privacy
2.1	As a Contact Tracer I want to be able to confirm the person I have on the phone so I can access their data	This may provide NHI verification	
2.2	As a Contact Tracer I want to have the right data added to my system without me needing to enter it		
2.3	As a Contact Tracer I want to prepare people I need to talk to so that they answer quickly and have the information I need		
24.	As a Contact Tracer I want to understand how many people I need to contact and when my job is finished.		

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Some other Context/Background

- We understand the Australian's will be releasing an updated version of TraceTogether on the weekend
- We are in conversations with Apple and have some further information
- We have a time booked to talk with Singapore and get an update
- We have information to come from Drew Deane – ex. Stats and Data Ventures
- NZs DTA have suggested Apple/Google model is most suitable technically

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Appendix

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Other References

App	Mandatory or voluntary	Protocol	Data collected	Data access	Infection reporting	Contact alerting	Actions
NHS app (in development)	Voluntary	To be determined	IDs created by nearby phones	User and public health authorities	Self-reported and by medical professionals	To user and medical professionals	Quarantine if infection reported by medical health professionals
Singapore Trace Together (live)	Voluntary	Bluetrace	IDs created by nearby phones	User only	Medical professionals	To user and medical professionals	Decided by medical professional
South Korea (live)	Mandatory	Not applicable	Citizen location information, credit card data	User and public health authorities	Self-reported and by medical professionals	To user and medical professionals	Quarantine
Taiwan (in development)	Mandatory	Not applicable	Citizen location information, credit card data	User and public health authorities	Self-reported and by medical professionals	To user and medical professionals	Quarantine
Germany, France, Estonia and other EU countries (in development)	Voluntary	PEPP-PT	IDs created by nearby phones	To be determined	To be determined	To be determined	To be determined
Israel (live)	Mandatory	Not applicable	Citizen location information, credit card data	User and public health authorities	Self-reported and by medical professionals	To user and medical professionals	Quarantine

Table 1
Comparison of proposed international digital contact tracing apps

Country	Digital Tracking	Censorship	Physical Surveillance
Austria	✓	X	X
Belgium	✓	X	✓
Brazil	X	X	✓
Bulgaria	✓	X	X
Cambodia	X	✓	X
China	✓	✓	✓
Ecuador	✓	X	X
Egypt	X	✓	X
Germany	✓	X	X
Hong Kong	✓	✓	X
India	✓	X	X
Iran	✓	✓	X
Israel	✓	X	X
Italy	✓	X	X
Kenya	X	✓	X
Niger	X	✓	X
Pakistan	✓	X	X
Poland	✓	X	X
Russia	✓	X	✓
S. Africa	✓	X	X
Singapore	✓	✓	X
South Korea	✓	X	X
Spain	X	X	✓
Taiwan	✓	X	X
Thailand	X	✓	X
Uganda	X	✓	X
United Kingdom	✓	X	✓
United States	✓	X	✓

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EU Perspective

Privacy-preserving app solutions that support public health efforts	Member States have been considering the most appropriate app solutions for their specific situations that comply with applicable laws and minimise the processing of personal data. Solutions can be grouped into at least two general categories: 1) Decentralised processing The proximity data related to contacts generated by the app remains only on the device (mobile phone). The apps generate arbitrary identifiers of the phones that are in contact with the user. These identifiers are stored on the device of the user with no additional personal information or phone numbers. The provision of mobile phone numbers or other personal data by the user at the time of the app installation is not necessary, because an alert is automatically delivered via the app the moment that a user notifies the app – with the approval of the health authority - that he/she has test positive. Public health authorities determine the content and timing of the notification message. The message may, for example, ask the person to stay at home and/ or to contact the public health authorities, should they develop symptoms and to facilitate testing. This approach would considerably reduce the risks to privacy as close contacts would not be directly identifiable and this option would thereby enhance the attractiveness of the application. Public health

authorities would not, however, have access to any anonymised and aggregated information on social distancing, on the effectiveness of the app or on the potential diffusion of the virus. This information can be important to manage the exit of the crisis.

Although not necessary for the functioning of the app, an alerted person (that she/he was in contact with a positively tested person) may wish to provide personal information to the public health authorities in order to get further support and guidance. The app can provide an option to do so. This should be an "opt in" option and clearly indicated as "opt in". The authority can then make contact with the individual and advise him or her accordingly.

2) Backend server solution

In this option, the app functions through a backend server held by the public health authorities and on which are stored the arbitrary identifiers. Users cannot be directly identified through these data. Only the arbitrary identifiers generated by the app are stored on the server. The advantage is that the data stored in the server can be anonymised by aggregation and further used by, public authorities as a source of important aggregated information on the intensity of contacts in the population, on the effectiveness of the app in tracing and alerting contacts and on the aggregated number of people that could potentially develop symptoms.

Through the identifiers, users who have been in contact with a positively tested user will receive as in the previous version an automatic message or alert on their phone.

As in the previous version, an alerted person (that she/he was in contact with a positively tested person) may wish to provide personal information to the public health authorities in order to get further support and guidance. The app can provide an option to do so. This should be an "opt in" option and clearly indicated as "opt in". The authority can then make contact with the individual and advise him or her accordingly.

This supplements manual contact tracing effort (where positive cases are interviewed), notably because penetration of the contact tracing app in the population is likely to be incomplete, and particularly because many vulnerable individuals such as the elderly are may not have access to this app. It would help authorities detect surges in cases, as well enabling them to follow up in a more personalised way contacts who are at risk of infection. Some public health authorities have a policy to phone all contacts directly

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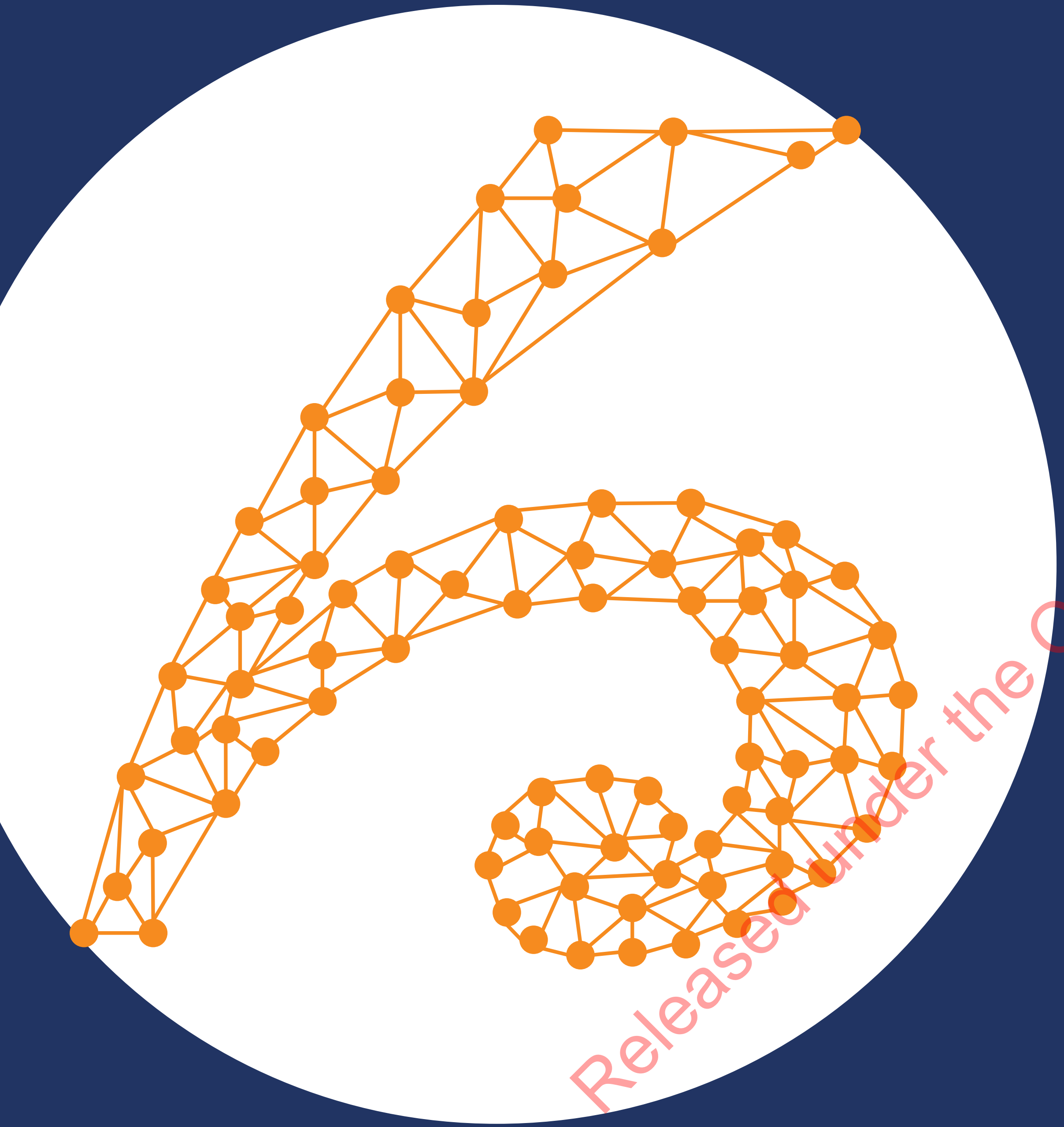
Document 2



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Bluetooth Exposure Notifications Framework

Requirements for a trial of the Apple/Google Exposure Notifications Framework to support contact alerts.

20th July 2020

patrick.hindmarsh@health.govt.nz

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Background

- In April 2020 Apple and Google announced the Exposure Notifications Framework, designed to support using Bluetooth proximity to assist contact tracing efforts for COVID-19.
- This was in response to a number of attempts (e.g. TraceTogether) to implement this technology using the existing Bluetooth APIs. It was quickly discovered that privacy features on iOS made it impossible to build a reliable solution for Apple devices.
- The framework uses randomly generated identifiers that are broadcast between participating smartphones. If a person tests positive to COVID-19, they can consent to a process where their identifiers are shared with others and, if they are determined to have been in proximity, an alert will be shown to the other person(s).
- There is some criticism of the framework not meeting the needs of contact tracing, and making it more difficult for Bluetooth tracing to happen without “playing by Apple/Google rules”.
- A number of countries and jurisdictions have opted to implement this technology to assist their contact tracing efforts. Currently Switzerland, Italy, Germany, Uruguay, and Denmark have public versions of mobile apps using the framework.

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Limitations of Bluetooth -based contact identification

- It is widely understood that using Bluetooth contact tracing for the identification of close contacts is fraught with issues and inaccuracies.
- It is extremely difficult to accurately predict distance between two devices given the wide variety of Bluetooth implementations in smartphones. Analysis by the Defence Technology Agency (DTA) concluded *"distance estimates may be subject to significant errors resulting in both false contacts, and actual contacts which are missed. In addition, Bluetooth signals can pass through walls and cause false contacts even if the distance estimate is accurate."*
- Limitations on background processing and Bluetooth functionality on iOS means a user has to keep an app open and in the foreground for it to be effective. Real-world examples show low uptake and usability with this constraint in place.
- Data from Singapore and Australia shows that only very low number of people were identified through the app that weren't already identified through manual tracing efforts.
- These issues are largely a function of the underlying properties of the Bluetooth protocol.

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Document 2

Why trial the Apple/Google framework?

- Moving past focussing on *identifying* people and rather considering how Bluetooth solutions could be used to simply *notify* people of potential contact with COVID-19 is worth considering.
- The Ministry has already developed a system to deliver 'contact alerts' that is broadly inspired by the Apple/Google Exposure Notifications Framework (ENF). This currently works by allowing people who scanned the QR poster at the same location around the same time as a person who has tested positive to receive an alert
- As NZ has been at Level 1 for a number of weeks we have observed a significant reduction in the number of people scanning posters, as it requires 'active' participation. As the threat of COVID-19 seems low, people don't see the need to spend the effort.
- Investigating other 'passive' options to allow consumers to keep a record of where/who they have been in contact with may improve adoption and provide benefits to contact tracing.
- Helping fulfil our outcome statement: *To improve the experience and performance of Contact Tracing through accessibility, adoption and integration.*

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Document 2

Goals of a trial

To answer the following question:

Does the Exposure Notification Framework support the needs of contact tracing in New Zealand?

To do this we need to:

1. Validate assumptions about how the Exposure Notifications Framework functions
2. Prove integration with the existing contact alerts and exposure events of interest systems is possible
3. Validate whether the ENF can play an effective role in supporting a contact tracing investigation
4. Determine interoperability of ENF with other solution, both existing and new.

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Approach for trial [draft]

- Develop a standalone native application for iOS and Android.
  This avoids any risk of interference with other NZ COVID Tracer work streams, and keeps all special permissions and entitlements within a separate application. This does not rule out using NZ COVID Tracer for the production version and maybe an opportunity to fix authentication issues.
- Provision the required backend infrastructure to distribute keys, and prove integration paths to NCTS
- Determine an appropriate forum to run a trial (or set of trials) to test the efficacy of the solution
- Recruit participants for the trial settings, and distribute the trial app to them.
- Trials should provide answers to the stated goals, and give insights into whether ENF has value.
- Observe outcomes from trial and collate findings
- Report back with outcomes and a recommendation on whether ENF should be implemented in a production app, either as part of NZ COVID Tracer or as a separate application.
- Work with OPC and GCPO along the way

This process could take 1-2 months to complete depending on resource availability and support

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Document 2

Assumptions to be tested

Each day the ENF generates a random key on each phone (daily keys). That key is used to generate 144 unique keys (one every ~10min or so) that are shared via Bluetooth (proximity keys). If a user tests positive a selection of their daily keys is uploaded to a central server and distributed out to all other devices. Those devices then generate the proximity keys again and look for a match. If one is found, an alert is shown to the user.

Based on this, we assume:

- It is possible for a contact tracer to choose specifically which daily keys they want to distribute to other users, based on their investigation with the positive case. If only one day was risky, only that day's key would be sent. Going further, could we include a time range that could further filter the results?
- When those key(s) are sent, it is possible to accompany those key(s) with the existing contact alert data (risk level, messaging) so the alert shown to a matching user can be customised.
- If a match is identified, we can reuse existing "alert" functionality within NZ COVID Tracer
- Future developments of ENF, including an Apple/Google operated central server will still support our use cases.

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Technology Approaches for Trial

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Technology function components identified for the trial

1. An app for at least one mobile platform (iOS or Android) that allows a user to enable the ENF.
   - Risk: Time pressures may not allow for both platforms to be ready by end of August.

2. A backend system to collect Daily Tracing Keys (DTKs) from a positive case. This would be a stand-in for the NCTS.
   - Risk: this is not a true 'like for like' for NCTS.

3. A user interface for 'contact tracers' to:
   a. Generate one-time-passwords to authenticate the upload of DTKs
   b. Display the collected DTKs for a person, and 'filter' them based on a discussion with the person (i.e. remove days 1,2,6,8 because they were low risk days)
   c. Tag any DTKs with windows of time where the risk is higher
   d. Push out the 'risky' DTKs with accompanying timeframes to all other devices

   - Risk: tight timeframes means that full UI functions may not be developed i.e manual workarounds in backend maybe needed.

4. A user interface in the app that allows a user to review any matching 'exposures', including limits by the time window if able.

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Approaches to build technology for trial

Document 2

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Recommended

Option 1

Customise an existing open source app, e.g. COVID Green

Benefits:

- Start from a known "good" base for items 1,2,4 (apps and backend)
- Likely less effort than other options

Limitations:

- Constraints on technology choices, esp. around backend meeting our arch standards
- Potentially limited reuse into core NZ COVID Tracer codebase.

Option 2

Fork NZ COVID Tracer and implement ENF from scratch (or demo code)

Benefits

- Good potential for reuse of existing alert functionality
- Possibility to make only minor changes to "productionise it" later rather than start over
- Start from a known base for items 1,4 (apps)

Limitations

•Potential confusion/complexity managing distribution to trial users (requires an account)
•Additional work to disable irrelevant features for trial.

Options 3

Create a new app and implement ENF from scratch (or demo code)

Benefits:

•Can keep the app scope narrow and have app do exactly what is needed for the trial, nothing else.
•Could reuse some components later in NZCT app if we are smart

Limitations:

•Starting from scratch may take more time than we have (no start base)

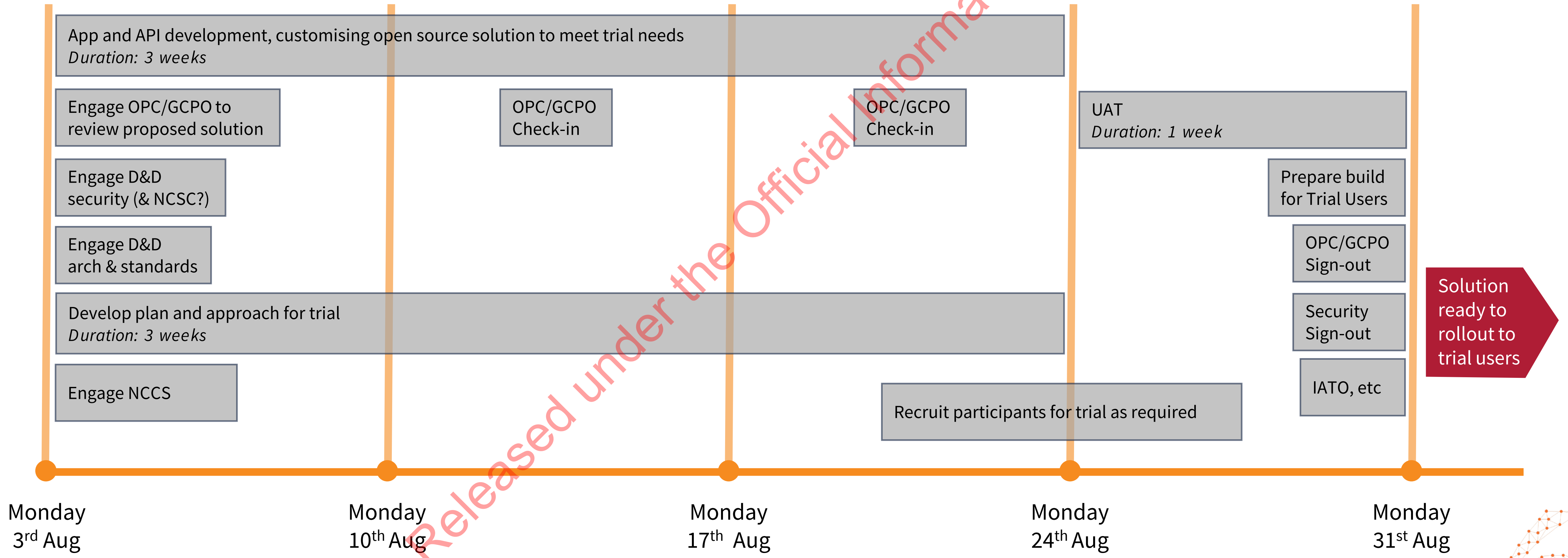
Regardless of which option is taken, we will need to build activities for all technology functional items. Item 3 (user interface for 'contact tracers') will be required to be built in all options as there is not starting point for this.

Document 2

Timeline to trial readiness

Approx investment required:
$200k ($120k for tech, assuming Option 1)
+ *$50k contingency*

Ready to trial by: Monday 31st August



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To make this happen we need assistance with

- Expertise to help design the trial parameters, including methodology for collecting observations and cataloguing findings. E.g data scientist.
- Acknowledge this assumes that we are using the Apple/Google ENF, and this will limit the interoperability discussion as there is no known hardware tokens (like CovidCard or Singapore token) that support ENF. Is this an issue?

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Appendix

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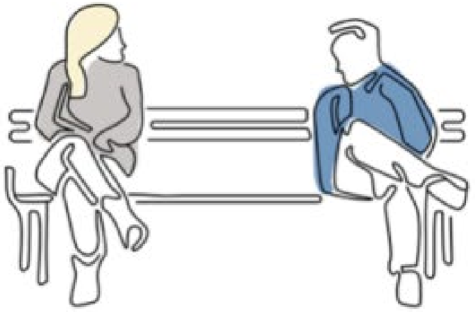
How it works – positive diagnosis

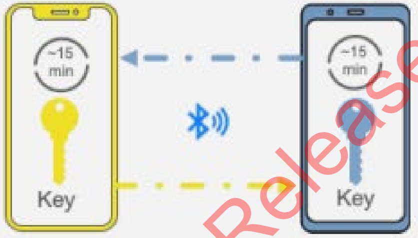
Alice and Bob don't know each other, but have a lengthy conversation sitting a few feet apart



Bob is positively diagnosed for COVID-19 and enters the test result in an app from his public health authority

A few days later…

Their phones exchange beacons with random Bluetooth identifiers (which change frequently)



With Bob's consent, his phone uploads the last 14 days of keys for his Bluetooth beacons to the server

Apps can only get more information via user consent

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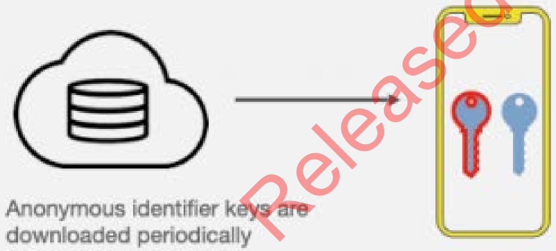
How it works – proximity notification

Alice continues her day unaware she had been near a potentially contagious person

Alice sees a notification on her phone

Sometime later...

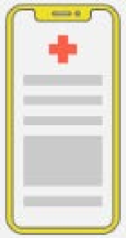
Alice's phone periodically downloads the Bluetooth beacon keys of everyone who has tested positive for COVID-19 in her region. A match is found with Bob's random Bluetooth identifiers.



Anonymous identifier keys are downloaded periodically

A match is found

Alice's phone receives a notification with information about what to do next.



