



# PLOT



## Private Location Tracking



Quantifying  
transmission  
control with

science - 6 m

The newly emergent human virus SARS-CoV-2 is resulting in high fatality rates and

[telecom-data-of-all-belgians-to-stop-covid-19-coronavirus/](#)

<https://science.sciencemag.org/content/early/2020/04/09/science.abb6936>

Social Media Today - 4 min

As more nations struggle to contain the COVID-19 outbreak, could digital surveillance

[https://www.socialmediatoday.com/news/more-nations-are-looking-to-use-cell-phone-data-to-track-the-covid-19-outbr/574695/](https://www.socialmediatoday.com/news/more-nations-are-looking-to-use-cell-phone-data-to-track-the-covid-19-outbreak/574695/)

...? The typical  
...ly "a whole

[}-geo-](#)

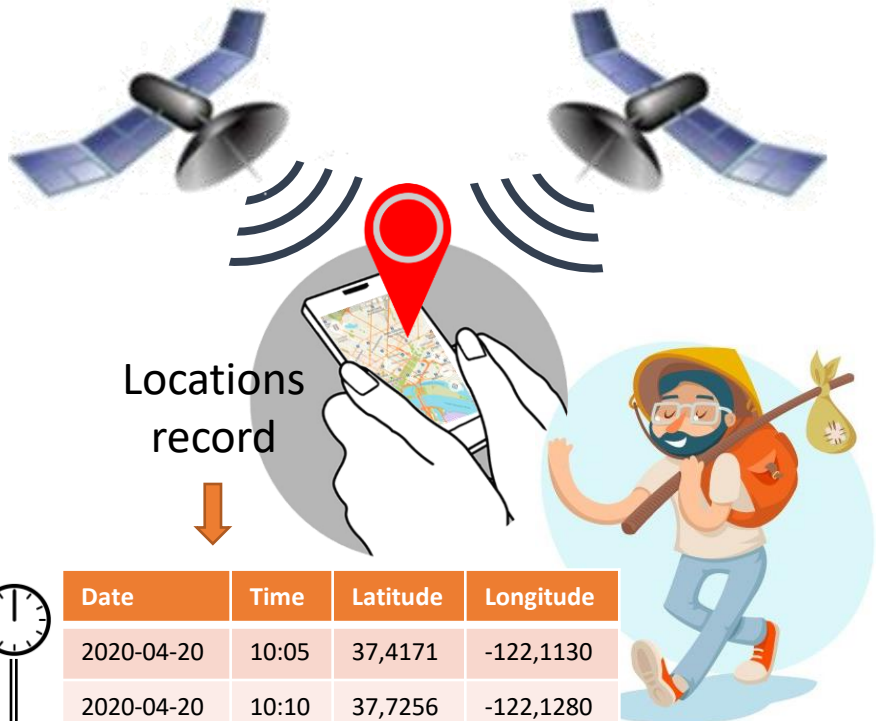
17828





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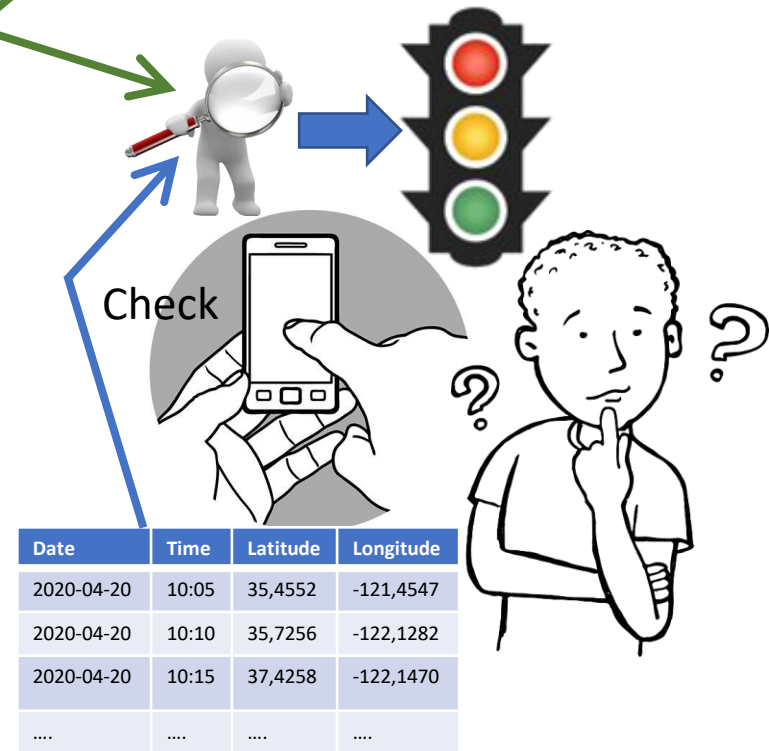
# General application concept



