Mobipack;
## Open Analysis Software of Mobile Big Data to Support COVID-19 Responses

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CDR(Call Detail Record) data

Data on time and location (base station) of voice/messaging/data communication of each hand-set for billing purposes. Data is recorded only when calling, messaging and data communication.
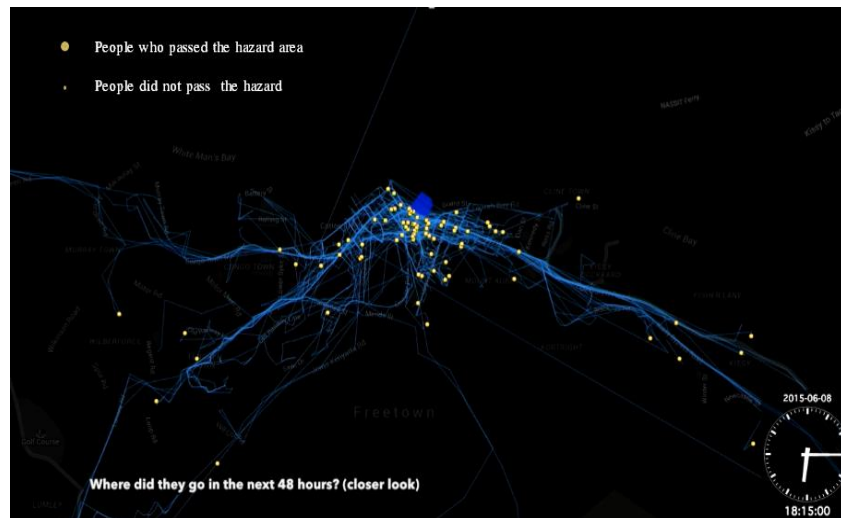
Calling!

Calling!

data

data
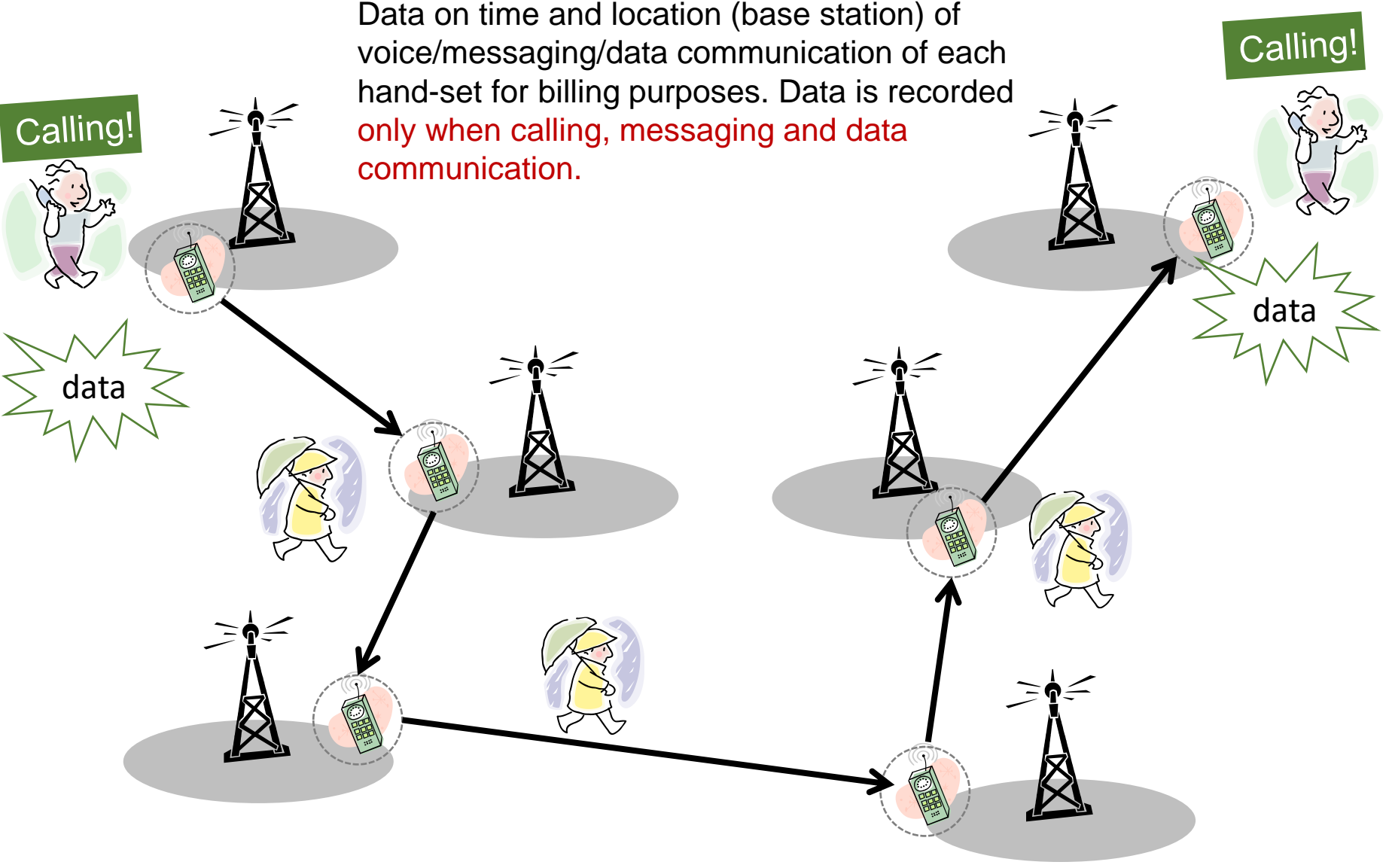
Tracing People who Passed through a Hazard Area

