

# Covid19 Contact Tracing: Overview

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# Overview

- **Apple and Google**
  - The issue of privacy and trust
- **Project: Covid Tracing Tracker**
  - Overview of used technologies
  - Five-star apps
- **Apps using Bluetooth and the Apple – Google API**
  - Getting the right information from Bluetooth
  - How Bluetooth signals get complicated
  - How to improve it
- **Project: PACT**

# Apple and Google

- Jointly building software into iPhone and Android devices.
- Contact tracing technique has been one key to the success of countries like South Korea.
- Apple – Google system's implementation will vary from country to country with the availability only to government public health agencies directly involved in coronavirus tracking.
- The new software will rely on **Bluetooth**.

# The issue of privacy and trust



- Will people believe that their **data will be protected**? Are they going to be concerned that this surveillance system?
- In **China**, citizen's data is shared with police.
- In **South Korea**, the government accesses smartphone location, credit card histories, immigration records, and CCTV footage from around the country.
- **Taiwan** has built “electronic fences” that track location to make sure that people are staying in place during quarantine.

# The issue of privacy and trust



- Apple and Google are helping government public health agencies in North America, Europe, and Asia build their **own apps** that utilize the same underlying technology.
- Those **governments will have their own rules**, but the app will require explicit user consent to start tracking.
- Importantly, it's **not true location** data: it's all proximity data gathered by Bluetooth.
- The companies say they will **shut it down** on a region-by-region basis when the pandemic is over.

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# Project: Covid Tracing Tracker

- Technologists everywhere have been rushing to build apps, services, and systems for contact tracing.
- Some services are being produced locally by small groups of coders, while others are vast, global operations.
- **No central repository** of information.
- With Covid Tracing Tracker—a database which compiles a list of **automated contact tracing apps** that are **backed by national governments**



# Project: Covid Tracing Tracker

For each newfound app, there are basic questions asked:

- Is it voluntary?
- Are there limitations on how the data gets used?
- Will data be destroyed after a period of time?
- Is data collection minimized?
- Is the effort transparent?



# Overview of used technologies

Basic technology underlying apps:

- **Location:** For instance, using GPS or triangulation from nearby cell towers
- **Bluetooth:** “Proximity tracking,” in which phones swap encrypted tokens with any other nearby phones over Bluetooth.
- **Google/Apple:** It lets iOS and Android phones communicate with each other over Bluetooth.
- **DP-3T:** Open-source protocol for Bluetooth-based tracking in which an individual phone’s contact logs are only stored locally.

# Five-star apps

## Austria: Stopp Corona

- Austria was one of the first major European nations to align with the Google/Apple API, using Bluetooth, Google/Apple technology.
- <https://www.stopp-corona.at/>

## Iceland: Rakning C-19

- Iceland decided not to use Bluetooth because it was too unreliable and instead uses location data.
- <https://www.covid.is/app/is>

## Switzerland: SwissCovid

- Initially, the Swiss opted to use DP-3T instead of the Google/Apple API. Now they are using both.
- <https://foph-coronavirus.ch/swisscovid-app/>

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# Apps using Bluetooth and the Apple – Google API

## Bluetooth

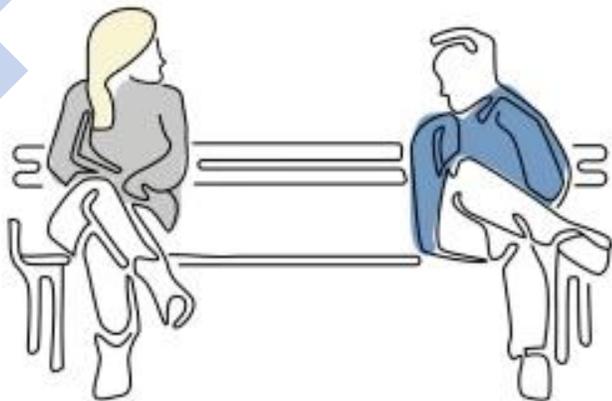
- Maximum range of about 100 meters (outdoors, without objects between the two phones).
- The "**Exposure Notification**" framework detects other mobile devices in the critical range of about 2 meters in open spaces.
- Mobile device **cannot indicate** whether people are **wearing masks**.
- Apps **do not use satellite positioning**, or any other mechanism for geolocation.
- People can freely decide how they want to react. The app recommends that check should be carried out on the Internet or medical advice should be sought.

# Apps using Bluetooth and the Apple – Google API

## API

- Protects the information stored in it.
- **The Exposure Notification API** implements a variant of the DP3T protocol.
- Offers advantages in terms of security and interoperability. It prescribes the principle of decentralized comparison proposed by DP-3T and does not allow the centralization of information collected by telephone.