Date	Time	Latitude	Longitude
2020-04-20	10:05	37,4171	-122,1130
2020-04-20	10:10	37,7256	-122,1280
2020-04-20	10:15	37,4258	-122,1470
....	....	....	....



Date	Time	Latitude	Longitude
2020-04-20	10:05	37,4171	-122,1130
2020-04-20	10:10	37,7256	-122,1280
2020-04-20	10:15	37,4258	-122,1470
....	....	....	....



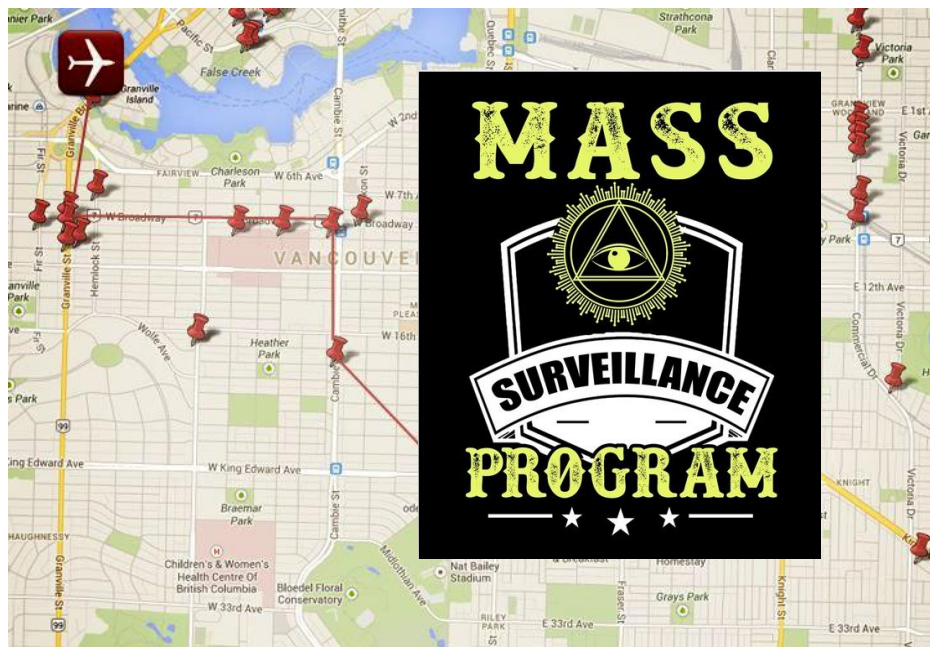
Date	Time	Latitude	Longitude
2020-04-20	10:05	35,4552	-121,4547
2020-04-20	10:10	35,7256	-122,1282
2020-04-20	10:15	37,4258	-122,1470
....	....	....	....





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# The Problem: Preserving Individual Privacy



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4 PRIVACY GUARDS

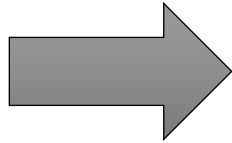


## 1. LOCATIONS FILTER



Locations record

Date	Time	Latitude	Longitude
2020-04-20	10:05	37,4171	-122,1130
2020-04-20	10:10	37,7256	-122,1280
2020-04-20	10:15	37,4258	-122,1470
....	....	....	....



Filtered Locations record

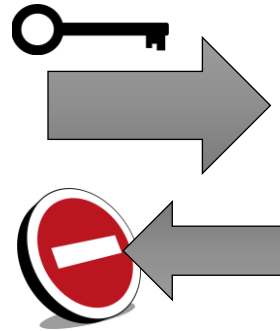
Date	Time	Latitude	Longitude
2020-04-20	10:05	37,4171	-122,1130
<del>2020-04-20</del>	<del>10:10</del>	<del>37,7256</del>	<del>-122,1280</del>
2020-04-20	10:15	37,4258	-122,1470
....	....	....	....