People's mobility is quite high even only for 48 hours, which potentially threaten a very large areas at the risk of Ebola epidemics.
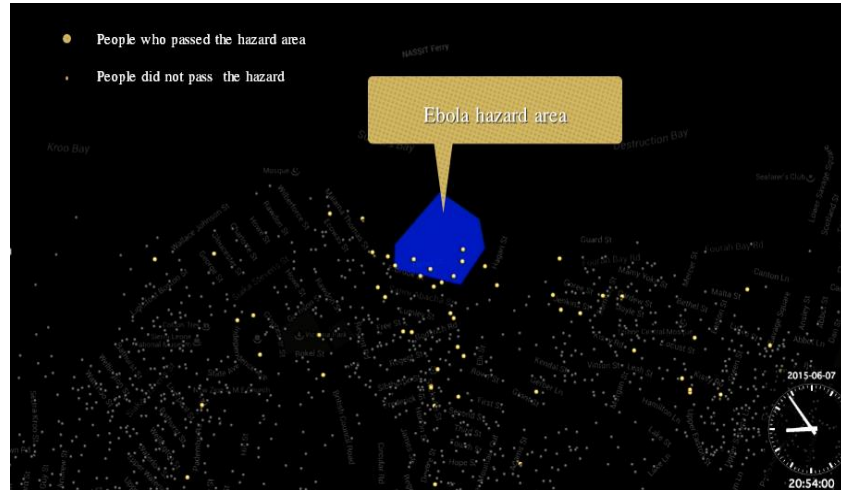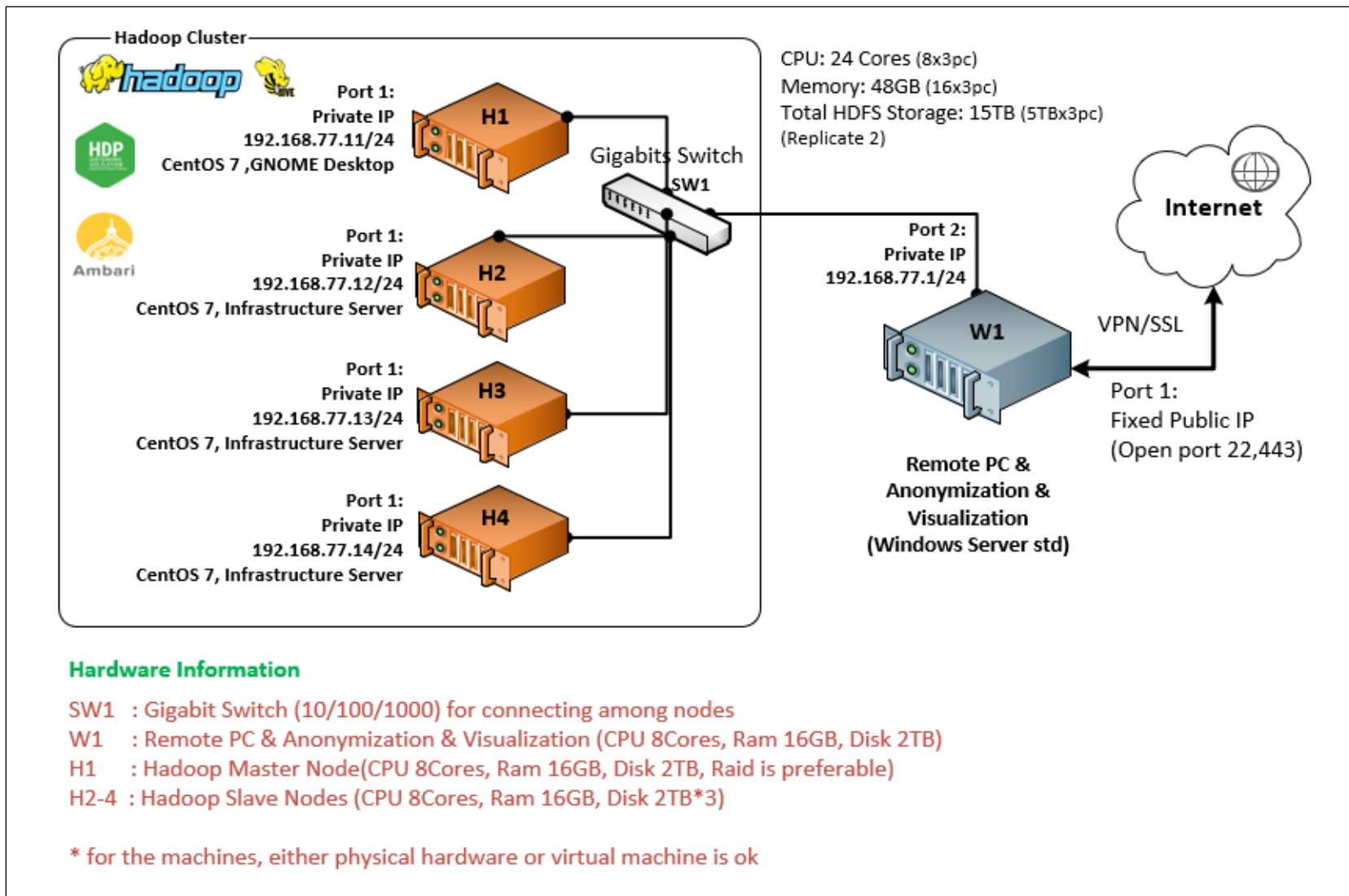