Additional information is provided by the health authority app

Google

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References

- Country adoption of Exposure Notification Framework – wikipedia.org
- Apple's Frequently Asked Questions v1.1 – apple.com

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Document 3

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NZ COVID Tracer

Release 5 platform decision

Decision Pack

25 August 2020

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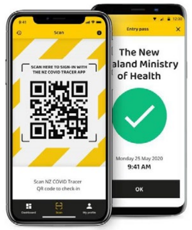
Document 3

NZ COVID Tracer History



Alert Level 3 | Alert Level 4 | Alert Level 3 | Alert Level 2 | Alert Level 1

Mar | Apr | May | June | July

Development starts

Web-app ready

Problem Definition
- Understanding the broad COVID-19 problems to be addressed
- Identify focus for a contact tracing app

User Stories & Requirements
- Define contact tracing app problem statements
- High level requirements
- Closed RFP

Selection & Procurement
- Select development partner
- High level technical design
- MVP scope defined
- App design

Integration & Standards
- Specification for third party integration published

Release 1
- Basic account functionality
- QR Code Poster Generation (MBIE)
- QR Code Scanning

QR Poster Service
- MoH QR Code Poster Service

Release 2
- Notification service
- Digital diary download
- Accessibility improvements

Release 3
- Manual location history
- Access for older phones (increase to 97%)
- Bug fixes and accessibility (disability) improvements
- Security improvements

- Developed as two separate native apps for iOS and Android based on international experience at the time
- Focus on iterative releases, develop functionality to meet tight timelines and public release milestones
- UX Design was led by initial roadmap of a web app followed by the mobile apps
- Significant take up in the last three weeks - 1.8M registered users, and over 300,000 posters have been created
- Platform issues compressed development time and causing increased support load wrt sign in process

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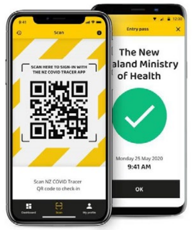
Document 3

NZ COVID Tracer - Roadmap



Tech Change Freeze

May	Jun	Jul	Aug	Sep	Oct	Nov	Dec/Jan 2021	Feb

R1 R2 R3 R4 R5 R6 R7 R8

Release 4 & 4.1 – 3 Sept (on track)
- Edit diary entries
- Accessibility (disability) Improvements
- Customisable Contact Alert text
- Call-back for locations deemed high risk
- NHI capture

August (complete)
- Placement advice for QR posters

Release 5 – September (in progress)
- Optional user sign up
- section 9(2)(c) [redacted]
- Improved app metrics/analysis
- Enhanced information access (stats/data/guidance)

Platform decision point

Bluetooth Trial (Aug – Oct) (in progress)
- ENF (Google Apple)

Release 6 – October
- Risk-based Contact Alerts
- section 9(2)(c) [redacted]

Release 7 –November
- section 9(2)(c) [redacted]
- ENF – if successful and agreed

section 9(2)(c) [redacted]

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NZ COVID Tracer

- Rush recently completed some ‘competitive analysis’ of other COVID-19 apps from around the world.
- The results found that many of the popular apps in this space do not have mandatory authentication
- A strong collaboration has emerged focused on implementation of Bluetooth ENF and use of React Native code base
- They provide a rich and streamlined onboarding experience to help users understand the purpose off the app and how it supports the fight against COVID-19 in that country
- We have known issues with session management in Cognito and strict password policies
- Potential implementation of the Google/Apple Exposure Notification Framework requires authentication to be optional

Conclusion: There is a compelling case to streamline the onboarding and registration process of the app as part of Release 5.

There are two technical options for implementing a streamlined registration process:

1. Implement changes in the current native app code base
2. Align the app platform to the Ireland/UK/Germany collaboration

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Ireland/UK/Germany collaboration

COVID GREEN

- COVID Green was donated by Ireland to the Linux Foundation for Public Health as an open source core of the Irish COVID Tracker app which includes the Apple/Google ENF
- Implemented using React Native, a cross platform technology for developing mobile apps originally released by Facebook. It allows developers to have “one codebase” that runs across both iOS and Android.
- Several countries have now coalesced around COVID Green as a base implementation for their COVID-19 apps, or are reusing components such as the bridge library for interacting with the ENF APIs.
- As Google/Apple develop more features into ENF, these libraries and components are regularly updated to keep pace.
- The Ministry has used COVID Green as the base for the app developed for the ENF trial in NZ to run in September/October.
- There is a potential for the Ministry to further adopt COVID Green as a foundation for future releases of NZ COVID Tracer, to participate in the group of countries further developing solutions based off COVID Green.
- There is potential benefit in leveraging the experience of other countries in trialling and implementing features

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Aligning NZ COVID Tracer to COVID Green

- The removal of mandatory authentication and onboarding improvements require a substantial change to the current native app codebase, as many of the early architecture assumptions about session management no longer hold.
- Future releases on the roadmap include a symptom tracker, improved stats and metrics in app, and improvements to onboarding, all of these are currently catered to inside COVID Green and could be reused/enhanced.
- A potential integration of the Apple/Google ENF APIs is a core part of COVID Green and could be reused, including the lessons learned from the implementation in Ireland around the clinical settings.
- Participating in the cohort of other countries using the COVID Green base means we can take advantage of their developments, and contribute ours as well. For example the UK is implementing a similar poster scanning feature that we have pioneered.
- Since COVID Green is open source, we can use it as a foundation to also bring forward open sourcing the NZ implementation, to improve trust and confidence in the technology we have developed.
- Rush strongly support a move to React Native, which in their view will increase delivery capacity and allow us to move and innovate faster on the backlog we have.

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Decision point

Ahead of Release 5 of the NZ COVID Tracer roadmap, currently scheduled for end of September, we need to make a decision on the optimal way to proceed.

Option 1 – Stick with the current native codebase:

- Continue implementation of roadmap on the current native app codebases.
- Ready around the end of September (pending other deliverables) and confirmation of approach.

Option 2 – Re-platform to React Native:

- Re-implement core functionality from current app into COVID Green base
- Lock off or disable ENF functionality until a determination on release is made.
- Ready in mid-October for public release.

Comments:
It is potentially possible to do both these streams in parallel as a risk mitigation that Option 2 has issues we have not foreseen, however this will increase costs for duplicate delivery.

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Sticking with native apps

Benefits:

- We'll be building on an already known codebase, and we won't be reimplementing most of the functionality again.
- Likely less time to market for removing authentication, and potentially less overall for R5.
- Can still benefit from lessons learned overseas, we'd just need to implement them from scratch each time.
- While open-sourcing the app is a priority, sticking with native doesn't compel us to do it sooner.
- The scope of change for R5 is more known and easier to predict, and there's less chance of introducing a defect into existing functionality.

Drawbacks:

- Limited ability for re-use of open source components and to contribute our components back.
- No opportunity to take advantage of improved development/stability efficiencies gained from a RN implementation

Timeframe

- Rush have indicated approx. 1 month from a go decision to implementing the first drop of the optional authentication
- Still need to consider how to enable other R5 features like symptom tracker, stats, etc.

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Re-platforming to a COVID Green base

Benefits:

- Opportunity for reuse of shared components and innovation from other partners using COVID Green, and, longer term, we can be aligned with international approaches to these kinds of apps.
- Participation in a community where we can learn from other implementation of the same tech, especially around specific clinical settings and configuration of the ENF.
- Rush cite improved development speed (e.g. 2 engineers can create 2 features in parallel, rather than one per platform); stability (e.g. RN handles a lot of the lifecycle management on Android); uniform tooling and ability to ramp up development capacity faster if needed because of the shared skillset; reduction in QA effort required.
- Opportunity to 'start over' on some of the UI paradigms if required, to simplify the UX and learn from the time in the market already.

Drawbacks:

- The risk of "starting over" means we introduce bugs or issues we haven't currently got.
- Potentially lose some time while we get back to parity from a feature perspective (order of magnitude around several weeks).

Timeframe

- Rush have indicated approx. 1.5 months from a go decision to having feature parity with R5 of current app.
- May be able to leverage COVID Green features like symptom tracker, stats, etc. for R5

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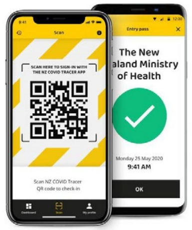
Document 3

NZ Covid Tracer – Updated roadmap (Option 2)



Tech Change Freeze

May	Jun	Jul	Aug	Sep	Oct	Nov	Dec/Jan 2021	Feb

R1 · R2 · R3 · R4 · R4.2 · R5 · R6/R7 · R8

Release 4 & 4.1 – 3 Sept (on track)
- Edit diary entries
- Accessibility (disability) Improvements
- Customisable Contact Alert text
- Call-back for locations deemed high risk
- NHI capture

August (complete)
- Placement advice for QR posters

Release 4.2 – 9 Sept (on track)
- Quick-scan to allow users to scan while logged out

Release 5 – September (in progress)
- Optional user sign up
- section 9(2)(c) [redacted]
- Improved app metrics/analysis
- section 9(2)(c) [redacted]
- [From R7] ENF – if successful and agreed
- [From R80 Open source app and APIs

Bluetooth Trial (Aug – Oct) (in progress)
- ENF (Google Apple) in separate app

Release 7 –November
- section 9(2)(c) [redacted]

Release 6 – October
- Risk-based Contact Alerts
- section 9(2)(c) [redacted]

Release 8 –Feb 2020

section 9(2)(c) [redacted]

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Next Steps

- Seek endorsement from this group for either Option 1 or Option 2
- If Option 1 is chosen:
  - continue with R5 as planned
- If Option 2 is chosen:
  - inform BDC and TGG
  - brief DDG Data & Digital, and seek approval to continue
  - engage Rush to formally define scope, estimates, and delivery timeframes
  - begin work on documents for C&A, including an updated SAD, to prepare an ATO
  - brief in third party security vendor, NCSC, and other interested parties on the change
  - request to join the Linux Foundation for Public Health to access resources and community around COVID Green
  - investigate options for managing the open sourcing process for R5 (eg. LFPH, NZ Open Source Society, etc)

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Appendix

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What do we get in each release (in-scope)?

Release 4 & 4.1:

- In the app users can edit and delete diary entries, we've cleaned up some technical debt, and incorporates more accessibility improvements.
- NCCS can customise the message sent out with a Contact Alert, depending on the situation and offer user a call back
- A new screen to capture NHI and show personal details to speed up provision of information at Testing Stations.
- We provide clearer advice about how to display QR posters at your premises, to improve accessibility and consistency

Release 5:

- *Users can use the app without having to log in, making the app more accessible and easy to use.*
- section 9(2)(c) [redacted]
- Potentially support more older devices, so more people in NZ can use the app

Release 6:

- NCCS can send Contact Alerts with different risk levels, so people who may have been exposed to COVID-19 can receive different advice based on the scenario.

Release 7:

- section 9(2)(c) [redacted]
- *Pending trial outcomes, people can enable Apple/Google exposure notifications using Bluetooth.*

section 9(2)(c) [redacted]

Note: these releases are indicative, so scope and benefits may change as we learn more or adapt to changing conditions in NZ

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Document 3

DRAFT High level milestones – NZ COVID Tracer app

Milestone	Scope	Date
QR Poster improvements	• Placement advice	27 August 2020
Release 4 - Go Live	• Edit diary entries • Customisable contact alert & call-back • Accessibility improvements • NHI capture screen	3 September 2020
Release 4.2 – Go Live	• Quick scan for logged out users	9 September
Bluetooth Trial app - Ready	• Technology solution ready	31 August 2020
Release 5 - Go Live	• Optional user sign up • section 9(2)(c) [redacted] • Switched off ENF	23 October 2020
Release 6 - Go Live	• Contingency for R5	29 October 2020
Bluetooth Trial - Complete		31 October 2020
Release 6/7 - Go Live	• Enable ENF pending trial outcome • Risk-based Contact Alerts • section 9(2)(c) [redacted]	26 November 2020
Release 8 - Go Live	• TBC	25 February 2021

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MINISTRY OF HEALTH
MANATŪ HAUORA

Health Report

NZ COVID Tracer app roadmap and timeline

Date due to MO:	25 September 2020	**Action required by:**	N/A
Security level:	IN CONFIDENCE	**Health Report number:**	20201730
To:	Hon Chris Hipkins, Minister of Health		

Contact for telephone discussion

Name	Position	Telephone
Shayne Hunter	Deputy Director-General, Data and Digital	[redacted] section 9(2)(a)
Darren Douglass	Group Manager Digital Strategy and Investment, Data and Digital	[redacted] section 9(2)(a)

Action for Private Secretaries

Return the signed report to the Ministry of Health.

Date dispatched to MO:

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NZ COVID Tracer and Integrated Technologies Roadmap

Purpose of report

This report responds to your request for an updated timeline for the NZ COVID Tracer app and information about how the app can be used to support testing of border workers and staff in managed isolation and quarantine (MIQ) facilities.

Summary

- The development and use of a public-facing application, the NZ COVID Tracer app, is a key component of New Zealand's response to COVID-19. Since being developed and rolled out to the public, the app has undergone a series of updates to improve the experience of users and the value of the information collected by the app to the process of contact tracing.
- You received a roadmap for development of the NZ COVID Tracer app and accompanying communications activity to promote uptake and use at the end of July (Health Report 20201297). This Health Report provides an update on upcoming work, as outlined in the attached NZ COVID Tracer and Integrated Technologies Roadmap.
- Use of the NZ COVID Tracer app rose considerably in August and September following the re-emergence of COVID-19 in Auckland and the Government's decision to make the display of official QR code posters mandatory for businesses at Alert Level 2 and higher. The number of people using the NZ COVID Tracer app rose from about 600,000 to 2.2 million and poster numbers from 87,000 to 381,000 by late September.
- The roadmap anticipates three major releases of the app in October/November, late November and February. The next significant update (Release 5) is on track to enable deployment of the Bluetooth-enabled Google and Apple Exposure Notification Framework (ENF) in mid-November. Release would be subject to trial results and a decision from the Government.
- Other planned roadmap features include:
    - improved user sign-up process

section 9(2)(c) [redacted]

- This work to further develop the NZ COVID Tracer app sits alongside other work such as integration with other sources of data to support contact tracing; investigation of alternatives to QR codes for location recording; and trials of the COVID Card and other wearables to assess their value to contact tracing. The work on the COVID Card is detailed in a recent memo (Memo 20201677, dated 15 September 2020) and an update on the CovidCard trials (Health Report 20201738, dated 25 September 2020).

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- [redacted]
- We are implementing improvements to testing processes, including those that relate to border controls and MIQ facilities. [redacted]
- We are ensuring that all testing stations display a QR code and are encouraging border and MIQ facility employees to scan using the NZ COVID Tracer app when they attend to be tested. [redacted]
- Positive COVID-19 results will continue to be communicated by Public Health Unit (PHU) staff.
- The Ministry plans to publish the NZ COVID Tracer and Integrated Technologies Roadmap on its website.

Recommendations

We recommend you:

a) **Note** the Ministry's intention to publish the NZ COVID Tracer and Integrated Technologies Roadmap.

Shayne Hunter
Deputy Director-General
Data and Digital

Hon Chris Hipkins
Minister of Health
Date: 6/10/2020

[redacted]

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Document 5

MINISTRY OF HEALTH
MANATŪ HAUORA

Health Report

NZ COVID Tracer app roadmap update

Date due to MO:	30 October 2020	**Action required by:**	N/A
Security level:	IN CONFIDENCE	**Health Report number:**	20201889
To:	Hon Chris Hipkins, Minister of Health		

Contact for telephone discussion

Name	Position	Telephone
Shayne Hunter	Deputy Director-General, Data and Digital	[redacted] section 9(2)(a)
Darren Douglass	Group Manager Digital Strategy and Investment, Data and Digital	[redacted] section 9(2)(a)

Action for Private Secretaries

Return the signed report to the Ministry of Health.

Date dispatched to MO:

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NZ COVID Tracer Roadmap Update

Purpose of report

This report provides an update on Release 5 of the NZ COVID Tracer app, including information on the deployment of the Bluetooth-enabled Google and Apple Exposure Notification Framework (ENF). section 9(2)(c) [redacted] and provides an update on other requested app changes that have been made or are planned.

Summary

- You received a roadmap for development of the NZ COVID Tracer app on 25 September (Health Report 20201730). This Health Report provides an update on the dates for the next release of the app and of subsequent releases, section 9(2)(c) [redacted]
- The next release of the app is a major release as it requires significant changes to the software to comply with ENF requirements.
- It was planned to deliver the next release across two go-live dates. The first (release 5.0) would establish the technical pre-requisites for ENF, improve the user sign-in process and provide enhanced information to app users. The second (release 5.1) would deliver ENF section 9(2)(c) [redacted]

Release 5.0

- Technical challenges related to the user sign-in process and an under-estimate of the scope of the development effort required to comply with ENF requirements means release 5.0 will be delayed from 29 October to 19 November. A pre-release pilot with public service volunteers is planned for one week from 11 November to ensure that testing is representative of the broad range of mobile phones that have the app installed.

Release 5.1

- Learnings from other countries using ENF have indicated that a staged deployment strategy is prudent to ensure the generation of notifications, integration of these with the app and advice to the app user is robust. If it is not robust this could impact negatively on the contact tracing process or user confidence in the app. The recent ENF deployment in England experienced 'phantom' notifications that advised people to self-isolate even when they had not been near a confirmed case or in close contact.
- As a result of what we have learnt, we plan to deliver release 5.1 in three steps rather than as a single go-live.
    - On **12 November**, a proof of concept app integrated with the technology that generates notifications will be deployed to a small group of public service volunteers.
    - On **23 November**, the NZ COVID Tracer app will be deployed to a wider group of already recruited public service volunteers to ensure testing covers a broad range of devices.

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  - On **10 December**, subject to the results from the initial deployment to public service volunteers, release 5.1 of the app will be released to the public.

- Operational changes for contact tracing as a result of the use of ENF are significant and we have established a team to work with the Public Health Units on the implementation.
- In a previous Health Report on 25 September we advised that deployment of ENF would require a decision from the Government. We are now seeking your agreement to the staged deployment of ENF in release 5.1.

Deferred

- To minimise the delays to releases 5.0 and 5.1, section 9(2)(c) [redacted]
- We have considered carefully the options to avoid deferral but this is not possible without further delaying release 5.0 and 5.1.

section 9(2)(c) [redacted]

- section 9(2)(c) [redacted]
- [redacted]
- [redacted]
- [redacted]

Communications related to the addition of the Bluetooth functionality

- Communications are being developed to support the rollout of Bluetooth-enabled ENF. The Ministry is working with DPMC on the messaging and approach, and DPMC will lead the campaign activity. It is recommended that communications do not start until after 23 November to ensure adequate testing has been undertaken before setting expectations.
- Key messages will focus on the continued importance of understanding where people have been and who they've been near in the event this information is needed for contact tracing. The campaign will explain the value of the Bluetooth functionality and emphasise the need to continue QR code scanning in conjunction with using the Bluetooth ENF function to enhance the effectiveness of contact tracing. Secondary messaging will note that Bluetooth tracing is only as effective as the number of people using it, and that it is not a complete solution or replacement for QR scanning.
- The all-of-government response team is considering barriers to use of the Bluetooth functionality and ways to combat misinformation about how it might be used (for example, people who are concerned about the privacy of their personal information or who fear it will be used in ways they have not authorised).

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Changes requested by the Minister or Minister's office – Completed

- Releases 4 and 4.2 in September provided the following functions:
  - the ability for app users to add their NHI numbers so this information is available if they go to a testing facility
  - the ability to customise messaging in contact alerts
  - retention of the app's diary to 60 days so more data is available if needed for contact tracing during longer investigation windows
  - the ability to allow app users to request a callback if they receive a contact alert.

Changes being investigated and/or planned

- section 9(2)(f)(iv) and section 9(2)(g)(i) [redacted]
- [redacted]

Recommendations

We recommend you:

a) **Note** the delay to the next release of the NZ COVID Tracer app.

b) **Agree** to the staged deployment of the Google-Apple Exposure Notification Framework in NZ COVID Tracer commencing 23 November 2020. **Yes/No**

c) **Agree** that communication about Bluetooth functionality does not start prior to 23 November or until testing has been completed. **Yes/No**

d) section 9(2)(g)(i) [redacted]

Shayne Hunter
Deputy Director-General
Data and Digital

Hon Chris Hipkins
Minister ~~of Health~~ for COVID-19 Response
Date: 20/11/2020

I want to see some very sound comms messages before any announcement is made. Privacy will be a key concern here. People need to have confidence they will own their own data and this will not be a "big brother" experience.

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MINISTRY OF HEALTH
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Using Bluetooth technology in Contact Tracing

Data & Digital, Ministry of Health

24th November 2020

V 2.5

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Contents

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Executive Summary

The purpose of this document is to build and share a common understanding of how Bluetooth technology and digital data could be integrated into the National Contact Tracing System and the Contact Tracing process.

The document describes the current processes and systems in place along with the strategic direction provided by Cabinet. This is then complemented with the intent of the programme along with a summary of current evidence and intelligence from researchers and other jurisdictions.

This suggests we should consider Bluetooth as an aid to contact tracing rather than a replacement. This is largely due to the known technical limitations of the technology.

Coverage is fundamental to how the solution can support contact tracing, however the amount of coverage should be considered as supplement to the existing process and other controls such as QR codes and third party data, rather than in isolation.

A key question to be answered is the impact of this on the number of people managed in an outbreak. Rates of notifications for different settings in other jurisdictions appear to be driven by coverage, population density, the signal thresholds, time thresholds and the volume of social interactions (affected by lock downs).

Next, there are some key differences between a centralised and de-centralised model. In a centralised model, the relationships between the case and close contacts is known to the contact tracer, potentially exposing illegal acts, immoral behaviours or situations of deprivation. Exposing these may reduce participation in groups that have low trust of government. The alternate model leaves revealing the relationship in the hands of the contact. This relies on the contact participating in the contact tracing process.

As a part of the work a conceptual model has been developed to help understand the components that influence and drive the use of digital data. This highlights four aspects:

1. **Context** – understanding the outbreak, case and exposure event of interest are important when using the data
2. **Constraints** – a number of constraints need to be worked within to ensure that the notification doesn't cause more problems than it solves
3. **Risk stratifying** – understanding how we stratify groups is important as this helps us define who receives which message and call to action
4. **Messages and calls to action** – given the context and constraints, there is a need to understand effectiveness and participation when messages are determined.

Implementation planning needs to consider that this is a new tool for contact tracing. The document describes some key processes and initial settings for an EN implementation – should that proceed. Consideration has been given to MoH policy and the governments algorithm charter when implementing a system such as this.

These considerations have been summarised into three principles for implementation with an operational governance group to review the use of the system through implementation in order to minimise risk and maximise the benefit to New Zealand. These principles are:

1. Use an Active Learning approach to ensure that we learn from using the system
2. Start from a manual process before automating
3. Start from conservative settings before choosing more aggressive settings

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Background

MINISTRY OF HEALTH
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Data & Digital Problem Statements - grouping the problems

This shows the different business problems identified by Data and Digital as a part of the COVID-19 Response. The highlighted pieces show how interconnected these problems are when considering digital technology to support contact tracing.

Public and whanau

Providers

Policy Makers

Communications

- 1. How do we communicate better with the public?
- 2. How do we communicate better with health workers?

Intelligence

- 3. How can we get patients to collect data for us?
- 4. What are the privacy implications of sharing data in this situation?
- 5. How do we collect the right data to plan well?
- 6. What do we do to analyse the data?
- 7. How do we share information more about hospital demand/capacity

Managing patients effectively

- 8. How do we more effectively manage initial triage for the system
- 15. How do we know the contact tracing has been completed
- 9. How do we get more virtual care in the health system
- 10. Where do the lab tests go?
- 11. Where does the self-isolation data go?
- 12. How do we collect data from the CBACs?

Coordination

Supply Chain workstream

- 13. What do we need to do to secure the supply chain for technology (new and maintenance)

Out of scope

- 14. How do we manage the process of NHCC more effectively?

WHO Pandemic Planning Guidance

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What is the role of Technology?

No one solution will let New Zealanders confidently be a part of society while also ensuring we maintain our independence and freedoms.

We need to consider that there are a number of technology actions that together will provide us confidence that we can enter a new normal for society.

Our approach to technology considers that:

1. Just because we can use technology to solve a problem doesn't mean we should
2. We should be thinking about how we deliver in line with our long term strategy
3. If we come out of this without foundational components that can be reused – we have missed out
4. We should be thinking about good, better and best, probably in parallel.

The operational response for Data and Digital, including in this programme will conform to these expectations.