## 2. IRREVERSIBLE ENCRYPTION

Filtered Locations record

Date	Time	Latitude	Longitude
2020-04-20	10:05	37,4171	-122,1130
2020-04-20	10:10	37,7256	-122,1280
2020-04-20	10:15	37,4258	-122,1470
....	....	....	....



Encrypted Locations record

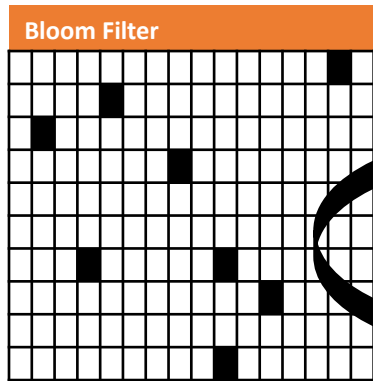
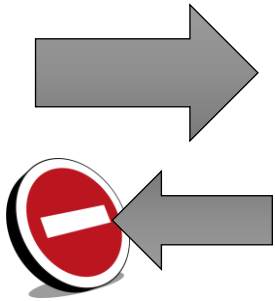
Cypher Data
D147C408 F2E4AA05 18D054F8 94F6D458
9E435B84 5AA8D384 B68F320F 7B47E5AC
....



## 3. BLOOM FILTERING

Encrypted Locations record

Cypher Data
D147C408 F2E4A05 18D054F8 94F6D458
9E435B84 5AA8D384 B68F320F 7B4765AC
....



*Was There Someone  
Infected at  
Coordinates (X, Y)  
at Time T ?*

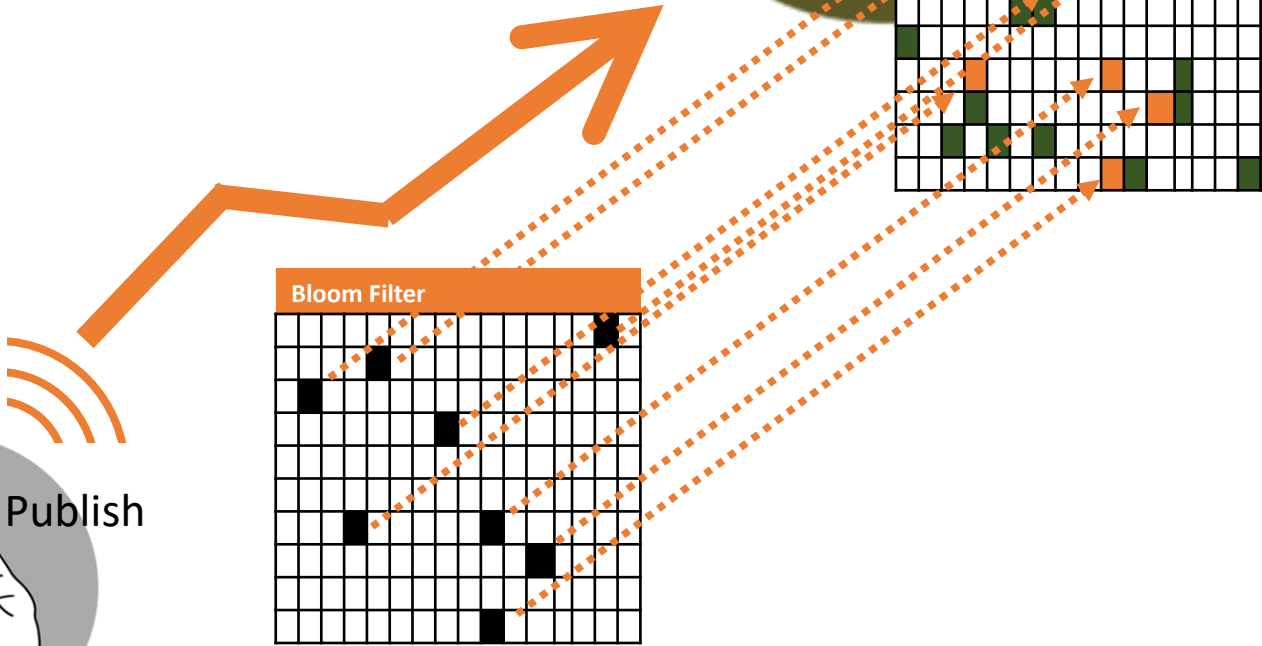
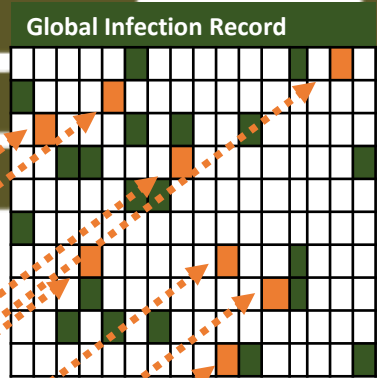
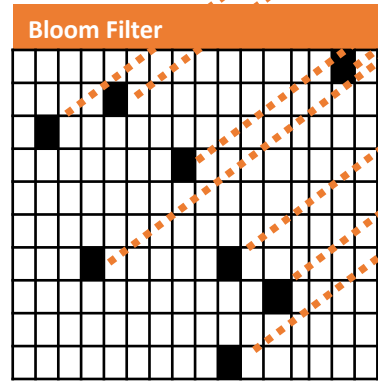
*Yes | No*