Trace People who Passed through a Hazard Area

Where did They Go in next 48 hours? (After 47.5 hrs.)

Network Diagram

Hadoop Cluster

Port 1:
Private IP
192.168.77.11/24
CentOS 7 ,GNOME Desktop

H1

Port 1:
Private IP
192.168.77.12/24
CentOS 7, Infrastructure Server

H2

Port 1:
Private IP
192.168.77.13/24
CentOS 7, Infrastructure Server

H3

Port 1:
Private IP
192.168.77.14/24
CentOS 7, Infrastructure Server

H4

Gigabits Switch
SW1

CPU: 24 Cores (8x3pc)
Memory: 48GB (16x3pc)
Total HDFS Storage: 15TB (5TBx3pc)
(Replicate 2)

Internet

Port 2:
Private IP
192.168.77.1/24

W1

VPN/SSL

Port 1:
Fixed Public IP
(Open port 22,443)

Remote PC &
Anonymization &
Visualization
(Windows Server std)

Hardware Information

SW1   : Gigabit Switch (10/100/1000) for connecting among nodes
W1   : Remote PC & Anonymization & Visualization (CPU 8Cores, Ram 16GB, Disk 2TB)
H1   : Hadoop Master Node(CPU 8Cores, Ram 16GB, Disk 2TB, Raid is preferable)
H2-4 : Hadoop Slave Nodes (CPU 8Cores, Ram 16GB, Disk 2TB*3)

* for the machines, either physical hardware or virtual machine is ok

Sample Analysis Results (Mobility indicators for COVID-19 responses)

This section illustrate result of analysis including footprint, population estimation and O-D estimation.