Strategy

Digital Health Strategic Framework	We are building an interoperable ecosystem

Cabinet Principles

Public Health efficacy	Respect for Privacy	Freedom of movement	Technical Feasibility & data access
Our efforts need to make our Public Health response more effective	Our efforts need to build trust with our communities, not erode it	Our goal of a recovering economy relies on maintaining this	We need solutions that can scale quickly and work together

Delivery

Value for Money	Our options need to conform to tax payer's expectations
Capacity & Capability	We need to deliver the solutions using the right people in the right order
Creating reusable assets	Minimise regretful spend

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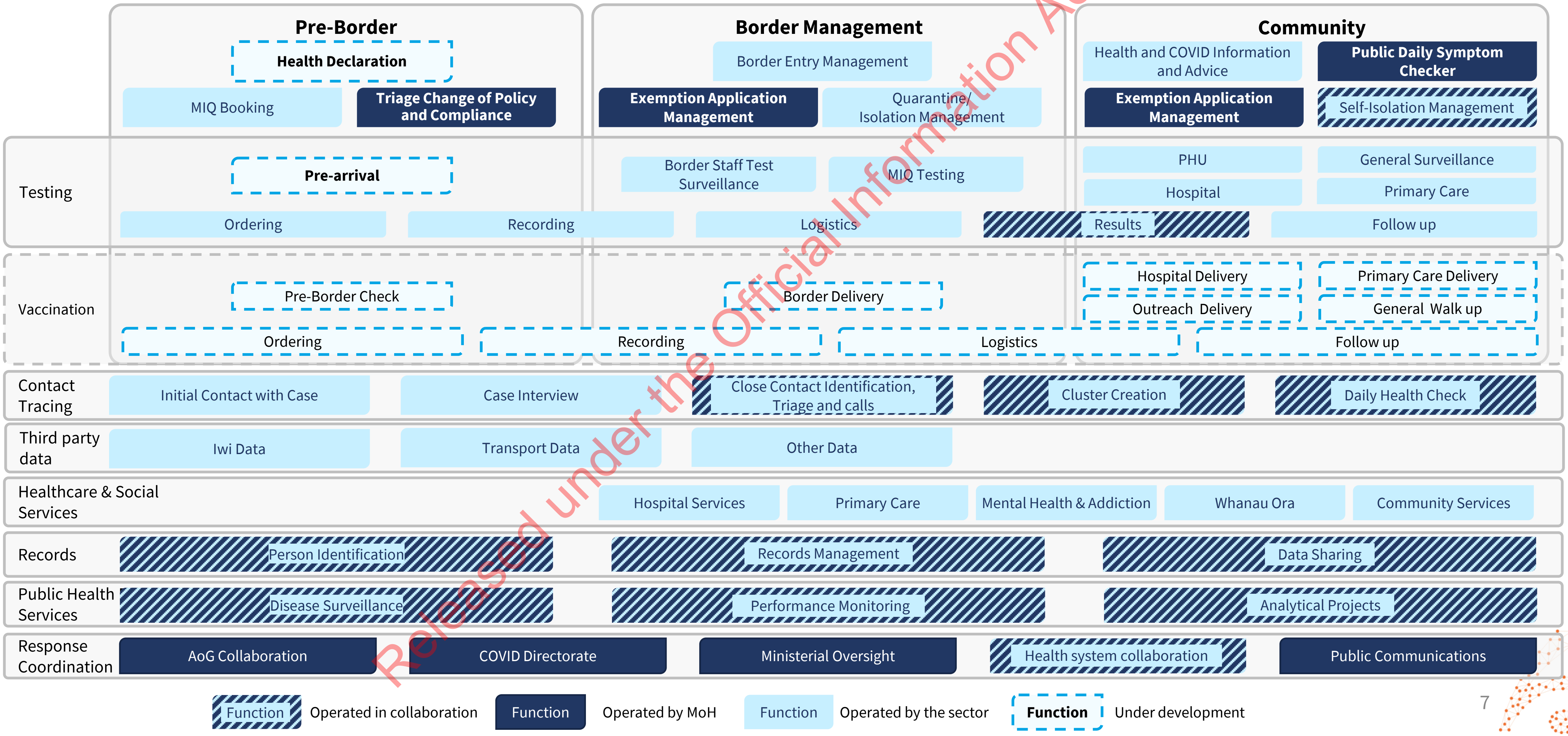
COVID-19 Business Functions

This shows the different business functions currently in place or in development for the COVID-19 response along with who operates them.



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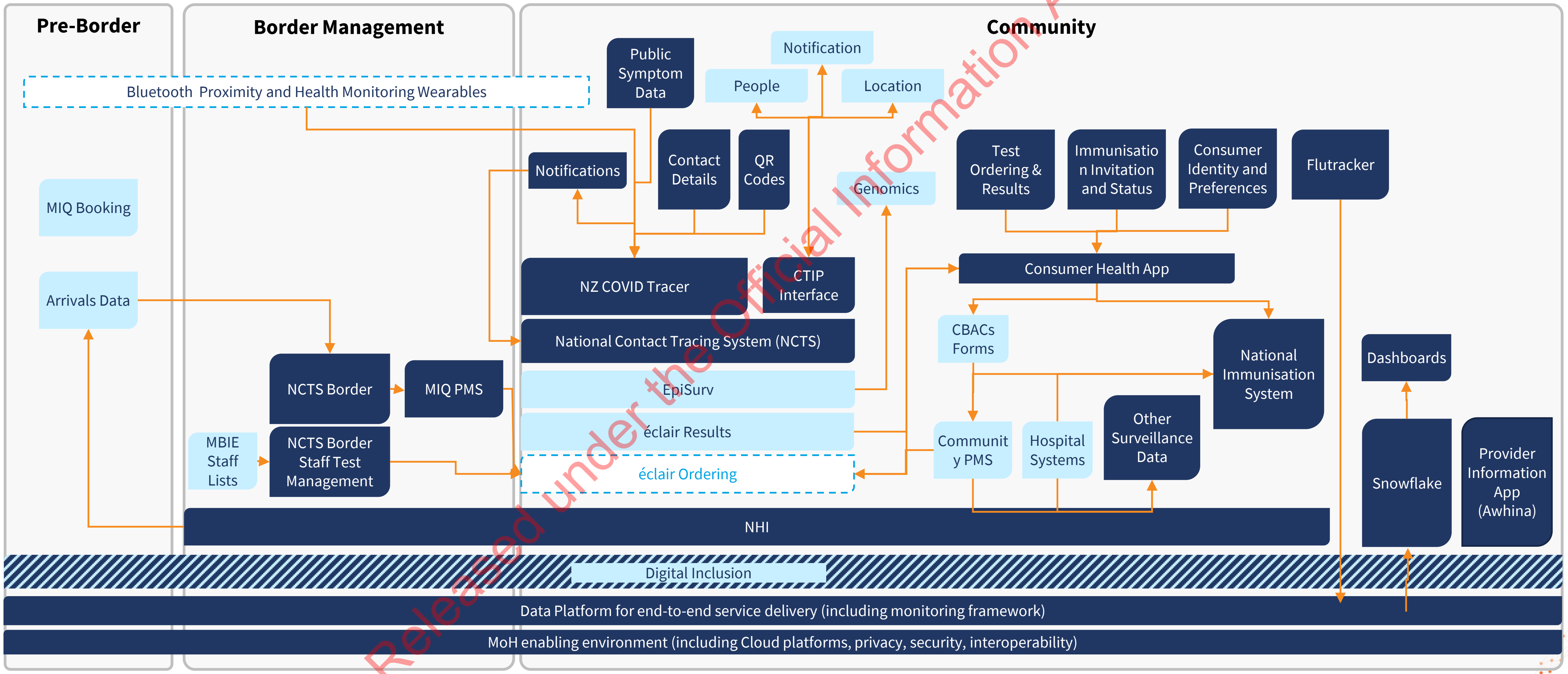
COVID-19 Digital & Data Landscape

This shows the current state of technology solutions for the COVID-19 Data & Digital response.



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Framework for Digital Contact Tracing Data

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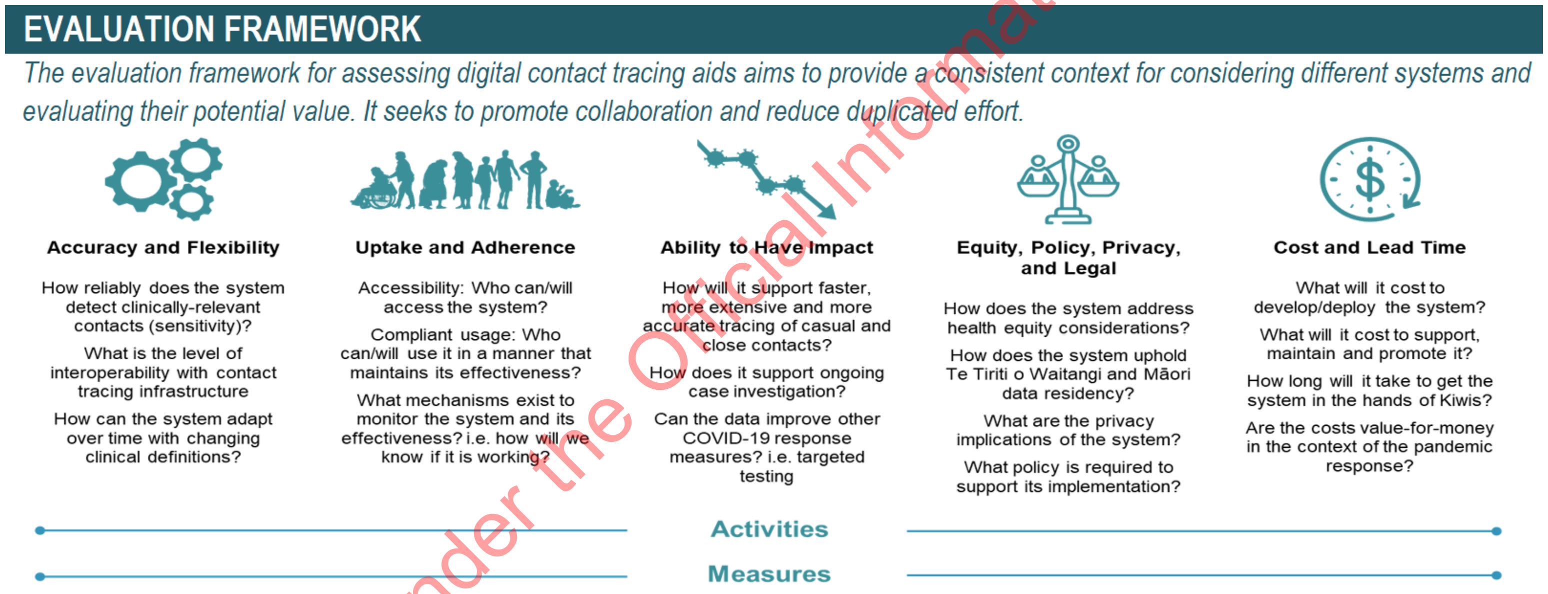
Programme Approach to Digital Contact Tracing

The intent of this document us to describe digital contact tracing sources and what to do with this data when it is collected. This shows the evaluation framework for the programme and the key questions and actions being undertaking in the context of improving contact tracing. There are other elements of the programme that relate to the performance and feasibility of technology that aren't covered in this document.



	What are peoples intentions?	What are peoples actions?	How do we use this information?
Questions	What are peoples intentions?	What are peoples actions?	How do we use this information?
Actions	Survey and Panel Groups	• Recruitment Questionnaire • Use of wearable • Collecting data from the wearable and/or app • Case investigations to go with the data • Close out questionnaire	**Scenario planning and modelling using data, technical and clinical experience**

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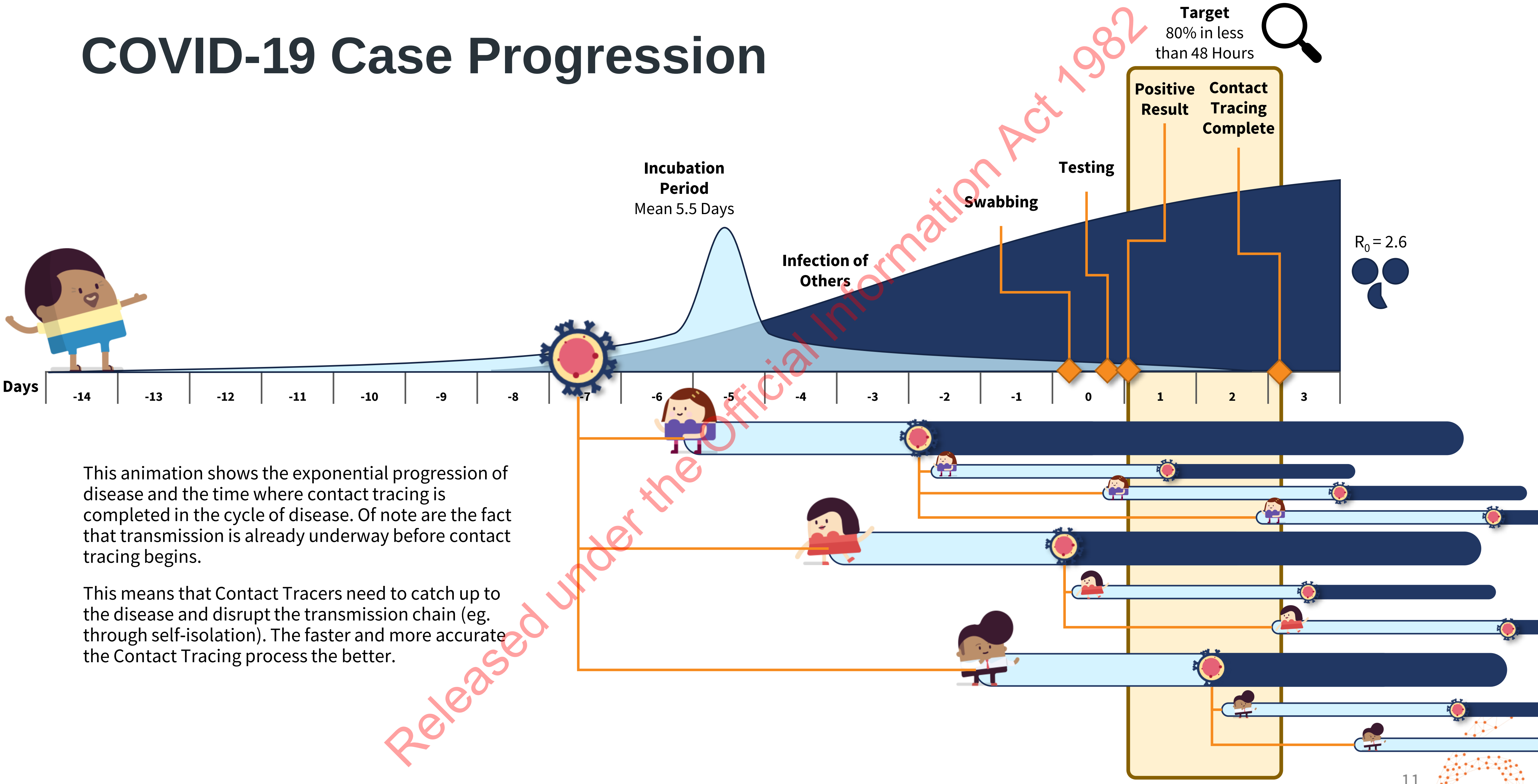
COVID-19 Case Progression



This animation shows the exponential progression of disease and the time where contact tracing is completed in the cycle of disease. Of note are the fact that transmission is already underway before contact tracing begins.

This means that Contact Tracers need to catch up to the disease and disrupt the transmission chain (eg. through self-isolation). The faster and more accurate the Contact Tracing process the better.

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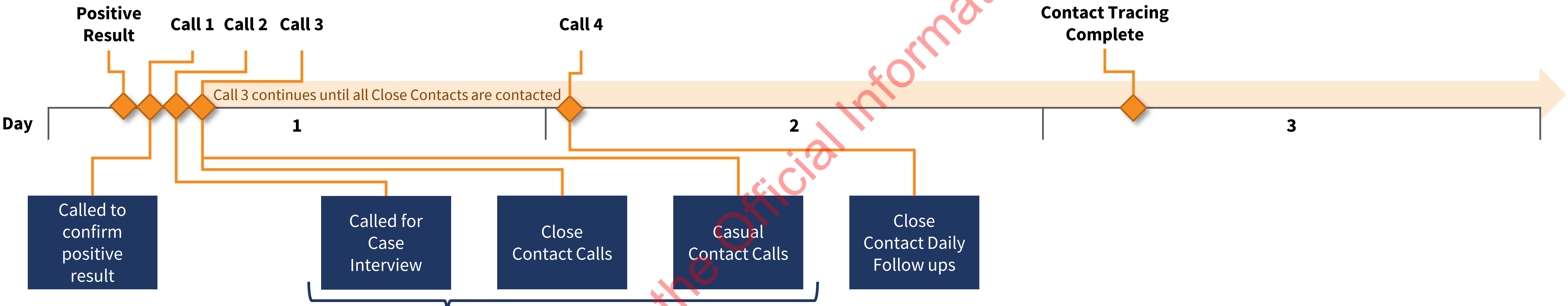
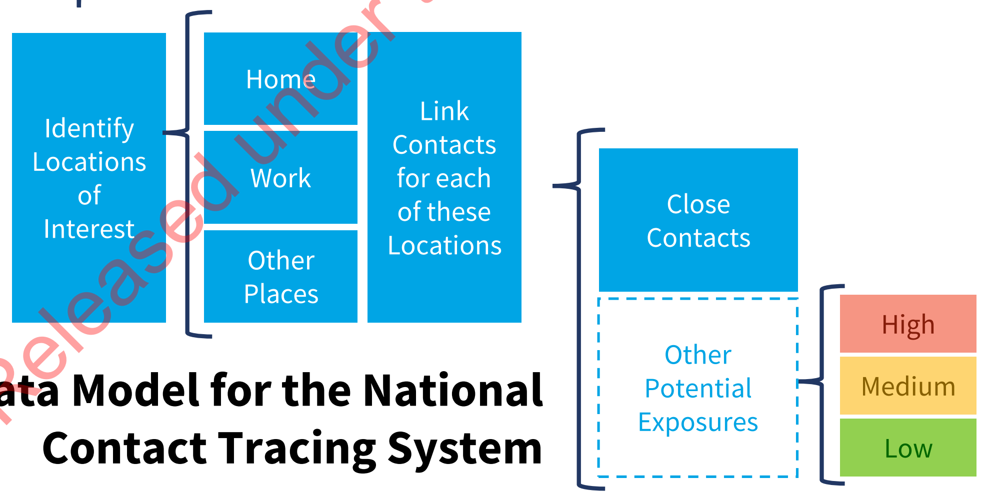
Understanding contact tracing in New Zealand

This shows how the contact tracing process works, the conceptual data model used for contact tracing and the business problems often associated with collecting this data. This should inform the solutions for improving contact tracing. Of note the information is collected as a consequence of a case interview. These technologies can supplement a case interview – particularly in order to help find places and people to contact, but the case interview seeks to identify risk, connections to other cases and high risk areas for investigations (ie. Exposure Events).



Business Problems - Locations
- Finding the places you don't remember
- Consistently identifying locations or Exposure Events
- Identifying locations of high risk
- Connecting people to a location-based cluster



Data Model for the National Contact Tracing System

Business Problems - People
- Getting in touch with people (contact details)
- Minimising duplication of people
- Finding people you don't remember
- Finding people you don't know
- Increasing speed of isolation/testing cycle

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Understanding different technologies

This shows the different types of potential technology that could be used for Digital Contact Tracing. Data models are of interest – particularly centralised vs decentralised, with decentralised models being less open to potential abuse.

	Bluetooth	GPS	Self-Report	Bluetooth Beacons	Third party data	Wifi	UWB	QR Code	Mobile Network	NFC
Key Description	Uses signal strength to measure how far apart users are	Uses GPS satellites to provide a location of the individual	People collect information in their normal way about who they go near and where they go	A beacon broadcasts a code identifying a location that is collected by a user	Allows users to contribute their existing data from other sources or be notified from other sources	Allows automatic check ins and detection of visitors	Passive collection of proximity. Uses time of flight to measure distance between users	Scanning a code results in a standardised record to create a history of visits	Data about phone locations collected by mobile network operators	A tags broadcasts a code identifying a location that is collected by a user
Collects	Proximity	Location - physical	Proximity & Location - physical & virtual	Location – physical & virtual	Location – physical & virtual	Location – physical & virtual	Proximity	Location – physical & virtual	Location – physical	Location – physical & virtual
Benefits	Doesn't record location	Passive if collected	Private except for asking stangers for their details	More passive than scanning a QR code	Low Cost Passive	Low cost Passive	Good at proximity & location with beacons	Low cost		Low cost
Risks	Accuracy Coverage Participation Privacy	Battery Significant Privacy risks Resolution & accuracy	Poor accuracy, consistency and participation	Potential privacy risks if these collect and broadcast	Potential privacy risks	Potential privacy risks if these collect and broadcast	Availability Cost	Participation is required	Resolution Significant Privacy risks	Faster than QR Codes
Examples	COVIDCard Exposure Notification (EN)	Google Maps History	Paper diary Existing phone calendar	Rippl – POC	CTIP – the use of location and close contact data is already part of the contact tracing process.	https://www.wired.com/brandlab/2018/06/whos-sniffing-public-access-wi-fi/	NIghtingale	NZ COVID Tracer	Ventures – population density/flow	Under investigation by MoH

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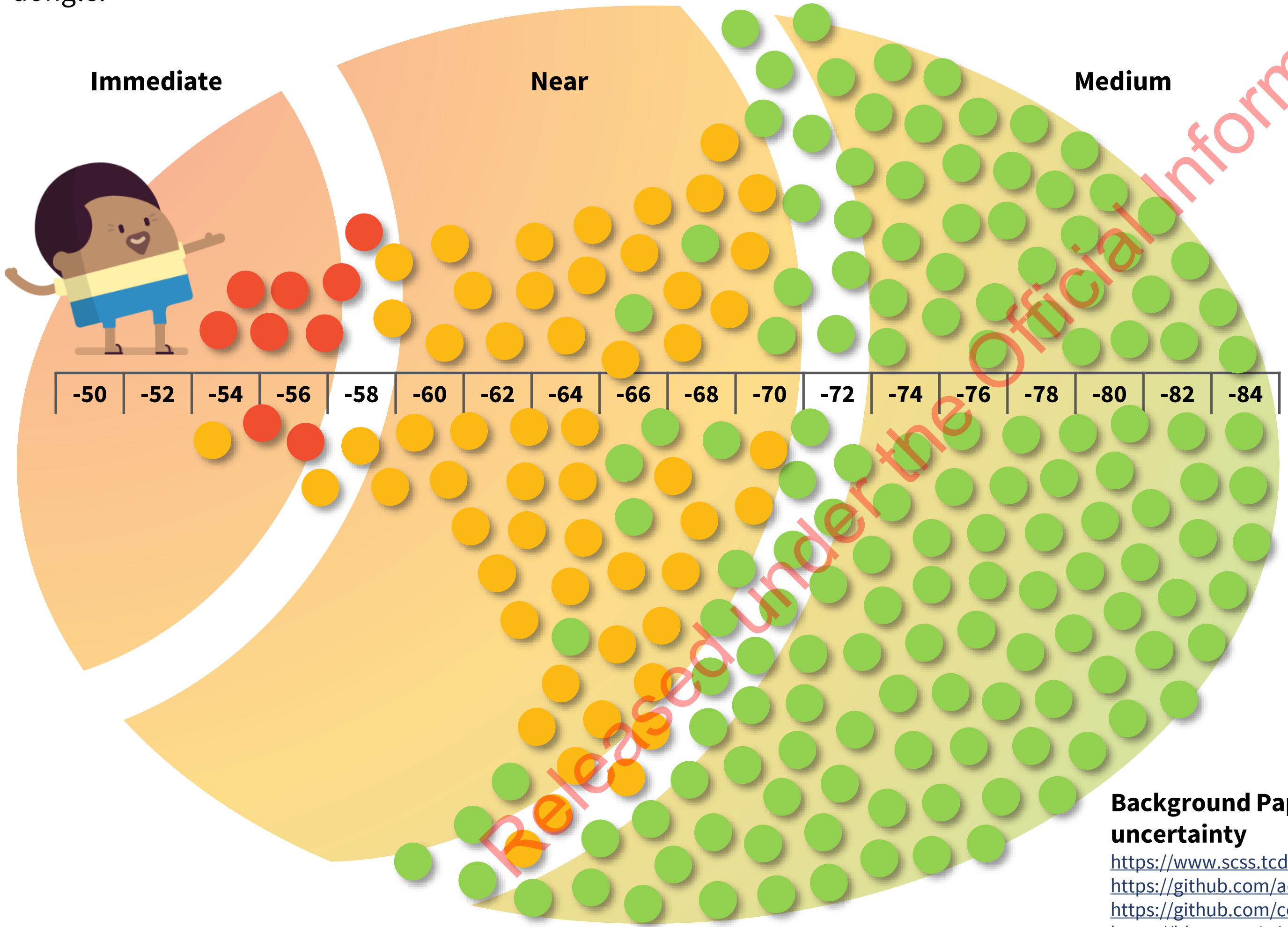
Understanding what Bluetooth data looks like

A Bluetooth digital model collects information about what other devices are nearby and for how long. It uses signal strength to estimate distance. This has some risks and issues associated with the fact that Bluetooth was designed to make connections and transfer data, not measure distance. Google and Apple have developed an ENF model that is available on smart phones to share these connections between devices, but a wearable can be used instead as Bluetooth is an open specification and the chipsets are openly available. A model like this has been implemented in Singapore where they supplement data from their Trace Together app with a custom built dongle.