Alice and Bob meet each other for the first time and have a 10-minute conversation.

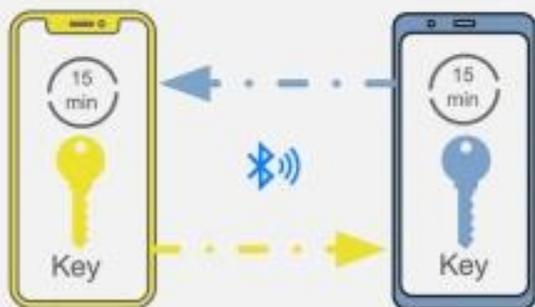


Bob is positively diagnosed for COVID-19 and enters the test result in an app from a public health authority.



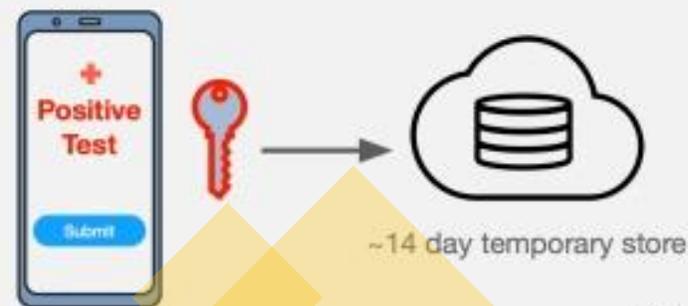
A few days later...

Their phones exchange anonymous identifier beacons (which change frequently).



With Bob's consent, his phone uploads the last 14 days of keys for his broadcast beacons to the cloud.

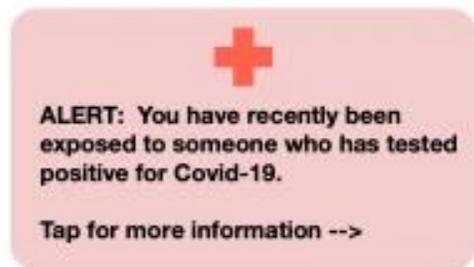
Apps can only get more information via user consent



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



Alice sees a notification on her phone.

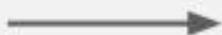


Sometime later...

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



Anonymous identifier keys are downloaded periodically



A match is found



Additional information is provided by the health authority app or website

# Privacy-preserving Bluetooth protocol to support Exposure Notification

- Broadcasting
  - Advertisements are **non connectable**
  - Advertiser address is a **random value**
  - **The advertiser address, Rolling Proximity Identifier, and Associated Encrypted Metadata** shall be changed synchronously so that they cannot be linked
  - The **broadcasting interval** is subject to **change**
- Scanning
  - Discovered Exposure Notification Service advertisements shall be kept **on the device**
- Privacy
  - **Only uses Bluetooth** beaconing to detect proximity
  - Rolling Proximity Identifier changes on average every **15 minutes**
  - Proximity identifiers obtained from other devices are processed exclusively **on device**

# Getting the right information from Bluetooth

- “**How close** do you need to be to a person and for how long in order to be at risk?”
- Bluetooth can measure the strength of a signal from another phone, known as the **RSSI** (Received Signal Strength Indicator).
- In theory, the amount of **power is proportional to distance**, so it can be used to gauge how far the two phones are from one another.

A strong signal means proximity, a weak one means the phones are further apart.

# How Bluetooth signals get complicated

- **Incorrect data** can be introduced by walls, human bodies, pockets, proximity to several phones at once, phone orientation (portrait or landscape mode)...
- **Other problem** can be many false positives:
  - If out, in the wide open, two Bluetooth devices might ping each other even if they're much more than six feet (2 m approximately) away.
  - They could also ping each other and report a proximity event through the wall of an apartment, or on a different floor of the building.



# How to improve it

- Taking **more data** into account (other sensors) and learning more about how to properly interpret signals
  - the ambient light sensor could tell if your phone is in your pocket or purse, which can tell about potential blockages.
  - compass and gyroscope can tell how a device is oriented on multiple planes.
- Proposed solution by **PACT** (Private Automated Contact Tracing) project
  - Using Bluetooth low energy alongside auxiliary data from the mobile device.

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# Using Bluetooth Low Energy (BLE) Signal Strength Estimation to Facilitate Contact Tracing for COVID-19

- **Binary decision** based on received BLE signal power estimates.
- Optimizing detector with available **auxiliary data** and **additional BLE power measurements**.
- Results indicate **60%** correct identification of true TCFTL events, while **Apple-Google API** provides **30%**.

**Thank you for your attention.**

**Questions?**