Monitoring People Mobility with Indicators Sample Data

- People mobility can be measured with a set of indicators along with the timeline of the mobility restrictions or lockdown. Examples of an African country are shown below;
  1. Population shares of visitors after the restrictions in Capital area
  2. Significant decreases in population inflow from other districts to the country capital
  3. population inflows from commuting towns to the capital district
  4. population inflows from other districts to a suburban province
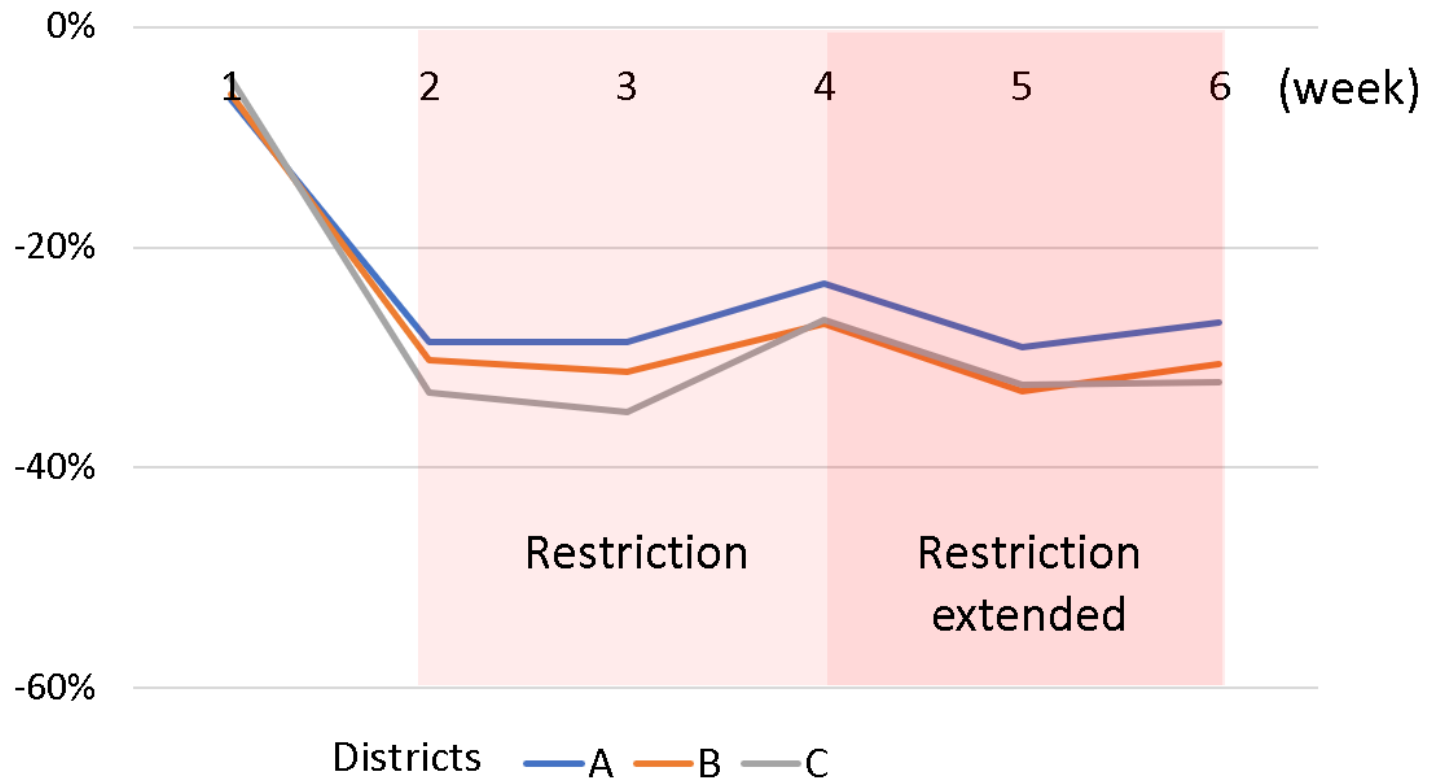
Timeline