From Google ENF Documentation – Proximity Estimate

- Lower attenuations indicate stronger Bluetooth signals
- **Very low values** indicate short distances
- **Larger values** can be caused by:
- Type of phone cover
- How it is being held
- Device in a pocket or bag
- Longer distances
- Other factors

Background Papers on the use of Bluetooth to measure distance – all suggest significant uncertainty

https://www.scss.tcd.ie/Doug.Leith/pubs/bluetooth_rssi_study.pdf
https://github.com/admin-ch/PT-System-Documents/blob/master/SwissCovid-ExposureScore.pdf
https://github.com/corona-warn-app/cwa-documentation/blob/master/2020_06_24_Corona_API_measurements.pdf
https://bluetrace.io/static/bluetrace_whitepaper-938063656596c104632def383eb33b3c.pdf

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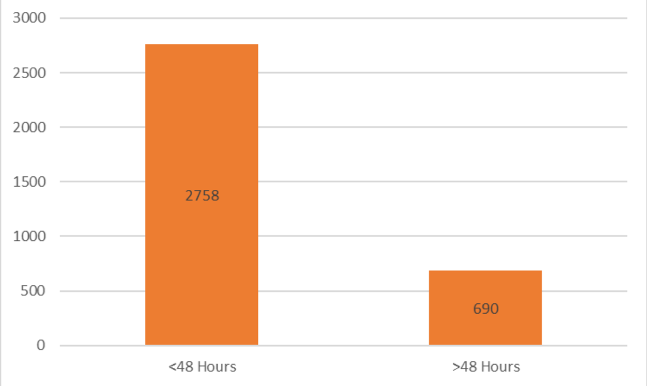
Understanding how coverage affects digital methods

Our current contact tracing system is designed to find close contacts within 48 hours. In the Auckland outbreak, shown in the graph below, this meant 2,758 close contacts needed to be found within 48 hours to reduce the R0 below 1 and then achieve elimination.

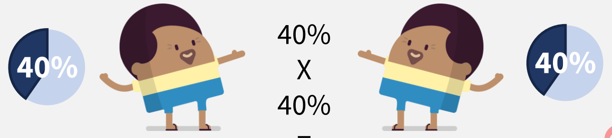


This time and completeness goal means we should consider how a digital technology can provide two benefits:

1. Speed up the finding of all close contacts – reducing time from identification to self-isolation.
2. Finding those who can't be found easily – this is likely to be a small percentage of those identified when surveillance testing is considered.

High coverage of a digital solutions can help us improve performance in both of these problem domains as it increases the likelihood of contributing. One model for considering how likely it is to find contacts using digital sources is a simple quadratic equation.

For example with 40% coverage, each party to the interaction has a 40% chance of interacting.



16% likelihood of an interaction

This suggests that while increasing coverage will increase the likelihood of interaction, small increases above 50% coverage grow the interaction likelihood much more than coverage increases below 50%. Further, this simple model discounts two key considerations:

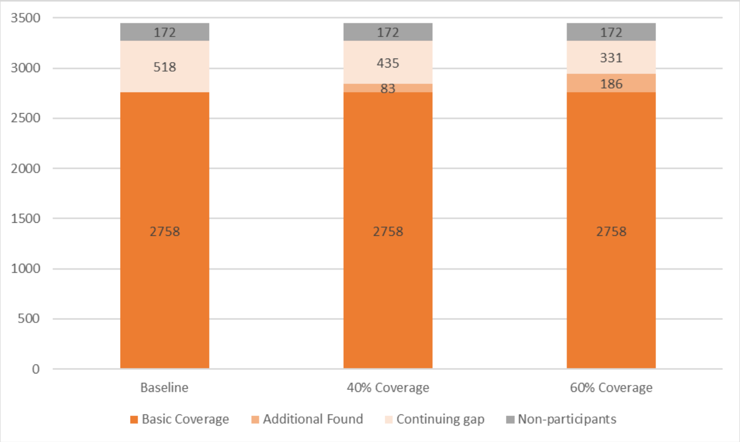
1. The use of digital tools is lumpy due to distribution of the population along with cultural/social groups being subject to clustering through consensus bias (ie. people tend to spend time with people they agree with).
2. That there is already a contact tracing model, that finds individuals to get them to self-isolate.

There is some evidence that this effect is already being seen in other jurisdictions with low coverage (Swiss reporting on outcomes). ** In order to understand how coverage affects contact tracing, we need to consider both of the benefits. The first benefit is described as the impact of finding those who otherwise weren't found. If we begin with an assumption that a case investigation can find 80% of people (the target), there are 20% of people who will be need to be found using other means.

There are probably two key reasons as to why contacts aren't found:

1. They didn't know they were at risk;
2. They don't want to be found.

If we discount the second group (estimated at 5% based on Colmar Brunton work), the first best option is to alert people that they might be at risk using digital tools if they didn't already know (we already publicise places of high risk and the need to get tested when showing symptoms).
If coverage at 40% or 60% is assumed with digital technologies (with 5% non-participation), as shown in the graph below, we would add 83 or 186 people using the Auckland example, an incremental improvement to 82.4% and 85.4%. Importantly, this model doesn't consider this 20% as being different to the 80% or whether these people could be found using other methods under investigation by the Ministry.



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** https://github.com/digitalepidemiologylab/swisscovid_efficacy/blob/master/SwissCovid_efficacy_MS.pdf
https://www.technologyreview.com/2020/06/05/1002775/covid-apps-effective-at-less-than-60-percent-download/
https://www.technologyreview.com/2020/09/02/1007947/coronavirus-contact-tracing-apps-save-lives-low-15-percent-adoption-rates/

Understanding time to notification of close contacts

The second impact of digital contact tracing would be on the speed to notify those of interest to the case investigation. Currently, this involves a largely sequential process where each close contact is called, and then asked to take specific actions based on their risk of exposure.

As described in previous pages, the time from exposure to starting contact tracing means that a number of transmissions has already occurred, and the intent of the contact tracing process is to catch up to the virus and ring-fence those affected.

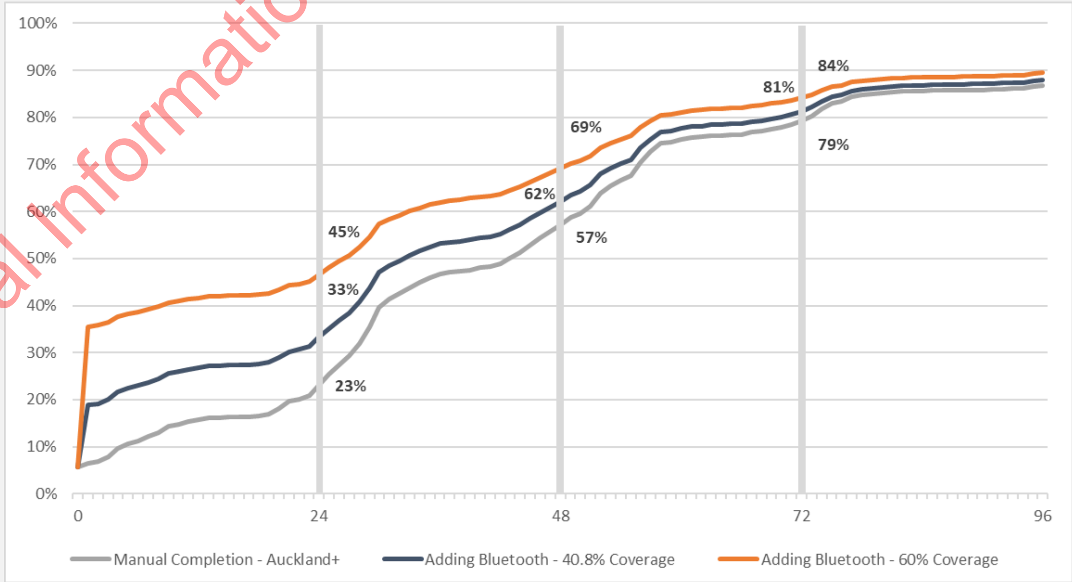
Reducing the time taken to notify close contacts is an opportunity to improve the contact tracing process, due to the need to stop continued infection of people in the community in an outbreak.

As described on the previous page, this is very sensitive to coverage and this can be seen in the profile change to the close contact call timelines seen in the Auckland outbreak.

From the original profile, we have identified two scenarios, consistent with the notification model identified further in the document, with coverage at 41% and with coverage at 60%.

This increases performance in the first 24 hours significantly by approximately 10%. This is reduced to a 5% benefit after 24 hours and a 2% benefit at 72 hours.

Number of Close Contacts Reached by Hour



Note The performance against the indicator measuring time from case notification to contact isolation/quarantine (target 80% within 48 hours) can be impacted by a number of factors, including the number of close contacts and timeliness of their identification, and total case numbers across the reporting period. For example, performance during the Auckland outbreak was affected by a number of large exposure events which were identified several days after the exposure occurred. This can happen for several reasons, including a case recalling further details following the original case interview, delays in obtaining a list of attendees for events, or the time it takes for an employer to prepare a list of close contacts. As a result, a number of close contacts were not able to be contacted within the target timeframes, although they were successfully contacted.

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Understanding notification volumes - conceptual

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Singapore

- 1100 contacts in 21 days in Singapore on average
- At the time population coverage was at 25%
- Current Population density is 8358 km^2

NZ Model for Notifications

- Our density is significantly lower and much more variable between places
- Our current uptake is much higher (44%)
- There is further behavioural consideration in terms of likelihood of movement etc.
- There is little variability in settings by different countries with ENF.

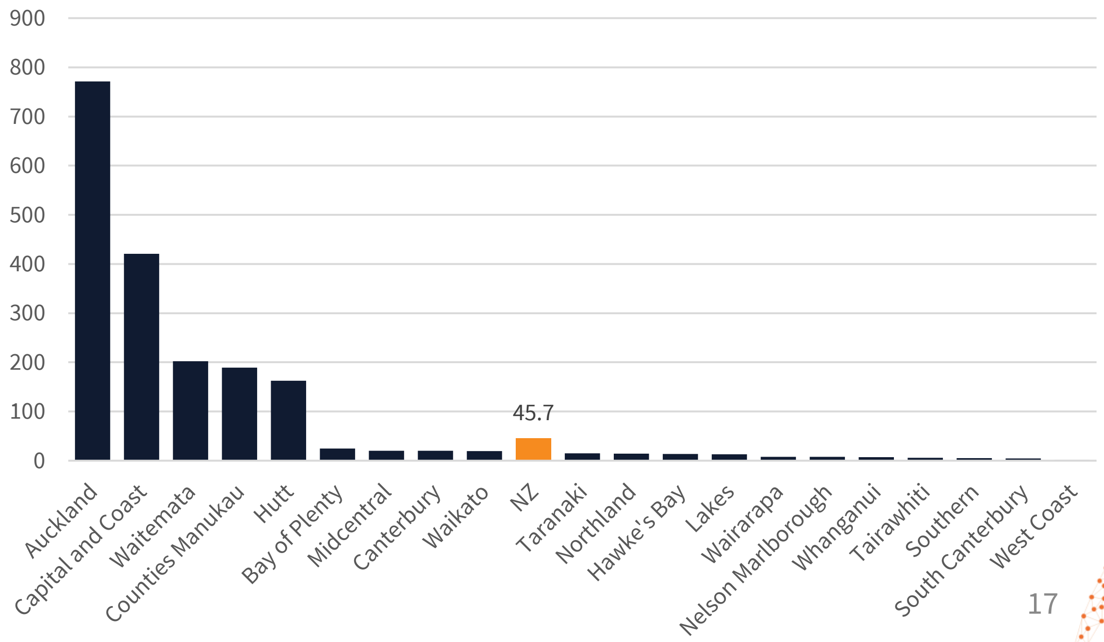
Actions

- Understand the impact on the variables on controlling the numbers notified
- Understand some more about the average number of contacts and variability from Singapore
- Utilise data from our open trial

ENF – signal thresholds by country

Country	Immediate	Near	Medium
German	55	63	70
Swiss	55	63	
Ireland	56	62	70

Population Density NZ - 2018



Understanding digital data types/elements

This shows the different types of data that is available in different models (centralised and decentralised) for Digital Contact Tracing and includes location data (GLN bound) and proximity data from Bluetooth.

Data Item	Description	Centralised Wearable model	ENF (v1.6)	ENF Wearable (v1.6)
Daily/Proximity Keys	Represents the case on the given period and this is what is used to derive what it shared with other people	Get the keys of contacts	Get the keys from the case	Get the keys from the case
Daily Key Weighting	Allows infectious period to be weighted higher	Calculated from symptom onset	Calculated from symptom onset	Calculated from symptom onset
Length of Contact	Measuring how long the case and contact were together	We collect this from Case – is a summary	Blind – held by contact	Blind – held by contact
Proximity Estimate	Signal strength between case and contact	We collect this from Case – is a summary	Blind – held by contact (average and minimum)	Blind – held by contact (average and minimum)
Proximity Weighing	Categorisation of proximity based on signal thresholds	Set by us	Set by us	Set by us
Calibration Confidence	Used to account for differences in antenna and source signal strength between different device types	Not required (all devices are the same)	Provided by Google/Apple based on the phone	Provided by Google/Apple based on the wearable
Continuity of Contacts*	A sampling and smoothing method to increase confidence in measuring actual distance	Would be post-hoc	Could be provided on the phone	Could be provided on the linked phone
Location of Interest	A GLN that represents the location, is embedded in a QR code at present	N/A	N/A	N/A
Time Period of Interest	The time a person was at a location	N/A	Could be linked to Bluetooth risk score	Could be linked to Bluetooth risk score

* Source: https://www.turing.ac.uk/blog/updates-algorithm-underlying-nhs-covid-19-app

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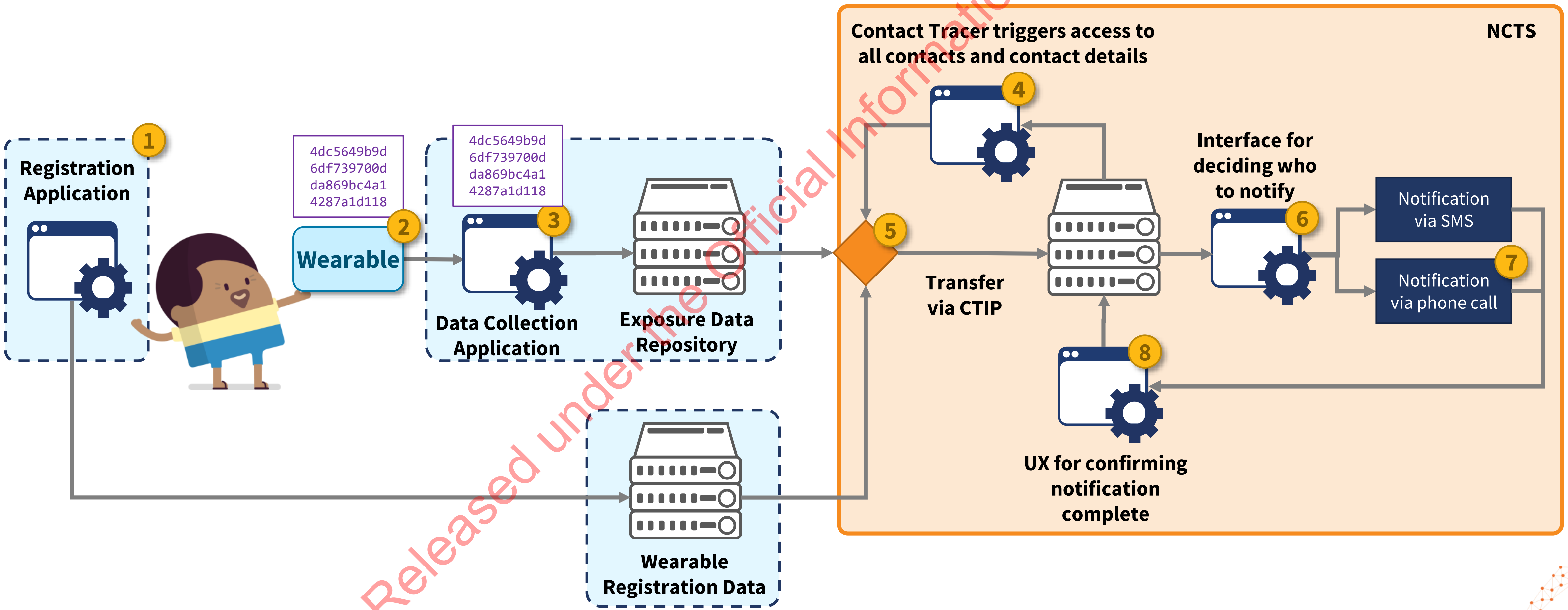
A simplified application architecture – Centralised

This shows how the application components come together in a centralised digital contact tracing model.



Owner and development would need to be identified if this model proceeds to production

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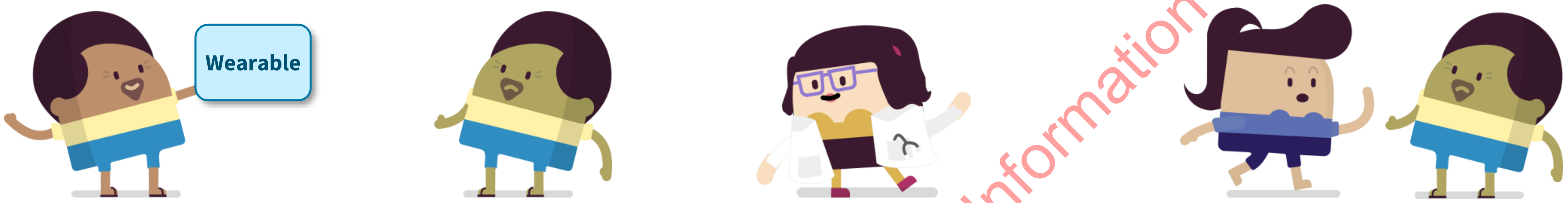
A community user story - Centralised

This describes the story for a user with a centralised system and how this works in real life. The story is similar to the Centralised Model with the differences between the models identified in the story.



Jack and his Whanau
Jack has organised a set of wearables for his whanau. They don't all have phones (particularly some of the tamariki and his nana). His whanau take them when the kids go to the Kura Kaupapa and when they go to the shops or to the marae. Jack scans the QR codes because he knows he has to remember where he been, not just who he has been near.

Jack doesn't feel well
Jack gets tested for COVID and uploads his data from his app and his wearable just in case he tests positive.

Jack has COVID-19
Jack gets a call from his doctor that confirms his test has come back positive. His doctor tells him that the Contact Tracers will be ringing him soon.

The Contact Tracer rings Jack
It is great that Jack has been scanning where he has been and has wearables for his whanau.

He tells the Contact Tracer Jill that his wife had been away for a work trip when he was most infectious, and she is able to stay away from home because she is pregnant.

The data from his wearable has been matched to all the people his wearable has seen and they can see his close contacts (his whanau) match those from his recollection.

The Contact Tracer finishes their investigation
Jill helps Jack remember seeing a number of extended whanau members who have a different wearable that didn't show up in his records. They also identified a number of people from work who use their phones rather than a wearable.

Jill notices in the data from his wearable that his wife's wearable was in close contact with him when she was on her work trip. The Contact Tracer suggests that maybe she forgot it when she went away, but Jack is sure she didn't.

Jack remembers that after telling his wife to remember her one he forgot his one day she was away. He wants to know what she was doing home that day. He gets angry at his wife because there shouldn't have been a reason for her to be home and not have told him, and she is reluctant to tell him why she was there.

It turns out she was there talking to a party planner. Jack is 40 next week and they were planning a big surprise for him.