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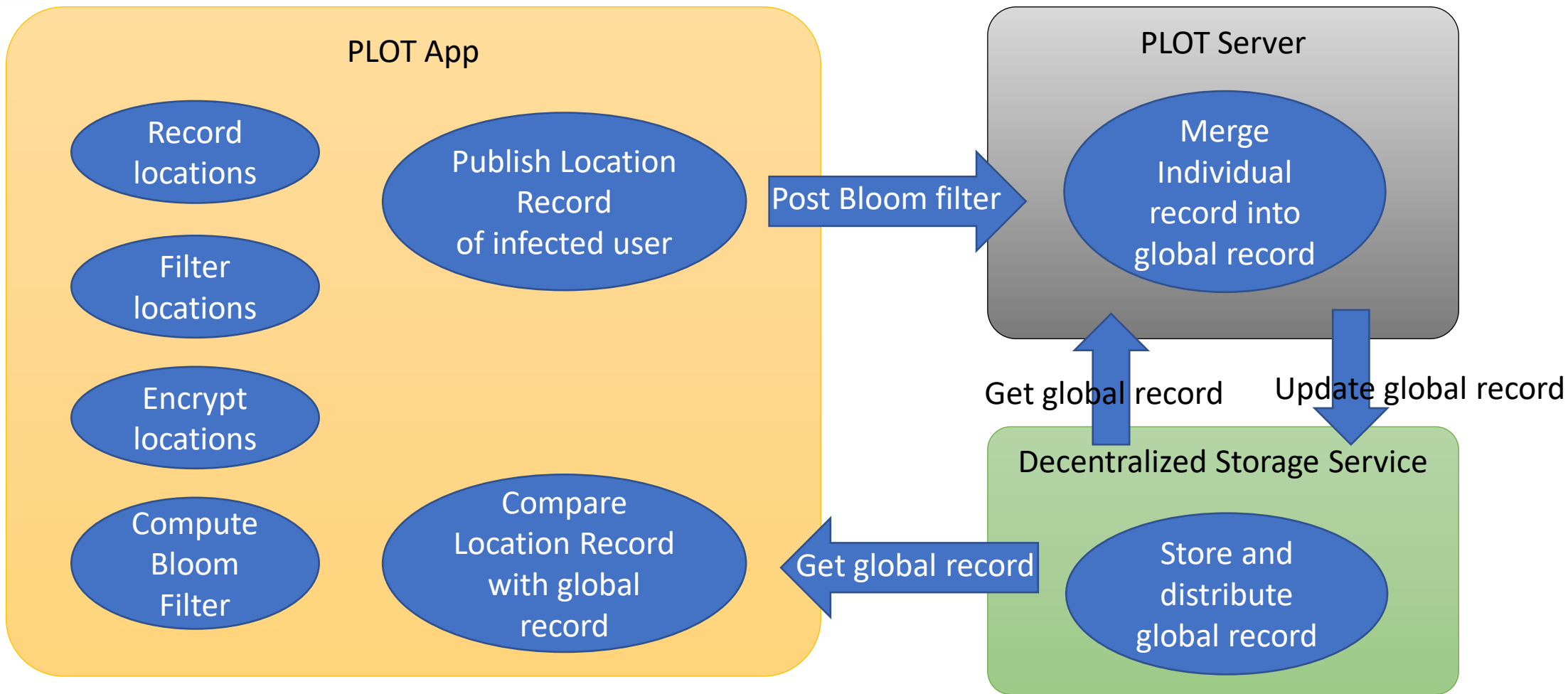
# Privacy Guard #4