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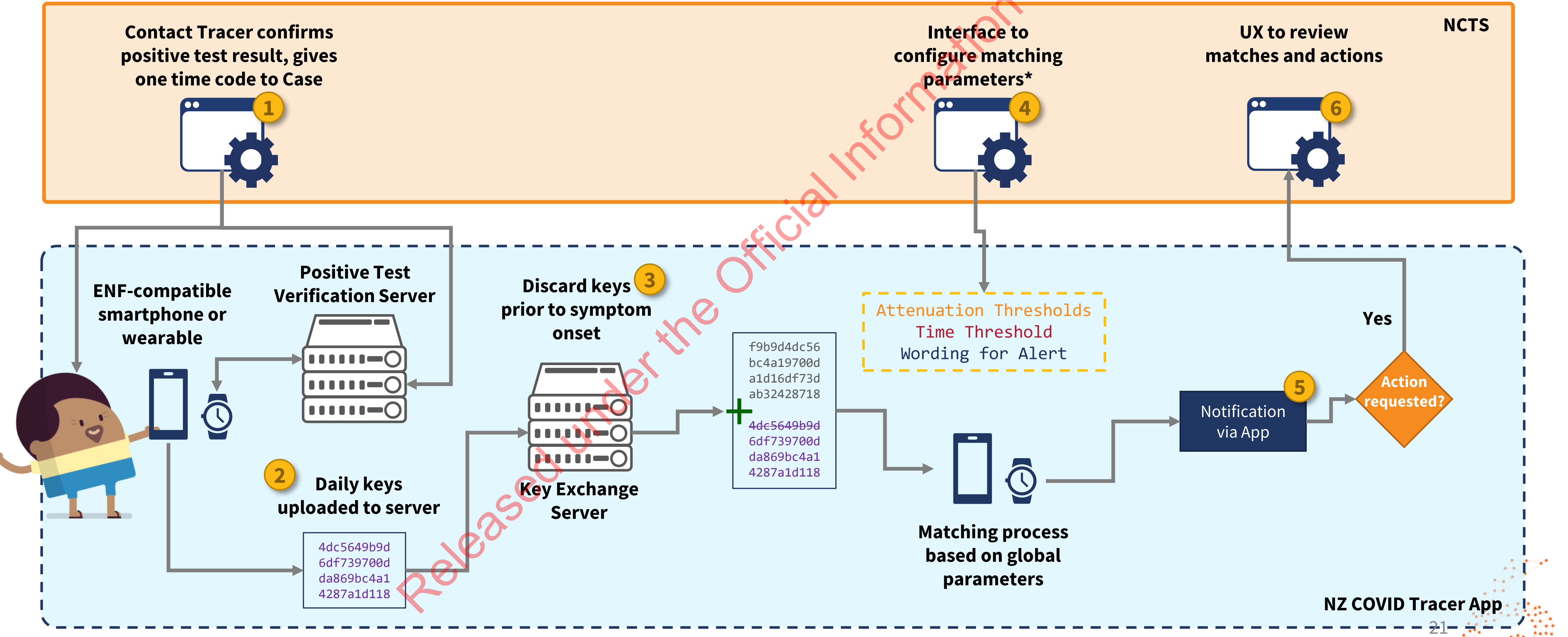
A simplified application architecture – Decentralised

This shows how the application components come together in a decentralised digital contact tracing model.



* Could happen before this as it is a global setting

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A community user story - Decentralised

This describes the story for a user with a decentralised system and how this works in real life. The story is similar to the Centralised Model with the differences between the models identified in the story.

Jack and his Whanau
Jack has organised a set of wearables for his whanau. They don't all have phones (particularly some of the tamariki and his nana), he registers them on his phone.
His whanau take them when the kids go to the Kura Kaupapa and when they go to the shops or to the marae. Jack scans the QR codes because he knows he has to remember where he been, not just who he has been near.

Jack doesn't feel well
Jack gets tested for COVID.

Jack has COVID-19
Jack gets a call from his doctor that confirms his test has come back positive. His doctor tells him that the Contact Tracers will be ringing him soon.

The Contact Tracer rings Jack
It is great that Jack has been scanning where he has been and has wearables for his whanau.

He tells the Contact Tracer Jill that his wife had been away for a work trip when he was most infectious.

Jill decides that Jack has been near a number of people recently and, can't remember all of them, and she isn't sure how many there are. She collects the handshakes from his phone and broadcasts them out to all the compatible wearables.

The Contact Tracer finishes their investigation
Jill helps Jack remember seeing a number of extended whanau members, these people get a notification on their phones. The notification also identifies a number of people from work who use their phones rather than a wearable. They are asked to call the Contact Tracing team.

Jacks wife gets a notification on her phone because she was home organising Jacks 40th birthday party. She was supposed to be away for work but was meeting a birthday planner at home. She remembers see his wearable next to the bed while she was home and realises that while he wasn't there she would have been pinged.

She doesn't tell Jack or the contact tracer as she doesn't think there was any risk (he wasn't there when she was).

The surprise birthday is great for Jack who is just starting to feel better after his illness.

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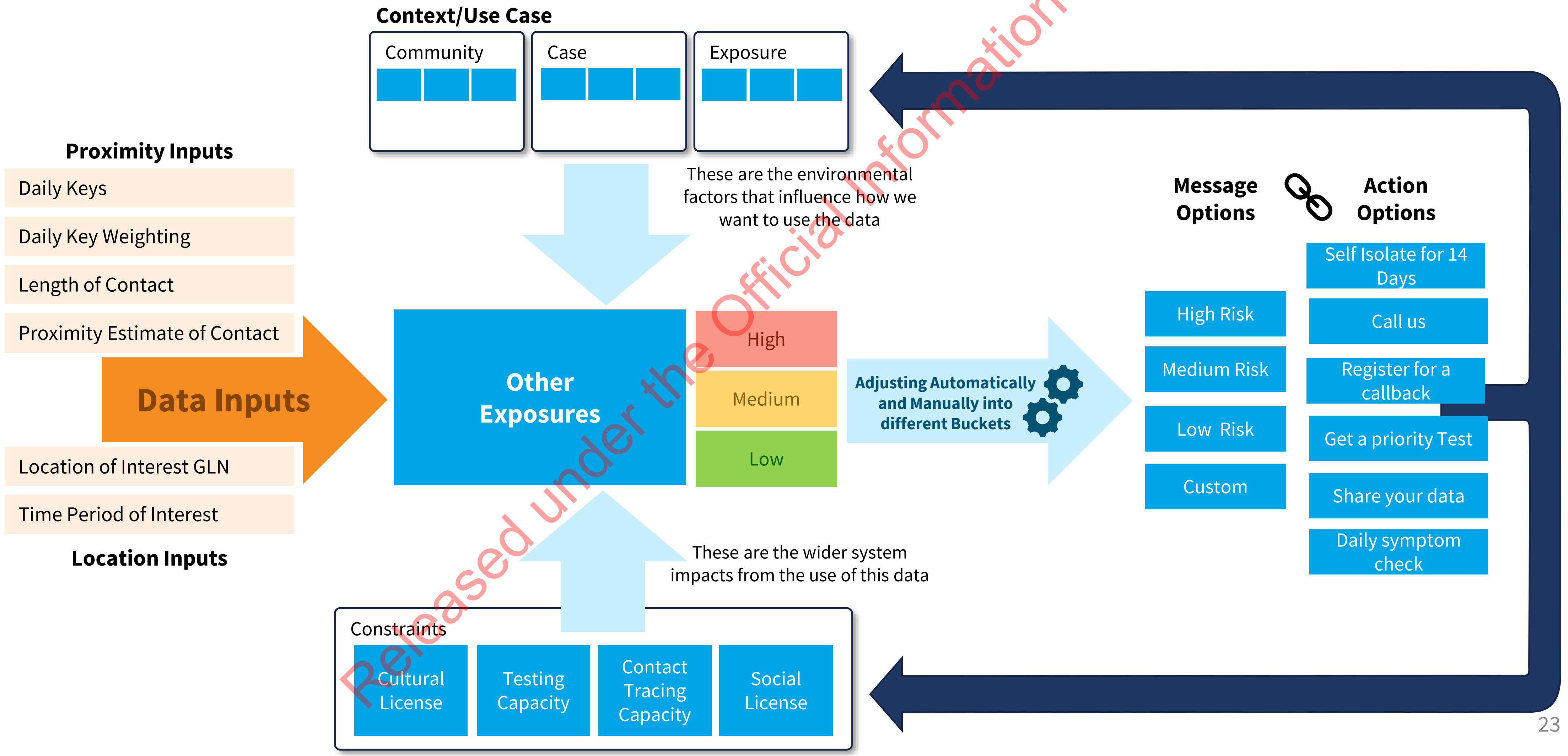
Digital Contact Tracing Framework v1.3

This shows conceptually how the data flows and is used within a digital contact tracing model. Key parts include the context, the risk model, the message and call to action, and the system constraints. Data Inputs are shown on the following page.



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Model for understanding digital contact tracing data

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Context

We have developed a model that begins to consider the numbers of people likely to be notified with digital data from Bluetooth. This is a point estimate model, with no accounting for statistical variance. A model that incorporates this will provide more understanding of the likely effect, and will only be possible as we gather data from our trial in Rotorua and through the use of the system.

A model for using digital data for notification therefore needs to start with the performance of these solutions in other jurisdictions in a real-world situation. We have been able to access data from Singapore, Ireland and Switzerland. The quality of this data is reasonable, but there are some potential limitations.

There are a partially known set of confounders that influence the number of people notified with a system like this. We have identified a number of features that influence this, but given the unknown nature of some of these and their relationships it is difficult to be confident in the accuracy of our approach.

Fundamentally, other jurisdictions use signal strength and time to identify individuals to notify. These are not linear relationships and given the lack of data from decentralised systems (and a lack of access to data from centralised systems) our ability to reflect these relationships is likely to limit our understanding.

The model includes a simple sensitivity analysis where assumptions and base data to create a “high” scenario. This scenario helps understand the uncertainty in the model. This is used to provide assurance around the risks with using the notification system. It is expected that data from the trial in Rotorua would provided additional insights into the likely accuracy of the model.

Further detail about the model is included in the Appendix.

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Key Limitations/Assumptions

In designing the model there are some assumptions/limitations that exist that mean we should be cautious in our initial use of the system and look to validate our assumptions. These have been considered in the sensitivity analysis completed where possible.

	Limitation/Assumption	Effect	Mitigation
1	All the people notified were all of those eligible for notification (some people may have turned notifications off).	Under-estimate	In conversations with Ireland and from the Swiss analysis – they are reasonably confident that people who are using the system have also enabled notifications
2	Population density is variable between centres in New Zealand	Increased uncertainty	Ability to use urban population estimates provides an alternative model (currently using DHB)
3	Social interaction is represented by number of steps taken	Increased uncertainty	There is the possibility that there may be other social interaction models we could use – it is unclear how reliable these would be
4	That effective coverage is a simple quadratic equation	Under-estimate	We know that due to cluster effects a simple quadratic equation is likely to underestimate the number of users that interact. It isn't clear how large this effect is.
5	Point estimates don't evaluate uncertainty and the associated statistical variance inherent in a model such as this	Increased uncertainty	Data from using our system is the best mechanism to understand this. There are sensitivity analyses that can be used to understand the risk of uncertainty in this in the immedicate term
6	Differences in the settings used by different countries	Increased uncertainty	Given the different signal thresholds used and the different time thresholds standardising to this model has been simplified.
7	Coverage - we are not clear the coverage of the systems is entirely accurate.	Over-estimate	There is a difference between downloads and active users – and it is difficult to know the number compliant phones. This means using "downloads" and assuming all phones are compliant will result in an over-estimate of interactions.
8	There may be increased contacts for different community groups - from the Auckland data – although these related more to the cluster than the case	Under-estimate	Considering differences in social interaction between communities is something that should be considered as this would affect volumes of notifications.

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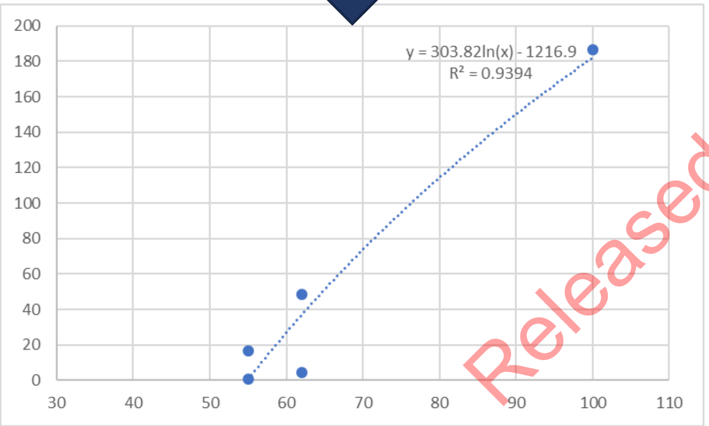
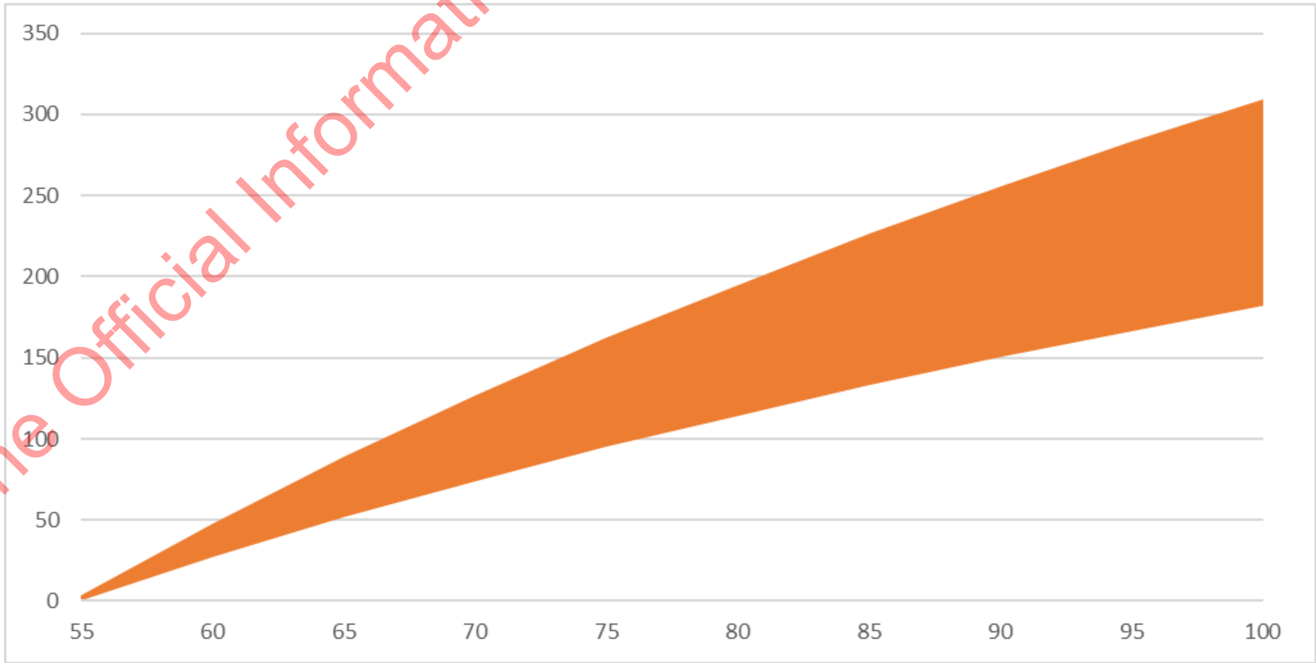
Creating a Model for Use (Auckland DHB Density)

This shows how the data from the international examples were used to create a model that fits the New environment. A sensitivity analysis increases the number of people identified in an Auckland context by approximately 70%.

Data Source	Threshold	NZ Numbers Identified
Swiss Immediate	55	0.92
Ireland Near	70	4.62
Singapore Total Contacts	100	186.38
Singapore Model Close (October) - 2m 30mins	55	16.86
Singapore Model Casual (October) – 5m 30mins	62	48.59



Numbers of Contacts Identified at different signal thresholds – High and Realistic Scenarios



Input Values and assumptions adjusted to create High Scenario

- Contact per Case – updated in Singapore to use upper range provided
- Social interaction model – adjusted down 50% of New Zealand estimate
- Singapore 30 minute timings – adjusted to account for likely decay model
- Coverage in New Zealand increased to 60%
- Population Density increased to reflect average urban density in NZ

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Applying the Model to the Auckland Outbreak

This shows how the model could have been applied to the Auckland outbreak. If all people were notified from all signal strengths, we would have notified between 30-54,000 users. When constraining this to similar weightings from other jurisdictions – eg. Swiss, Irish, Singapore, the volumes drop to between 3-8,000.

Key Point

Weighting and **thresholds** provide us the ability to constrain notification volumes

	Calculation	Immediate	Near	Medium	Other	Total
A) Weighting		100%	100%	100%	100%	
B) Signal Threshold		56	65	70	100	
C) Number	C=model(B)	6.1	45.3	22.5	108.4	182.2
D) Weighted Number	D=C*A	6.1	45.3	22.5	108.4	182.2

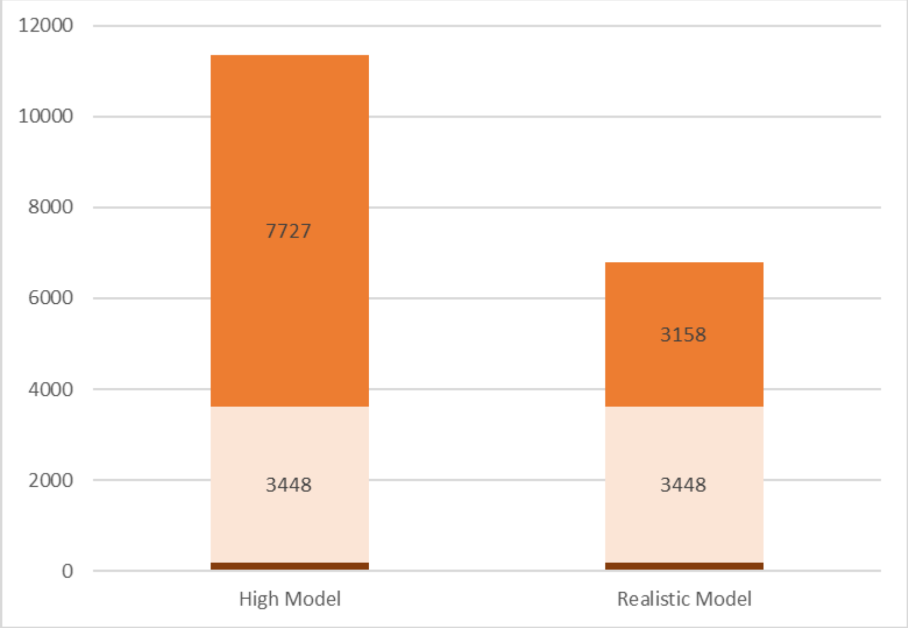
These are key variables that need to be considered

Number of People Notified – High and Realistic Scenarios

Adjust Weightings to:

Immediate: 100%
Near: 50%
Medium 0%
Other 0%

Number of People Notified – High and Realistic Scenarios



Additional found with Bluetooth Notification
Close Contacts in Auckland Outbreak
Cases in Auckland Outbreak

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Draft Business Processes (Contact Tracing)

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Approach to implementation

This shows the principles by which an operational service has been developed and will be delivered should it be approved. This also identifies key risks for consideration when implementing this service.

Principles

1. **Active Learning Approach**
   Need to make use of the feedback loop

2. Manual → More Automated

3. More conservative settings → More aggressive settings

Risks

- We underestimate the impact of our use of this data and damage trust or overwhelm the system
- We fail to use the system because the process for using it is too onerous
- A lack of cases mean that we don't get the system tuned quickly and effectively

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Operational Governance Process

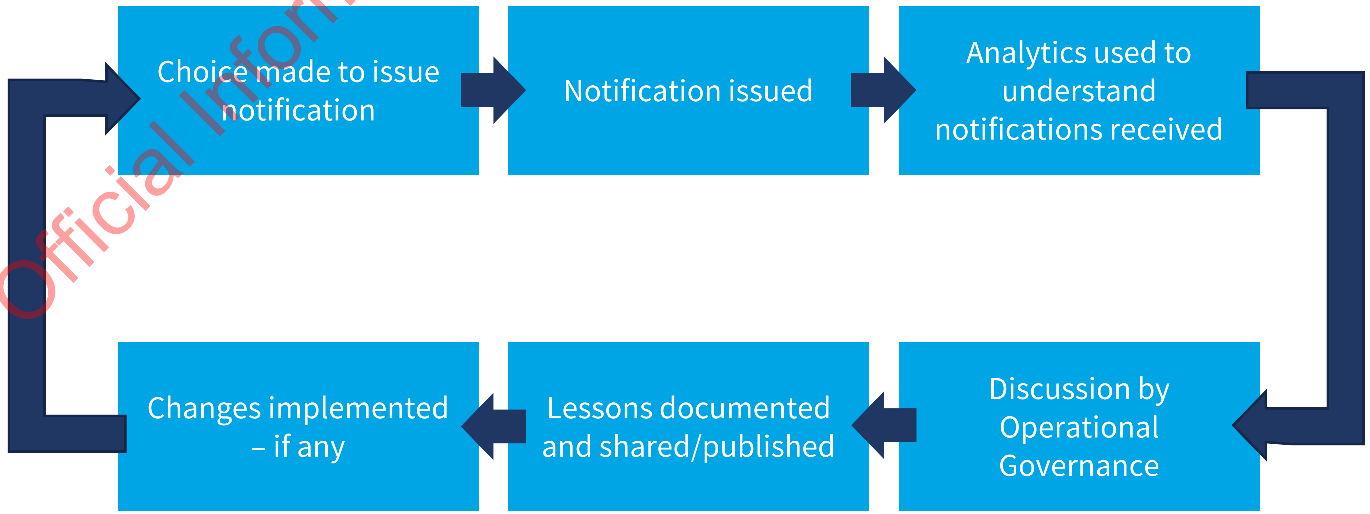
In order to make the most of the new data and the approach, there is a need to utilise the learnings from the process.

This shows how the process will work in order to use the notification process and learn from it. The Operational Governance group will meet once a notification is issued and the analytics are available.

This conversation will include considering all the different components of the Digital Contact Tracing Framework. Key components include:

1. Context the notifications were issued in including:
   1. Features of the outbreak
   2. Features of the case
   3. Features of the exposure event of interest
2. The settings in use with the system at the time (including text of notification and Next Best Action Requested).
3. The number of people notified
4. The impact of the notification on our key constraints if known.

Timeliness is important, however impacts on our constraints may either compound over time (and not be immediately observable) or may occur in PHUs rather than centrally.



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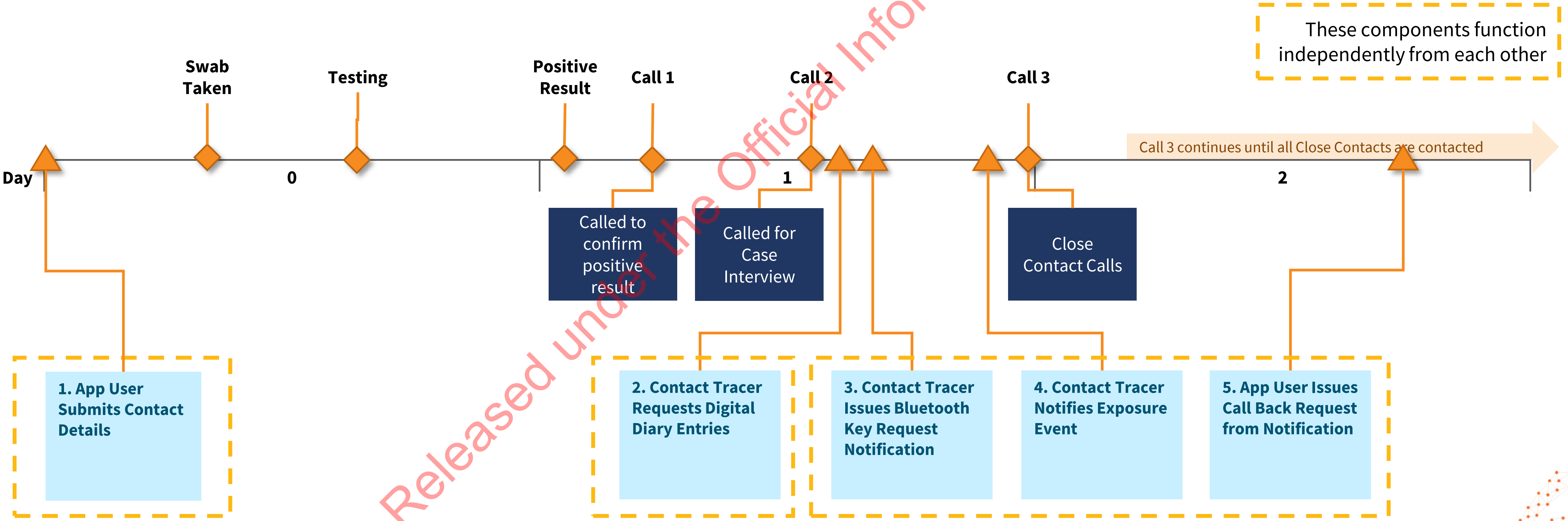
How digital processes fit with Contact Tracing

This shows how the processes for integrating with NCTS and the Contact Tracing process connect. These begin with Step 1 - App user submitting contact details. This can happen at any time before the contact tracing process starts, and isn't bound to a positive case occurring. Step 2 – a contact tracer requests digital diary entries – happens as a part of the case interview along with Step 3 – these aren't compulsory steps. This is then followed by an operational process (Step 4) to determine whether to make a notification, if agreed this is then completed. From here Step 5 – App users issue a call back request to contact tracers.



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1. App User Submits Contact Details

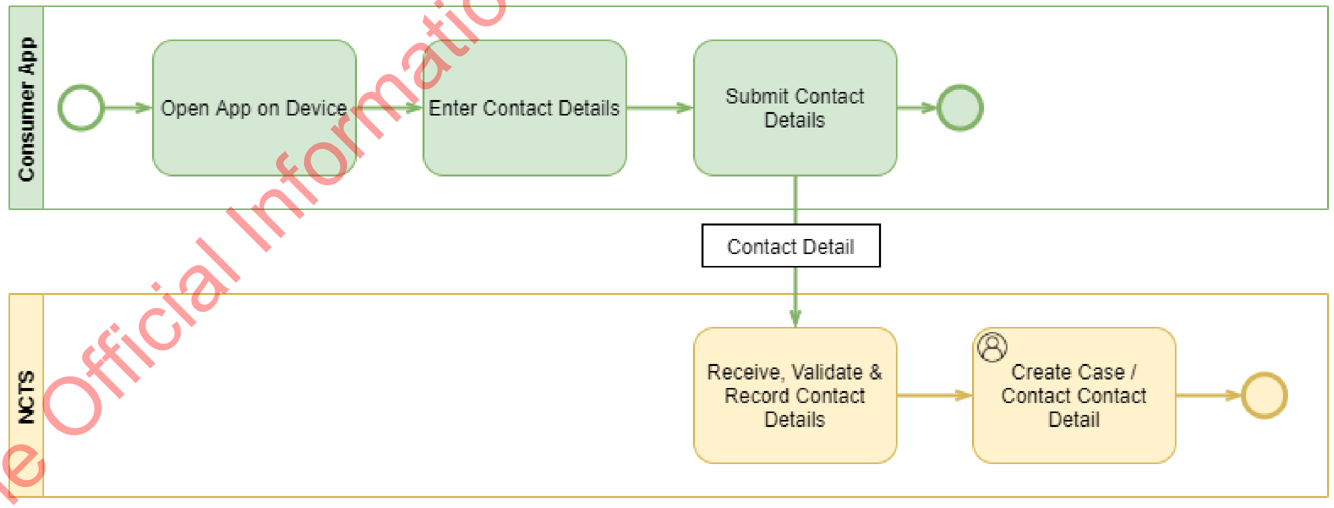
App Users are able to submit their contact details to the NCTS.

The submitted contact details are stored within the NCTS system boundary and are available to support contact tracing activities, including finding services.

The contact details can be queries by an NCTS user and where that can chose to create a contact detail record on the Person, Case or Contact objects within the NCTS.

App users can submit the following information:

- Name
- Date of Birth
- Gender
- Email
- Phone number
- Address



Preconditions	Post Conditions	Alternative Outcomes
1. App User has App Downloaded and wishes to submit updated contact details via the consumer App.	1. Contact Details submitted by the App user are recorded in the NCTS and available to support contact tracing activities. 2. The source of the contact details is recorded on the Contact Details record in the NCTS.	1. Submitted data is invalid and cannot be recorded in the NCTS 2. Submitted data is a duplicate of previously submitted data

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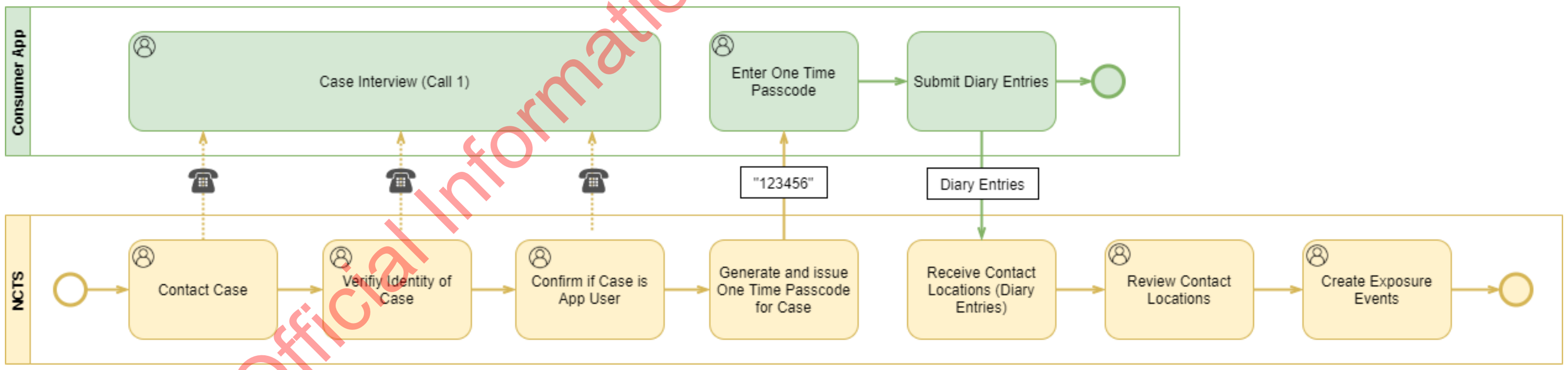
2. Contact Tracer Requests Digital Diary Entries

During the Case interview contact tracers, and where the Case is identified as an App user the case investigator can provide a One Time Pass Code to the Case to enter into their App that will allow their Digital Diary Entries to be submitted to the NCTS.

Once submitted the Diary entries are recorded as Contact Locations within the NCTS. These Contact Locations can be further investigated and Exposure Events relating to those Contact Locations can be created by the Case Investigator.



Preconditions	Post Conditions	Alternative Outcomes
1. COVID-19 case created in the NCTS	1. Digital Diary for the App is available in the NCTS as Contact Locations to support the contact tracing process. 2. Case investigator is able to create Exposure Events for the Case directly from the Contact Location information.	1. Case is not an App user 2. Case has not maintained a digital diary

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3. Contact Tracer Issues Bluetooth Key Request Notification

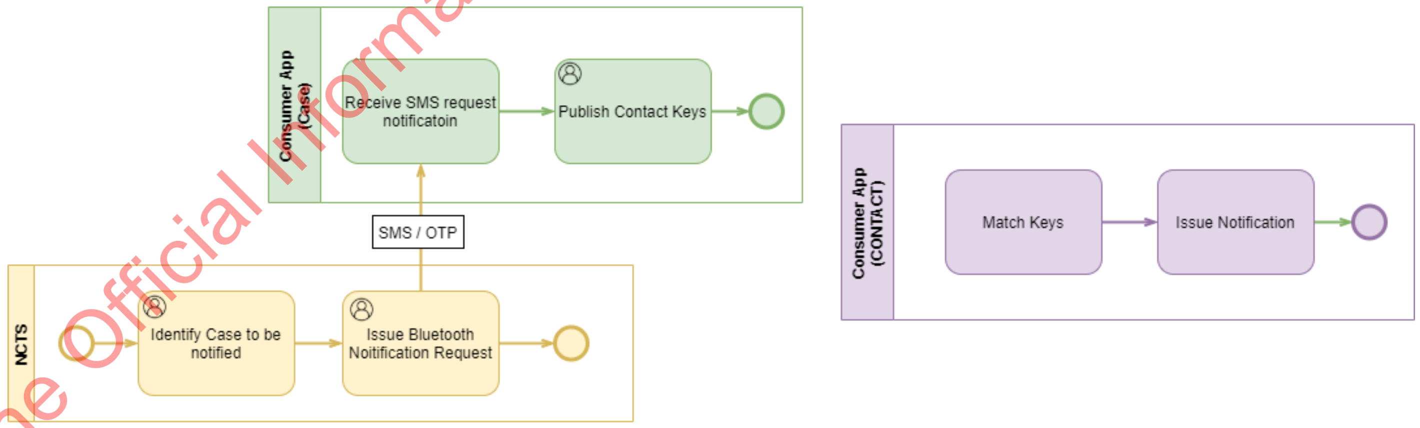
At any point through the contact tracing process and investigator may identify the need, based on risk, to issue a Bluetooth notification for a case.

The Investigator will define the parameters necessary to inform the notification, including proximity thresholds which can be used to provide different notifications based on the risk level estimate of the contact.

The notification request will be sent to the App User (Case) via and SMS message.

The Consumer App user (Case) will receive the notification and submit their contact keys for matching.

Consumer App users (Contacts) device will poll the central repository of published keys. Where a match is identified they will be notified with a message. Messages can vary depending on the risk of their contact based on proximity signal thresholds.



Preconditions	Post Conditions	Alternative Outcomes
1. COVID-19 case exists in the NCTS 2. Contact details for the case have been verified (through investigative interview) 3. Case confirmed as App user with Bluetooth enabled (through the investigative interview)	1. Bluetooth notification issued from NCTS. 2. SMS Notification issued to App user 3. App User confirms / accepts the requests and published their contact keys form their device. 4. App users that are identified as contacts through the matching process will be notified.	1. Case is not a App User / as deleted the app / has Bluetooth disabled in the App. 2. User does not confirm / accept the request and does not publish their keys.

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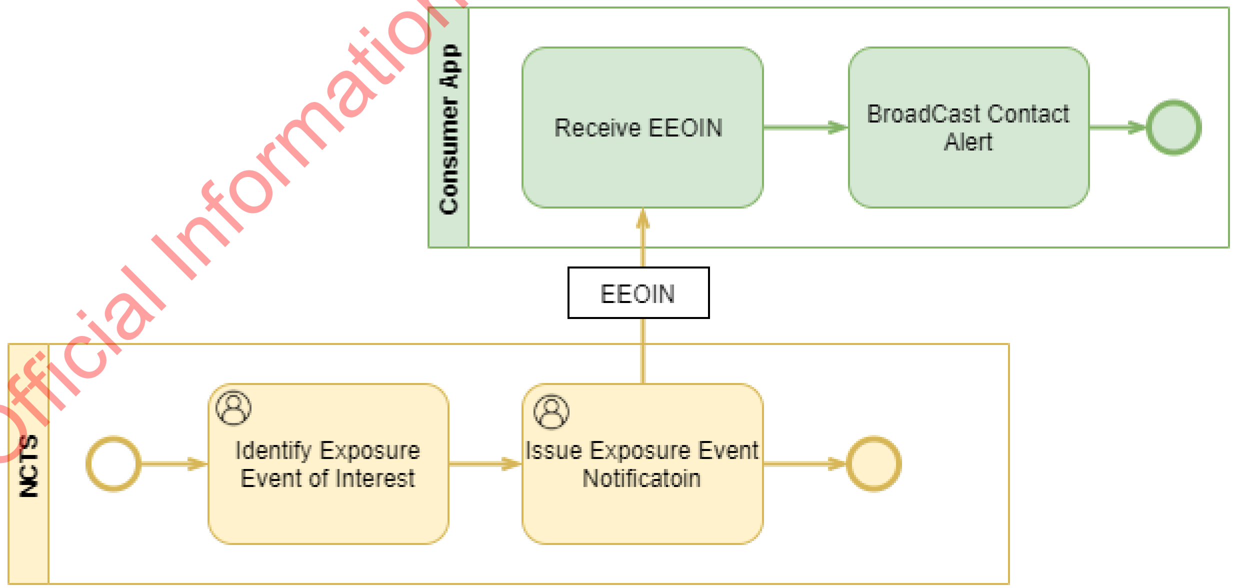
4. Contact Tracer Notifies Exposure Event

During or after the initial case investigation a decision may be made to issue notifications for one or many Exposure Events. Exposure Events of Interest (EEOI) are identified by the investigator in the NCTS and a parameters set for the Exposure Event of Interest Notification (EEOIN).

Once submitted to the Consumer App, the app will receive the EEOIN and create a Contact Alert which will be broadcast to the App instances running on peoples devices.

The App instance on peoples devices periodically polls for Contact Alerts, where one exists the App instance for a person will attempt to match the Contact Alert against the persons Digital Diary.

Where a match exists the person will receive a notification on their device with a message / interactions that is specific to that Exposure Event of Interest Notification.



Preconditions	Post Conditions	Alternative Outcomes
1. COVID-19 case exists in the NCTS 2. Exposure Event for case has been created in the NCTS for the case.	1. Consumer App receives EEOIN, including details of messaging to be provided to App user where match exists. 2. Contact Alert notification broadcast and available for matching by User App instances on their devices 3. App users with matching	None

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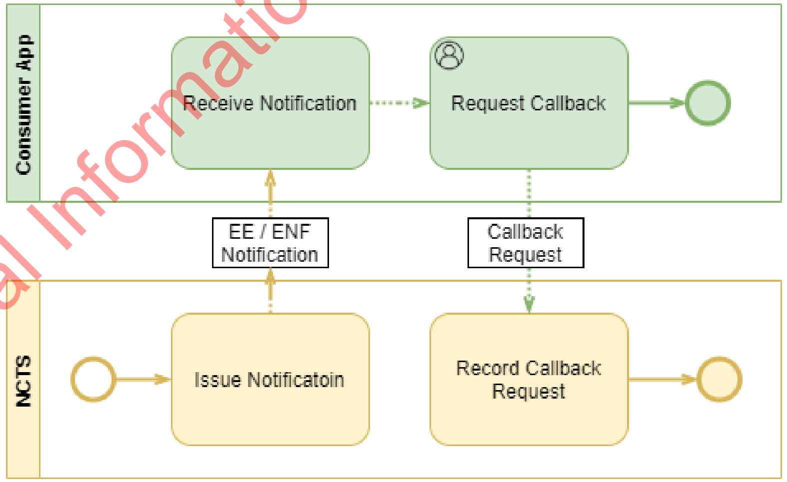
5. App User Issues Call Back Request from Notification

Following either a Exposure Event Notification or a Bluetooth notification a Consumer App will be able to

Users will only be able to issue a call back request where a notification from the app has been issued. The ability to issue a call back request will be time bound (say 96 hours after the notification was issued).



Preconditions	Post Conditions	Alternative Outcomes
1. A Exposure Event notification has been issued to an Consumer App user, or 2. A ENF(Bluetooth) notification has been issued to a consumer App user	1. A call back request has been recorded within the NCTS.	None

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Alignment to MoH Algorithm Use Guidance

The Ministry has developed a set of guidelines for health organisations to consider when implementing an algorithm. These cover the domains below and describes how the approach described conforms to this guidance.

Domain	How this has been considered
Governance	• Person driven control mechanism for use is in place with the process • There will be operational governance in place to assess the use of the system as part of the active learning approach. • The key to the governance model being effective is ensuring that there is a mix of skills and perspectives providing oversight of this.
Operationalising	• There is a recognition that there is risk in using the system • Roll out of the system includes a review after every use to understand how the system is performing and whether it is performing in a manner that is expected (Active Learning) • The system is initially going to be manually activated and conservative settings are being used • There is wide global use of the Apple/Google ENF framework, and descriptions on how the technology works • Publish plain English description and diagrams about how it works • Limitations and uses for data are documented and understood • Data collection, transmission, and redistribution are documented and understood
Bias	• There are significant risks that the service includes bias as a result of access to the service, settings used, the notification message and call to action. These potential risks will be considered as a part of the Active Learning approach.
Assurance	• As a part of the Active Learning approach, we will be collecting data and have the ability to collect feedback on the use of the system. This should be used to ensure that the service is working as expected. • Solution architectures and system design limits data collection, and maintains privacy in line with Google/Apple restrictions • Apple/Google developer agreements limit app functionality where ENF is implemented, and review of apps before public release • Independent security audits of the solution prior to public releases • Adoption of the COVID Green Open Source project to implement ENF

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Source: https://www.health.govt.nz/system/files/documents/pages/introductory_guidance_-_algorithms_v0.4_-_web.pdf

Alignment to Algorithm Charter for Aotearoa NZ

The Government has developed an Algorithm Charter that the Ministry of Health has signed up to. This describes how an implementation of Bluetooth data would be considered against the commitments in the charter.

Commitments	Considerations and actions towards commitment
Transparency	• There is wide global use of the Apple/Google ENF framework, and descriptions on how the technology works. This allows a number of conclusions to be considered based on international implementations. These identify open source and privacy centric models to be of high importance. • There is a need to consider how to publish plain English description and diagrams about how this would work
Partnership	• There is a need for community engagement for Digital Contact Tracing technologies
People	• Engagements should include key groups that are likely to be impacted by this technology including: Māori, people with disabilitys, privacy advocates etc. • Colmar Brunton research into consumer digital contact tracing has provided some insight into potential concerns
Data	• A decentralised model with minimal additional analytics except that required should be implemented to prevent unintentional disclosure or scope creep. • Limitations and uses for data should be documented and understood • Data collection, transmission, and redistribution should be documented and understood
Privacy, Ethics, and Human Rights	• Independent security audits of the solution prior to public releases • Open source app code for public verification and transparency is a key way of managing trust in other jurisdictions • Engagements with OPC/GCPO about privacy implications including a Privacy Impact Assessment
Human Oversight	• Human control points for any data capture and use should be in place. Requires invitation to share data, and consent from end user • Active Learning from Operational Governance will assure the use of the service • Media team briefings on how algorithms work, and comms strategy are important to provide consumer understanding • Documentation on operational processes for end-to-end process

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What this would mean with an Exposure Notification Implementation

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What is the Exposure Notification framework

This is a Bluetooth protocol for broadcasting and receiving the encrypted identifiers of Bluetooth devices that represent the user. It was designed to preserve the privacy of members of a community sharing electronic identifier information with each other about their estimated proximity in the context of the COVID-19 pandemic.

The identifier begins as a 32 byte Tracing Key and from this a 16 byte Daily Tracing Key is derived. This is then time sliced (every ten minutes) and derived again into a Rolling Proximity Identifier (RPI). This RPI takes the form of a 16 byte integer that is broadcast for other devices in range to receive.

An example of an RPI (UTF-8 encoded):

1229832187623198

A users device checks for these RPIs and stores them along with the time stamp, and signal strength received at the time. This is stored on the device. A device then regularly checks and downloads a list of DTKs published by a Public Health authority, so a user can identify whether they have collected a RPI from a user that has tested positive and has had their DTKs published.

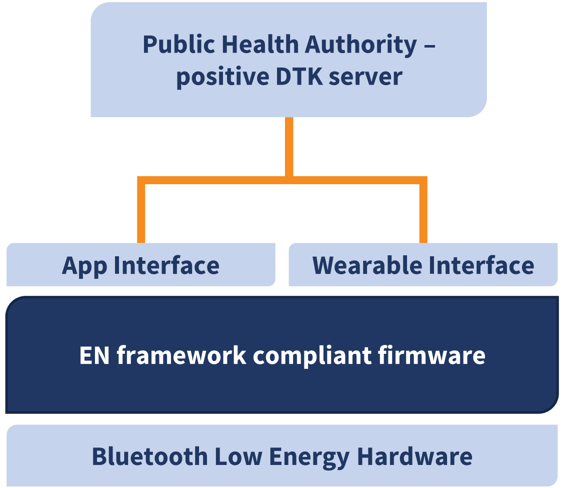
This publish/subscribe method is consistent with the model implemented for the NZ COVID Tracer location alerts.

The protocol is encrypted using SHA-256 – commonly used for encrypting internet protocols and applications. The protocol has been published by Apple and Google publicly for scrutiny by third parties (Source). The protocol is consistent with the European DP-3T consortium and is GDPR compliant. The protocol has been reviewed by the United Kingdom Information Commissioners Office (Source).

This protocol was developed by Google and Apple and has been implemented in iOS and Google smartphone operating systems to minimise potential for third-party abuse and energy consumption. The form this has taken initially is as APIs that can be used within an app developed by a Public Health Authority.

There are a few open source implementations of this protocol within a smart phone application including COVID Green (Source) and CoronaMelder (Source). Apple and Google have published a reference server architecture, for collecting DTKs from positive cases, and publishing them for users to check against (Source).

The protocol is being further developed by the Bluetooth Special Interest Group and given the open nature of the protocol, this could be re-implemented using other devices such as wearables (Source) and has already been implemented for enthusiast hardware such as the Raspberry Pi (Source).