## 4. DATA MERGING











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Demo

LOCATIONS FILTER

PUBLISH LOCATION RECORD

CHECK INFECTION STATUS



## PRIVACY vs FEATURES

Privacy-protection maximalist solution:

- Users can still decide to remove locations from their published data
- Very limited data analysis potential:
  - Number of locations infected each day
  - Number of infected people each day

## CENTRALIZATION

Not a fully-decentralized solution (yet)

Centralized service still required to merge the individual data.

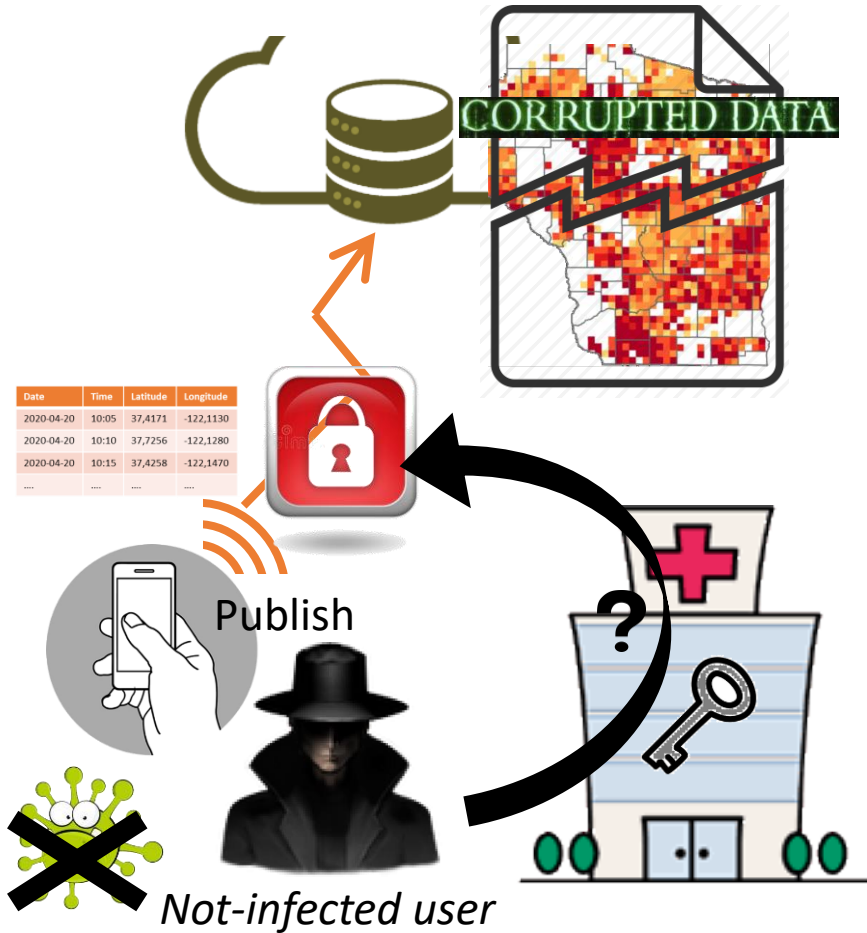
Full-decentralized approach (smart contracts): transparent transactions/data, reducing privacy protection level

Potential solution: using secret contract  
(Enigma layer 2 platform)





## PREVENTION of ABUSES



## INCENTIVIZE USERS





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Q & A

# Thank You For Your Attention



PLOT



*Private Location Tracking*