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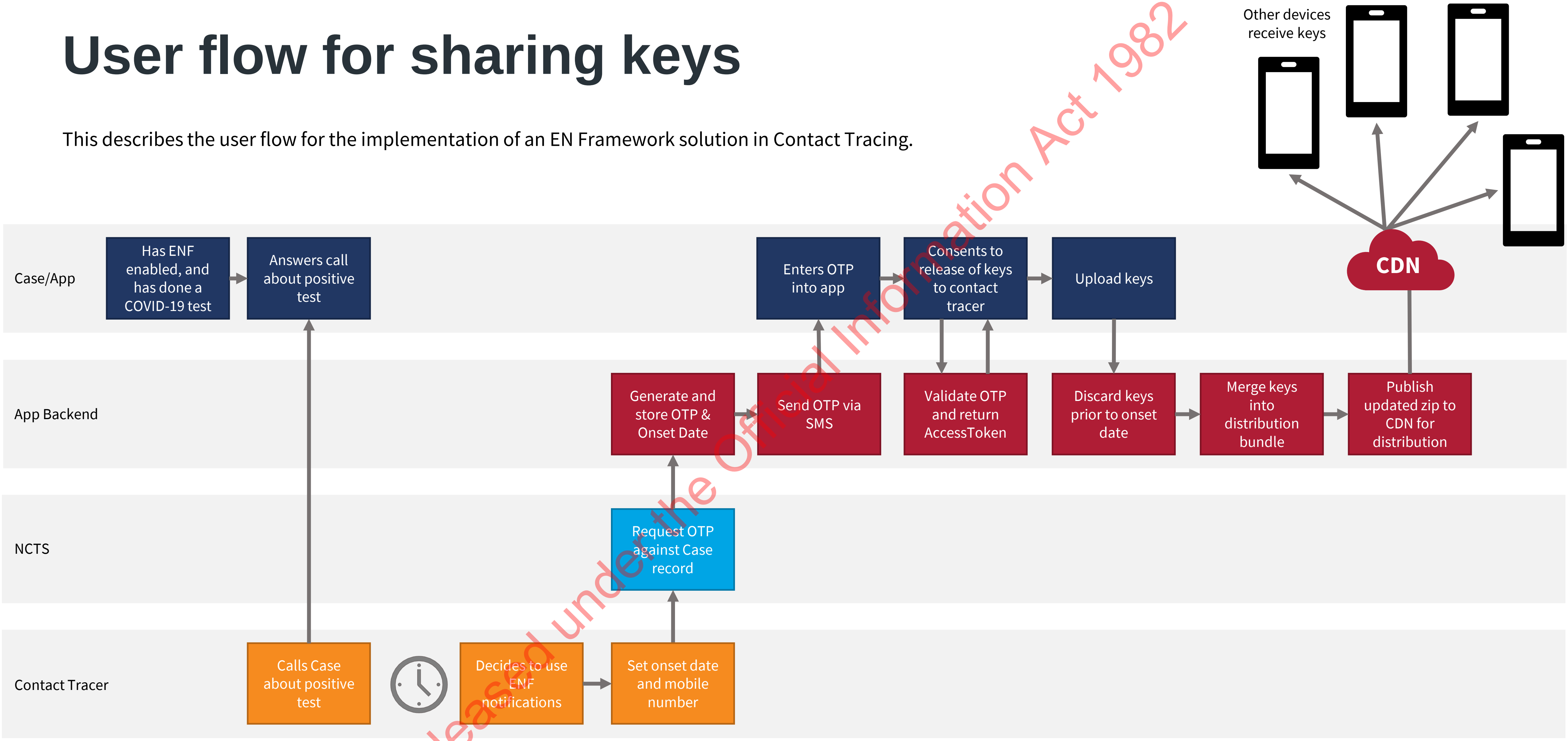
User flow for sharing keys

This describes the user flow for the implementation of an EN Framework solution in Contact Tracing.



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How the notification threshold is calculated with EN

This shows how the notification threshold is triggered with the decentralised EN Model. The minutes at each threshold are weighted and then added together. This total is then compared to the threshold. Generally this is 15 minutes internationally and this would be consistent with our case definition.

Recorded exposures to positive cases on a device over the last 14 days. Different signal strengths and length of exposure (in minutes)

Take all the different exposures and put them into buckets

How close were the phones? → For each match between phones (up to 30mins duration)

	Immediate		Near		Medium	
Count up all the minutes of exposure in each of those buckets	Summed Minutes at "Attenuation"	$> t^1 >$	Summed Minutes at "Attenuation"	$> t^2 >$	Summed Minutes at "Attenuation"	
Weight those buckets relative to how much we care about exposures at that attenuation. Higher attenuation = more risk	$a \times w^1$	+	$b \times w^2$	+	$c \times w^3$	= **"Minutes Exposed"**
Add those all together, and if the total minutes exceeds the threshold, show an alert to the user	**5 x 1**	+	**15 x 1**	+	**5 x 0**	**= 20** → Is this above our threshold?

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Configuration Parameters

This shows the parameters required to be set for an EN compatible service.

Parameter	Example	Purpose
durationAtAttenuationThresholds (t^1 ,t^2)	[56, 62]	Configures three different buckets (immediate, near, and medium) that all the individual exposures get sorted into. The two values are signal attenuations (in dB) where: • immediate > t^1 • t^1 > medium > t^2 • t^2 > near
thresholdWeightings (w^1, w^2, w^3)	[1, 1, 0]	A multiplier for each bucket to weight how important exposures in that bucket are to us in the calculation of whether to show an alert. By setting it to 0 it would mean that any exposures in that bucket are not counted in the final score
timeThreshold	15	After the calculation if the number of minutes exceeds this threshold, an alert is shown to the user.

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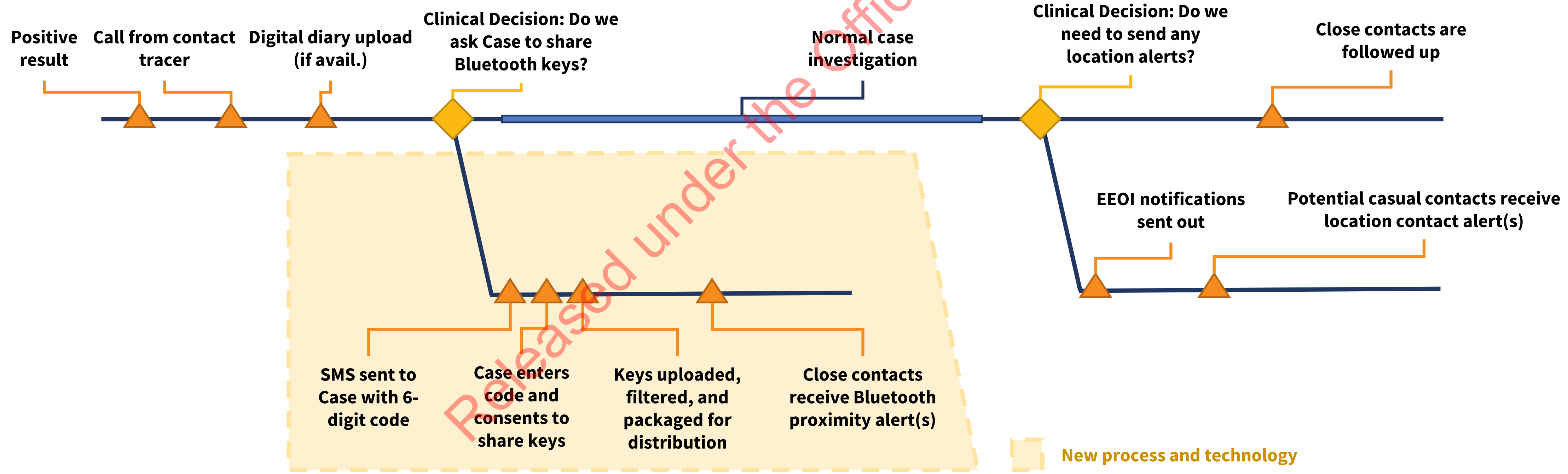
Proposed flow for using both diary and EN notifications

This shows how an EN service would be used from a systems and business process.

Key points:

- Digital diary is collected up front if its available to support a normal case investigation process
- Early in the case investigation a decision will be made about whether to request Bluetooth keys from the case. This decision will be informed by clinical guidance and the circumstances of the case.
- If yes, contact tracers can initiate the EN key sharing process via the NCTS. A 6-digit code is sent to the Case via SMS requesting they share their keys.
- These keys are distributed and any other devices that have been within range of the Case for long enough will receive an alert to self isolate and get in touch for advice and next steps.
- The existing process for sending a location-based contact alert at the end of the case investigation can still happen as is does currently.



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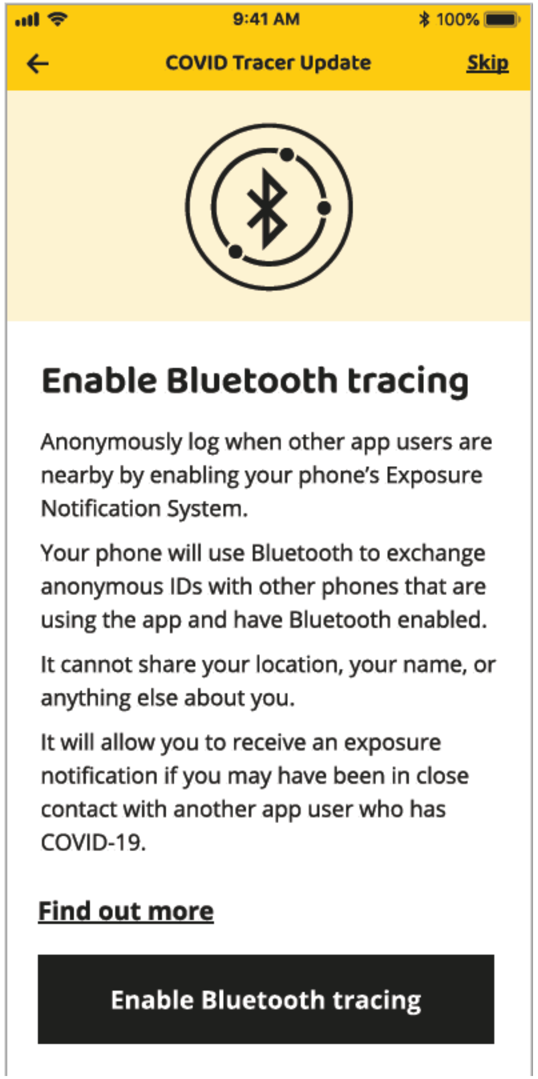
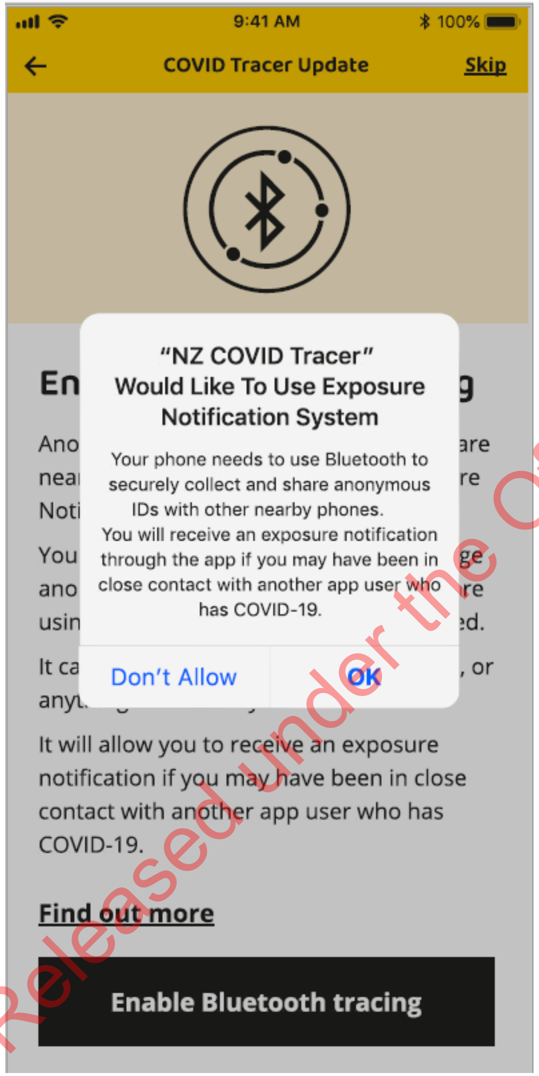
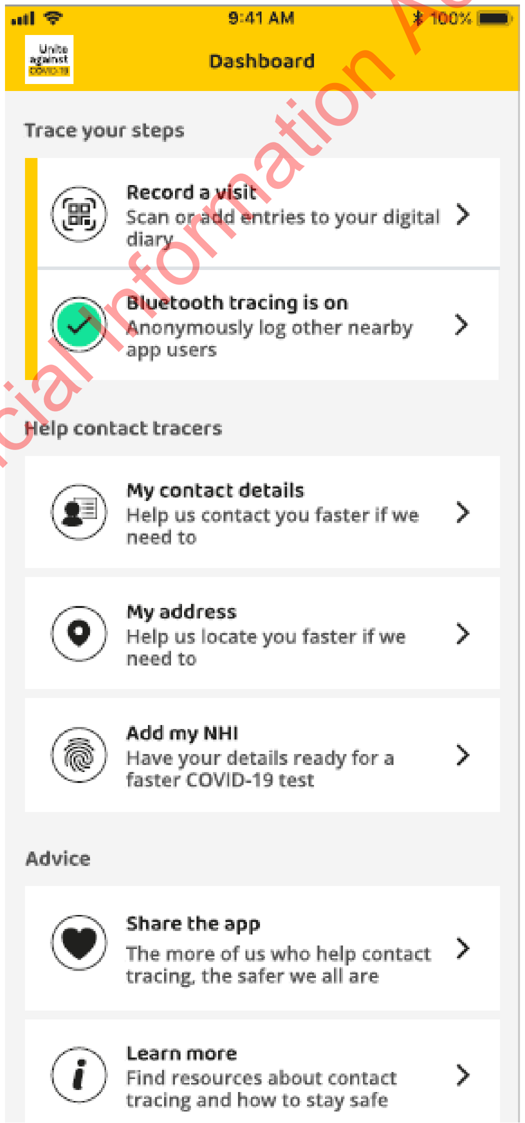
Onboarding screens for App users who have ENS compatible phones







When updated or installed, users with supported devices are asked to enable Bluetooth tracing.

The dashboard will indicate whether Bluetooth tracing is on.

It stays on unless the user switches it off or enables an ENS app from another country.

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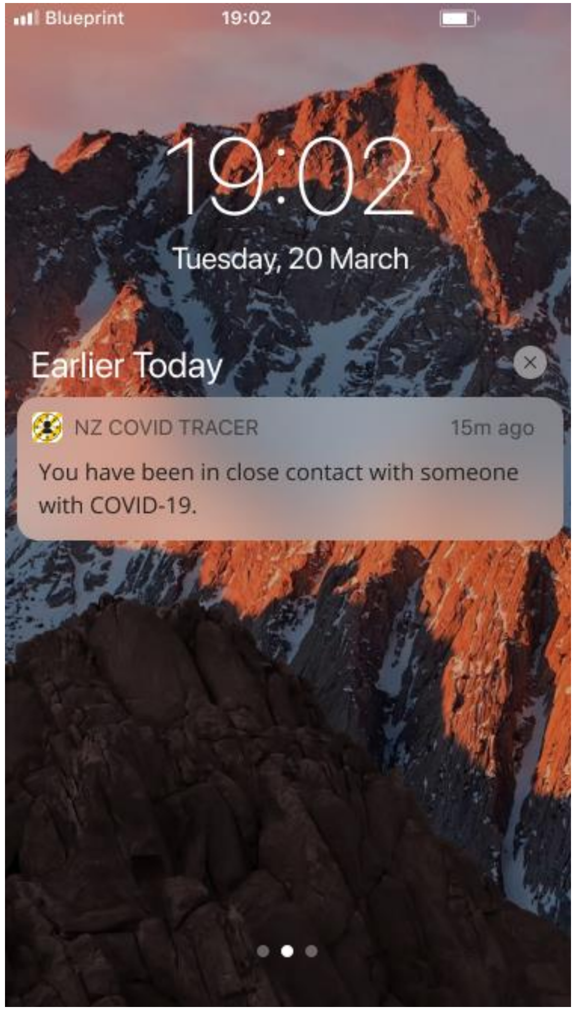
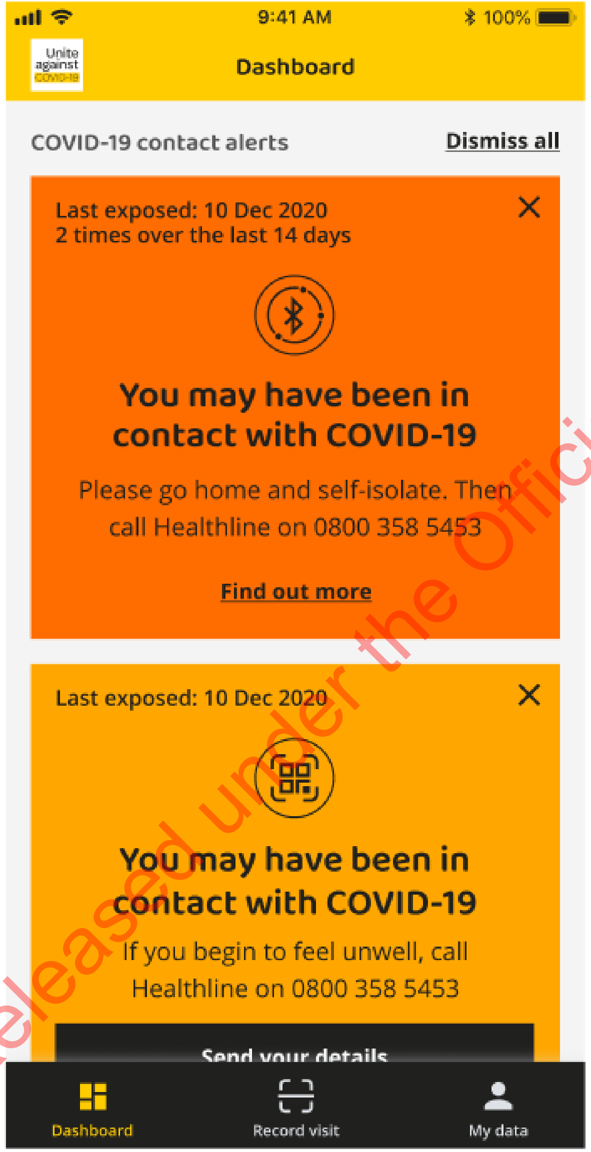
Example of what notifications could look like





The text of the alert can be configured for all alerts – but not for contact with specific people.

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Open questions for resolution

	Question	Answer
1	What does the messaging show for a user who receives both a location-based contact alert and an EN alert?	
2	How do we ensure consistency of message for people who receive an digital alert before/after being spoken to via the current manual process? It's likely that close contacts of Cases who upload their keys will be notified of this exposure, even though they may have already spoken to a contact tracer prior?	
3	How can we reduce the lead time for the notification decision, to maximise the benefit of early alerts being sent?	
4	What are the settings that we would use initially?	
5	What is the make up of the Active Learning Operational Governance Group?	
6	Does issuance of notifications rest with PHUs or the national team?	

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Context / Use Cases

These are externalities that would influence how you place contacts into risk categories based on the particulars relating to the case or society at the time that the process is being undertaken.

Key Context Considerations

Community

- How big is the outbreak?
- When in the outbreak are we?
- What is the community this is in?
- What is the tolerance of infection in the community?
- What is the population density?
- What is the freedom of movement?
- Targeting testing or self-isolation?
- Health literacy in the community
- Has coverage and/or participation changed?

Case

- How reliable is the case?
- How social is the case?
- Number of close contacts

Exposure

- What type of exposure event is it?
- How formal is the participation in the event?

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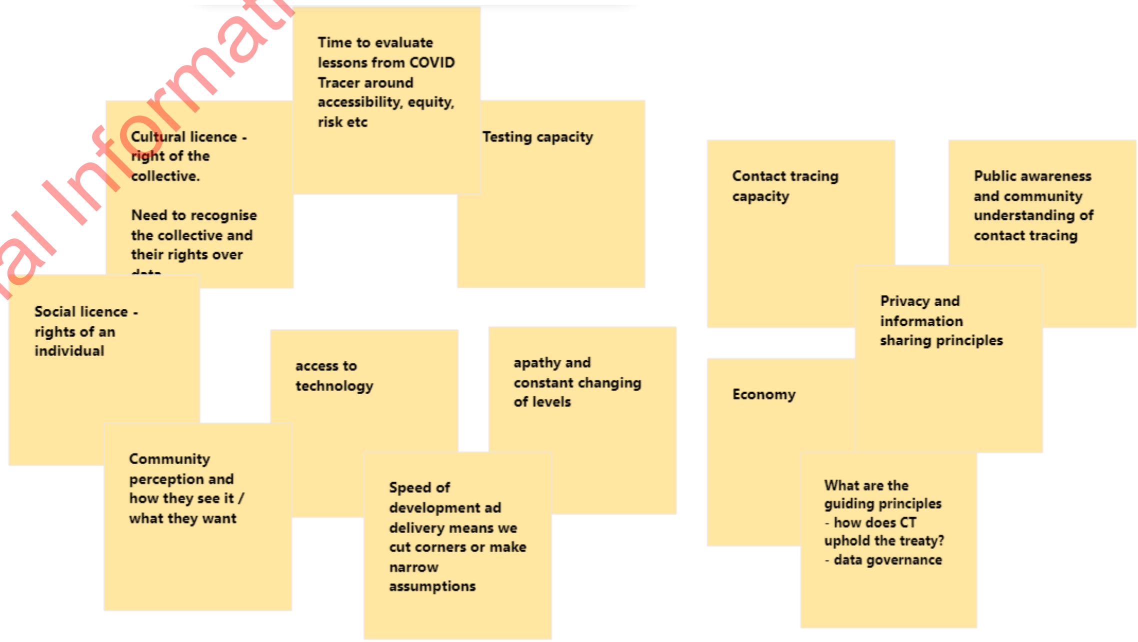
Constraints

We think that these are the constraints that both the health system, people and population would put on our ability to use this system.

Key Constraints for consideration

Economic Effects	Testing Capacity	Contact Tracing Capacity	Social License	Cultural Licence



We think that these are the contraints that both the health system, people and population would put on our ability to use this system.

Questions for discussion

- What other key constraints may there be (how would we measure them)?
- Under what conditions would you use the data?
- How much would these influence the weighting and the messages/actions?

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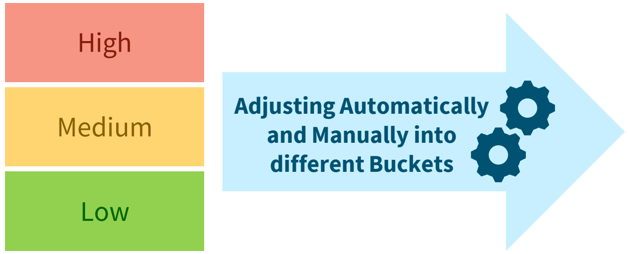
Process for confirming these buckets – Group A



This is the process of stratifying the contacts into different risk categories, this can be done based on manual or an automatic approach – and can also have both manual and automatic checks before proceeding

Questions for discussion

1. This needs to be considered alongside our location based alerts (do we do both, do they look the same)
2. How automated is the decision making – keys and other weighting variables
3. How much oversight/accountability is required of this (does the approach vary per case)?
4. What review process exists to learn from each time?
5. Should we assume we would move from a conservative to more liberal approach (is this the same as moving from a manual to more automated approach)?
6. We know that with ENF we can have a maximum of four buckets – is this too many (or not enough)?

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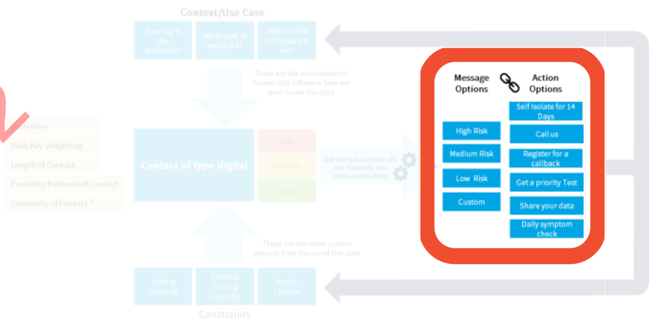
How are message and actions linked?



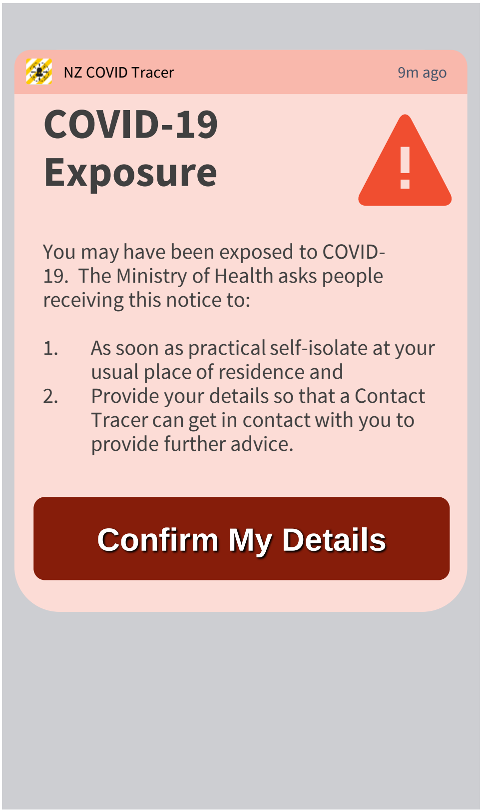
We have assumed that linking these important. The reason is that we think there are certain actions you don't want to be possible with certain message types.

Some Examples

Message Options	Action Options
	Self Isolate for 14 Days
High Risk	Call us
Medium Risk	Register for a callback
Low Risk	Get a priority Test
Custom	Share your data
	Daily symptom check

Questions for discussion

1. Can we use more conservative messaging to increase speed/automation in lower risk situations?
2. How many message categories or actions there are (and what are they)?
3. Should we have standard messages (with the ability to amend)?
4. What are the visual cues and options for high vs low risk – There is a behavioural insights component with this
5. Are some of these options only available with certain message types and risk levels (need to draw connections between the risks)?
6. This needs to be considered alongside our location based alerts (do we do both, do they look the same)



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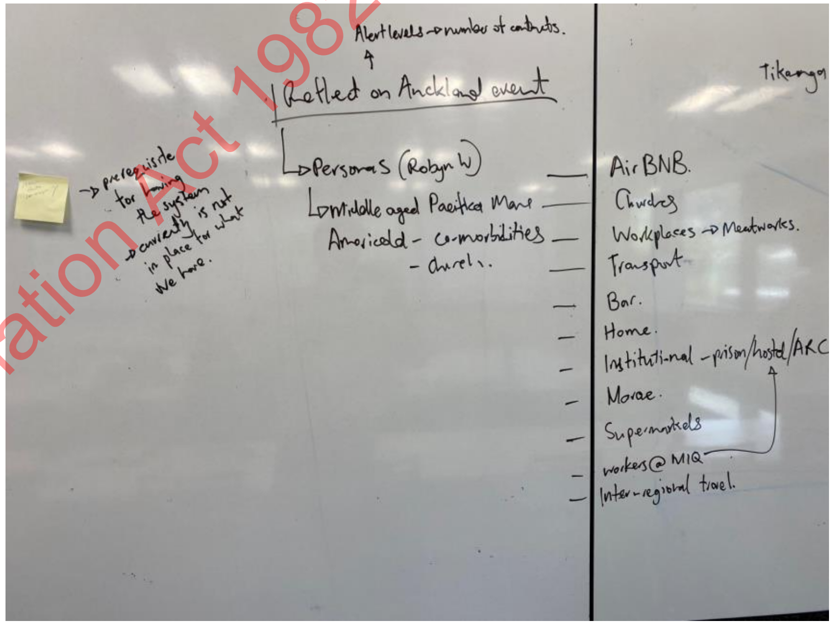
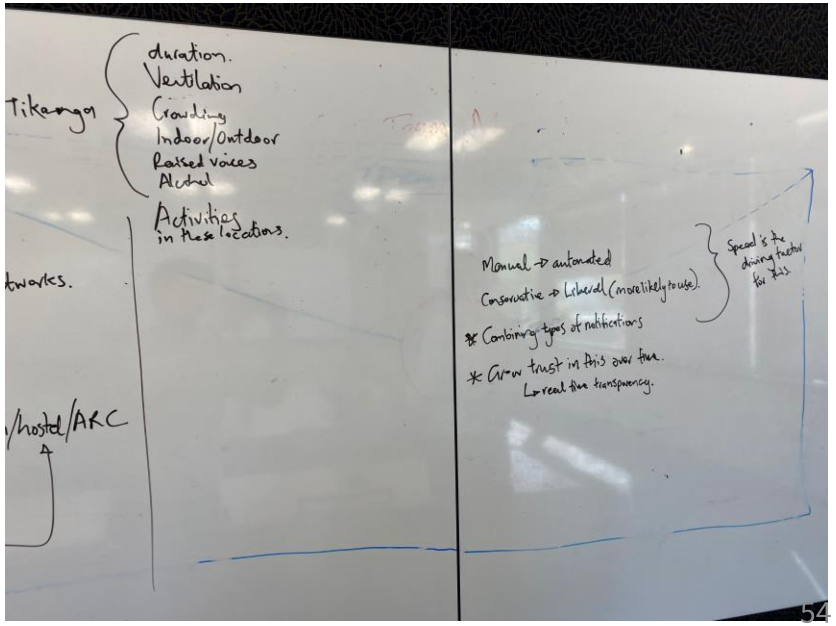
Scenario Building

Help us come up with a set of scenarios that allow us to:

1. test our system
2. operationalise our system

Consider the data and measurements we require for this to provide assurance we can use the service as expected





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Definitions

Case – person with a COVID-19 diagnosis

Close Contacts – defined as those who require follow up from the Public Health Unit due to the high likelihood of transmission

Casual Contacts – may be high index of suspicion (high risk) but also may be low risk

Exposure Event – place or interaction where transmission could have occurred

Location of Interest – place where a Case has been

Case Interview – Normally face to face interview process for identifying locations of interest, exposure events and close contacts.

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International Data for Creating the Model

	Formula	Swiss Model - Immediate (19 September 2020)	Irish Model (13 October 2020)	Singapore Model Total (April)	Singapore Model Close (October) - 2m 30mins	Singapore Model Casual (October)
A) Coverage (active users estimate)		19%	27%	25.0%	34%	34%
B) Effective interaction likelihood (assumes simple quadratric)	$B=A^2$	4%	7%	6.3%	11.4%	11.4%
C) Population Density		219	70	8358	8358	8358
D) Number of codes uploaded		1643	2673			
E) Number of call backs from contacts		1695	5186			
F) Number of contacts per case	F=E/D	1.0	1.9	1110	5	25
G) Found Contacts per day based on coverage	G=F/[Number of days of data collected]	0.07	0.14	52.9	0.2	1.2
H) Likely real contacts per day (adjusted for coverage)	H=G/B	2.1	2.0	845.7	2.1	10.5
I) Likelihood of meeting people (steps as a proxy)		1.1	1.1	1.1	1.1	1.1
J) Likely real contacts per day adusted for likelihood of meeting people	J=H*I	2.3	2.1	952.3	4.7	23.6
K) Ratio of contacts to Population Density	K=J/C	0.0103	0.0297	0.1139	0.0006	0.0028

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Applying International Data (Auckland DHB density)

	Calculation	Swiss Immediate	Ireland Immediate	Singapore Total Contacts	Singapore Model Close (October) - 2m 30mins	Singapore Model Casual (October)
A) International Standardised Outputs		0.0103	0.0297	0.1139	0.0006	0.0057
B) Coverage (28/9/2020)		46%	46%	46%	46%	46%
C) Reduction to account for iOS Compatibility		78%	78%	78%	78%	78%
D) Eligible Coverage	D=B*C	41%	41%	41%	41%	41%
E) Effective Contacts	$E=D^2$	17%	17%	17%	17%	17%
F) Population Density		771.4	771.4	771.4	771.4	771.4
G) Real Contacts per day based on Density	G=A*F	7.9	22.9	87.9	0.4	2.2
H) Contacts per day based on coverage	H=G*F	1.32	3.82	14.64	0.07	0.36
I) Steps Per Person per Day		0.91	0.91	0.91	0.91	0.91
J) Adjusted for Social Interaction	J=H*I	1.20	3.47	13.31	0.07	0.33
K) Number of Contacts in 14 Days	K=J*14	16.86	48.59	186.38	0.92	4.62

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Config File for COVID Green

#	COVID Green Config Parameter	Values	Apple APIs		Google PS Versioning	Google APIs	Apple OS Versioning	Notes
1	Minimumriskscore	1	Minimumriskscore		1	Minimumriskscore	1 (13.5)	Minimum for setting individual scores back to 0
2	Attenuationlevelvalues	[2,3,4,5,6,7,8,8]	Attenuationlevelvalues	[1,2,3,4,5,6,7,8]	1	Attenuationscores	1 (13.5)	Different buckets for attenuation
3	Attenuationweight	1	Not used	1	1	Not documented	1 (13.5)	
4	Dayssincelastexposurelevelvalues	[1,1,1,1,1,1,1,1]	Dayssincelastexposurelevelvalues		1	Dayssincelastexposurelevelvalues	1 (13.5)	Two day increments
5	Dayssincelastexposureweight	1	Not used		1	Reserved for future use	1 (13.5)	
6	Durationlevelvalues	[1,1,1,1,1,1,1,1]	Durationlevelvalues		1	Durationlevelvalues	1 (13.5)	Five minute increments
7	Durationweight	1	Not used		1	Reserved for future use	1 (13.5)	
8	Transmissionrisklevelvalues	[1,1,1,1,1,1,1,1]	Transmissionrisklevelvalues		1	transmissionriskscores	1 (13.5)	
9	Transmissionriskweight	1	Not used		1	Reserved for future use	1 (13.5)	
10	Durationofattenuationthresholds	[56,62,70]	attenuationdurationthresholds		1.5		2 (13.7)	
11	thresholdweightings	[1,1,0]	Immediatedurationweight		1.5		2 (13.7)	Four variables
12	Timethreshold	[15]			1.5		2 (13.7)	
13	Infectiousness	[1,1,1,1,1,1,1,1,1,1,1,1,1,1]			1.6			Non, Standard, High
14	Calibration Confidence	[1,1,1,1]			1.6			Lowest, Low, Medium, High

Version 2 of the notification service
Version 1 of the notification service

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Intelligence from other jurisdictions

Jurisdiction	Singapore	Australia	England	Republic of Ireland	Canada	Japan/Uruguay/Spain/Brazil/Ecuador	Linux Foundation – COVID Green
Key findings	• Moderate coverage, improved with dongles but unclear on true benefits (benefits not published).	• Doesn't have large coverage and doesn't integrate to get good notification speed	• Second attempt has a key focus on building trust and participation • Combines QR codes, Bluetooth, self-isolation and test ordering	• Key focus on building trust and participation • Very similar contact tracing model to NZ, and good learnings beyond the app.	• Key focus on building trust and participation • Good marketing efforts and investment	• Interested in global interoperability for EN implementations	• A growing group of organisations participating in the collaborative
Strengths	• Open source model for software and hardware • Have considered lots of different technology options • Have a focus on data re-use and integration – are sophisticated in terms of understanding participation and impacts	• Is in the market • Good political support initially	• Is a relatively complete offering • Some further algorithm work has recently been completed that can be incorporated into other EN apps to increase accuracy • Interest in measuring specific benefits	• Is in the market • Has symptom checker • Interested in publishing the impact of the app on • Well integrated with contact tracing with call back feature	• Is in the market	• Unlikely that Apple or Google will operate this • A broker would allow apps to travel with the person as long as both countries use EN	• Opportunity to engage and gather feedback from others on a similar journey
Weaknesses	• Not compatible with global solutions or Australia • Doesn't work on iPhones • Finding difficulty contacting dongle users.	• Not compatible with global solutions or Singapore • Doesn't work on iPhones • Isn't integrated with Contact Tracing systems (state-based) • Doesn't collect information about location • Less privacy protective	• Failure in the first instance has meant slower uptake than might have occurred • Not connected to the Test and Trace process directly		• Vanilla implementation • Integration with contact tracing secondary	• Less likely people will use our app when in our country.	• A sense that having an app is the end point rather than an opportunity to join up the different elements of the response.

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Document 7

BLUETOOTH SIMULATION TEST

Client	NZ Ministry of Health
Project	COVID Tracer 5.1
Version	1.0
Created on	Tuesday 15 December 2020
Created by	[redacted] section 9(2)(a)

Introduction

Background

With the integration of the ENS system in the COVID tracer app, two simulations were conducted at two different points to test the functionality of the delivery of exposure notifications. This report focuses on the second of the simulations, after an inconclusive first one.

Purpose

The purpose of the simulation was to test the ENS configuration desired by the Minstry of Health's data modelling team in-situ

```
"minimumRiskScore":1,
 "attenuationLevelValues": [2,3,4,5,6,7,8,8],
 "attenuationWeight":1,
 "daysSinceLastExposureLevelValues": [1,1,1,1,1,1,1,1],
 "daysSinceLastExposureWeight":1,
 "durationLevelValues": [1,1,1,1,1,1,1,1],
 "durationWeight":1,
 "transmissionRiskLevelValues": [1,1,1,1,1,1,1,1],
 "transmissionRiskWeight":1,
 "durationAtAttenuationThresholds": [56,62],
 "thresholdWeightings": [1,0.5,0],
 "timeThreshold":15,
```

During the testing process, the QA team at Rush were not able to trigger notifications for testing purposes, and therefore in all test environments, the Rush team have adjusted the threshold weighting to increase the number of notifications sent. However, in the production environment, the Ministry's desire was to use the above weighting in production.

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Method

Devices and users

7 users were recruited to participate in the ENF trial, these were their devices:

- 3x iOS users (SE, X, 12)
- 4x Android users (Xiaomi, Huawei, Oneplus)
- 1x user who has purchased their android phone overseas (India)

All users used their day to day devices, with ENF turned on at all times during the 4 days.

Experiment design

The following table shows each participants' schedule.

- **P1** denotes participant one, P2 is participant 2 etc...
- **WFW** denotes work from work, where all participant meet up for lunch or tea
- **WFH** denotes work from home, some participants who could not work from home would leave their devices off-premise/ turned off.
- **WFX** denotes work from anywhere, participants decide what suits them best

Day	Activity	P1	P2	P3	P4	P5	P6	P7
Day 1	P1 symptom onset	WFW	WFH	WFW	WFH	WFW	WFH	WFW
Day 2	P2 symptom onset,	WFH	WFW	WFW	WFW	WFW	WFH	WFH
Day 3	P2 upload	WFH	WFH	WFX	WFX	WFX	WFW	WFX
Day 4	P1 upload	WFH	WFH	WFX	WFX	WFX	WFW	WFX
Expected alert outcome		**None and upload**	**None and upload**	**2x Alerts**	**1x Alert**	**2x Alerts**	**None**	**1x Alert**

Uploads were done via Postman, in the UAT environment. Participants were asked to measure if they:

1. Check to see if they received a push notification and dashboard alert
2. Submit their OS exposure notification logs so see if a hash was downloaded and matches found.

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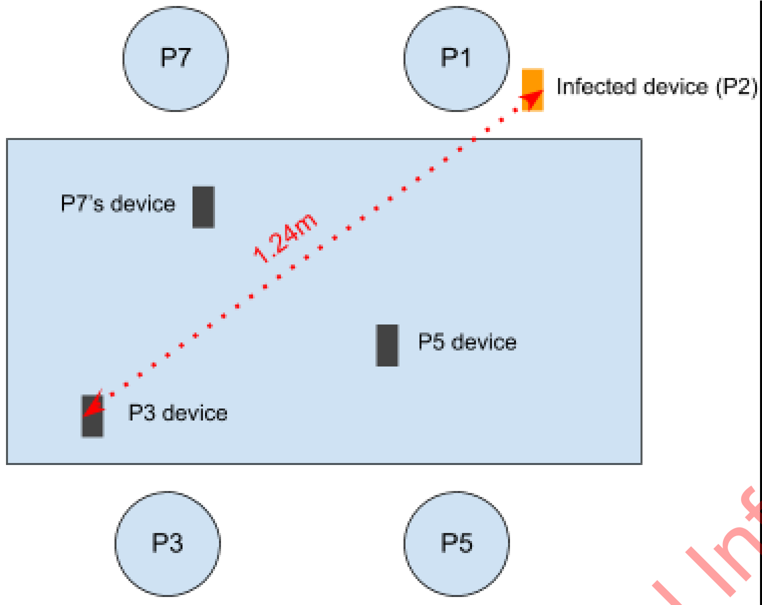
Set up for meetings between participants

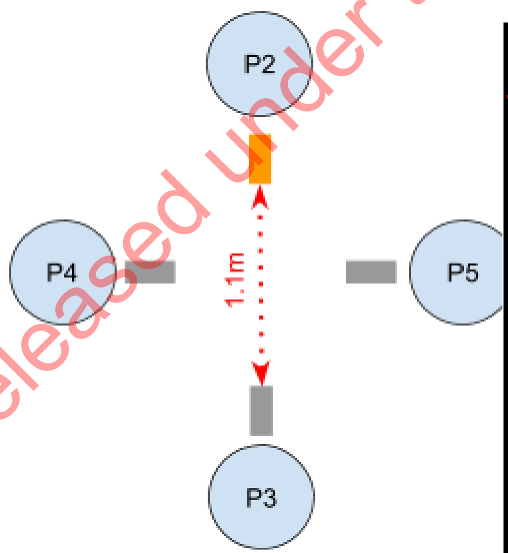
Day one set up:



section 9(2)(a)
[redacted]

Participants 1,3,5 and 7 went to lunch, all devices were within a 2m radius, the furthest device being 1.24 meters away from the "infected" device. The lunch was around 1h in length

Day two set up:



section 9(2)(a)
[redacted]

Participants 2,3,4 and 5 met for 45mins in the office. They were sat facing each other with their devices in front of them. All participants were within 1.1m radius from the "infectious" phone.

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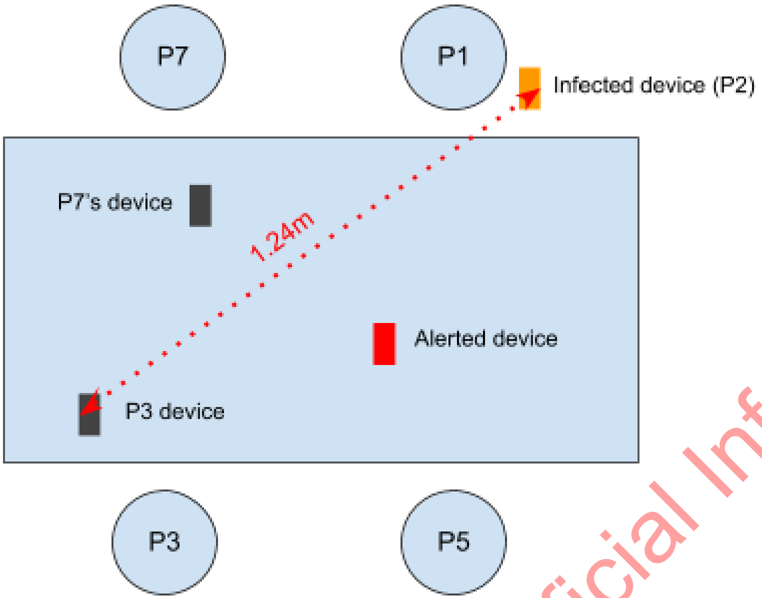
Results

Only one participant had received the notification at the end of the experiment, with the exposure date on the UI associated with the lunch exposure event.



Upon inspection of the OS JSON file, we found that all participants' logs had key:


```
{"timestamp":"12 December 2020, 7:23pm",
"keyCount":2,
"matchesCount":0,
"appName":"NZ COVID Tracer",
"hash":"BSp5HMqmsQTbV8OKuOaDOJrQ6QV24w0qH9+qp45m0kI="},

{"timestamp":"10 December 2020, 5:49 pm",
"keyCount":21,"matchesCount":0,"appName":"NZ COVID Tracer",
"hash":"2A5D45hPsUIKR+CZ1JdEvslWoXODw\/UDNlbYmL\/cOOo
```


Logs from a participant who did not get a match (P4)


```
{
"Build" : "18B92",
"ExportVersion" : 2,
"ExposureChecks" : [
  {
    "Timestamp" : "2020-12-11 21:55:16 +1300",
    "Files" : [
      {
```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```
        "Hash" :
"63F3714607486BC28332C147C28BE731B5307C89A4728CDBD38036C2E7E8BBC9",
        "MatchCount" : 1,
        "KeyCount" : 23,
        "AppBundleIdentifier" : "nz.govt.health.covid-tracing-app",
        "Timestamp" : "2020-12-11 21:55:16 +1300"
      }
    ],
    "AppBundleIdentifier" : "nz.govt.health.covid-tracing-app"
}
```


Logs from the participant who had a match on the dashboard (P5)

Conclusion

The results show that the ENF implementation works from a technical perspective, however, with the distances in the simulation, all participants have a risk of being exposed to the COVID-19 virus.

It is recommended that to increase the weighting to the configuration and conduct more in-situ testing to fine-tune the efficacy of the feature in the COVID Tracer app, in order fulfil the potential of helping stop the virus.

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out of scope [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Improving contact tracing and other layers of defence

QR Codes, contact tracing and other measures

out of scope [redacted]

[redacted]

60 Subject to further advice, I am considering the introduction of Bluetooth functionality to the NZ COVID Tracer app on 10 December. Bluetooth enables

avtd5lk5e3 2020-12-22 10:39:43

the passive recording of close contacts. It is complementary to QR code scanning which creates a record of where someone has been, rather than who they were with.

out of scope [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted] [redacted]

[redacted]

[redacted]

[redacted] [redacted]

[redacted] [redacted]

out of scope [redacted]

[redacted] [redacted]

Exposure Notification Framework Proof of Concept

Over the past month, a team at Rush has been investigating the newly introduced “Exposure Notifications Framework” available on Android and iOS devices to assess the technical feasibility of implementation in New Zealand within the NZ COVID Tracer app.

To assist in the speed of development for this Proof of Concept project, we made modifications to the existing open-source code - “COVID Green” app made available by HSE Ireland.

Functionality included in this PoC:

- Create a minimal app to support the following features
    1. Turn on / Turn off “Exposure Notifications” feature
    2. Share exposure to contact tracer team (MoH) - when a user receives a positive diagnosis
    3. Register contact details (name and phone number)
    4. Receive push notifications and in-app notification banner when a close contact is later tested positive (proximity between users device and another device) so that the user is aware and can be tested or go into self-isolation if needed.

- Set up a “Back end” server capable of the following
    1. Receive “exposure keys” from the users’ app when a user is diagnosed with COVID and subsequently chooses to upload their “exposure keys” to assist with contact tracing
    2. Store these keys on the server securely and anonymously
    3. Provide all “exposure keys” from positively diagnosed users to users apps who are subscribed to the “Exposure Notification” service.

Validation and Testing

Rush QA testers have tested this Proof of Concept app using real physical devices in close proximity to each other.

We have successfully verified that:

1. The framework works as described in the documentation provided by Apple and Google
2. The intended functionality was tested with the following steps
    a. Devices were kept in close proximity for a period of time
    b. At some time in the future (within 14 days), one of the devices simulated a positive diagnosis patient and uploaded their “exposure keys” to our server
    c. The other devices which were in close proximity to this “positive” patient received a push notification and in-app notification.

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