Week 0	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6

● **First case confirmed**

● **People in Capital started working from home**

● **Lock down**

● **Lock down extended**

Sample Data

Fig. 1) % changes population share visiting from other sub-districts to the capital province during the daytime

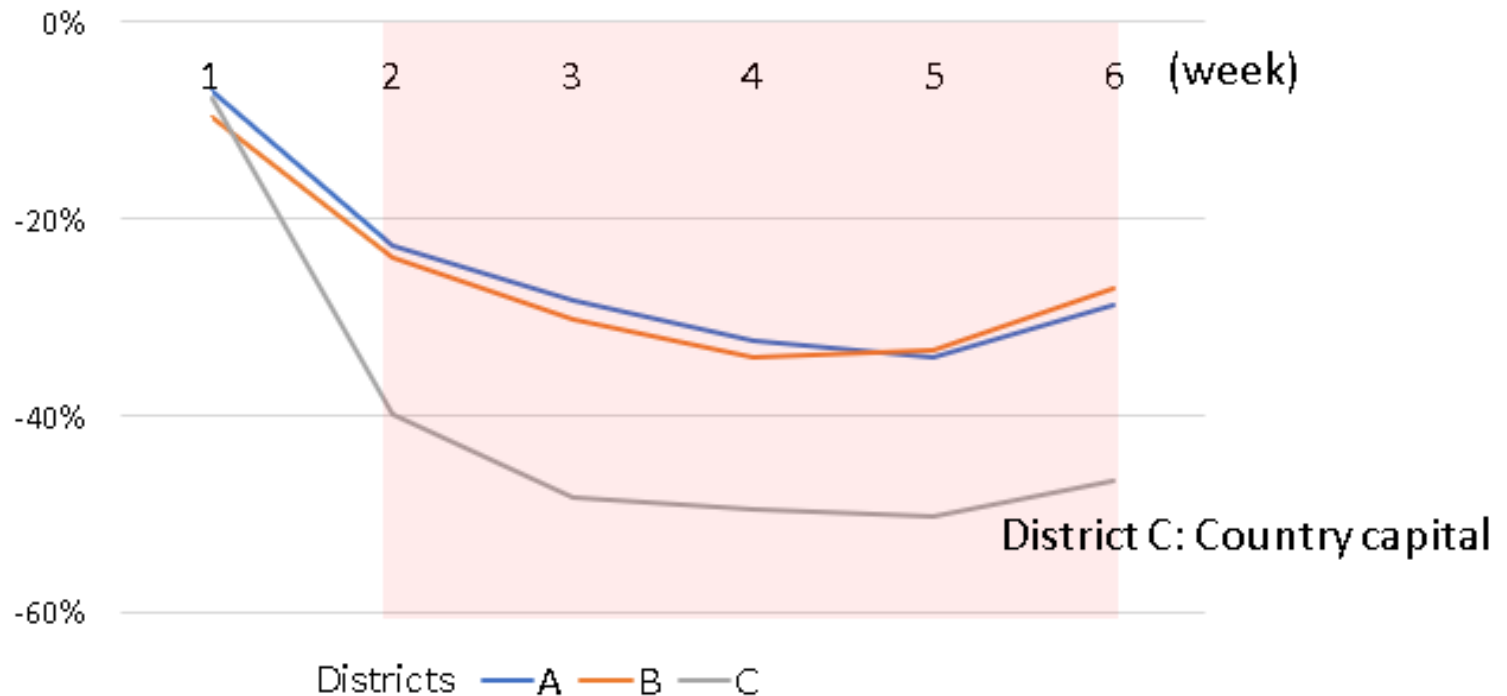**% changes in this presentation use the values of Week 0 as baselines**

Fig. 2) % changes of inter-district trips attracted to each district

District C: Country capital

Districts ━ A ━ B ━ C

- Country Capital is in District C that contains most of the city's businesses

Sample Data

Fig. 3) % Changes of inter-district trips to the capital district (Week 1)

International airport

Commuting towns to Capital

Districts

20%

-30%

-80%

Fig. 4) % Changes of inter-district trips to the capital district (Week 2)

Districts

60%

10%

-40%

-90%

Sample Data

Fig. 5) % changes of inter-district trips attracted to a suburban province

A: Province capital

F: Major port city to a neighbor country

(week)

C & E: Country borders closed

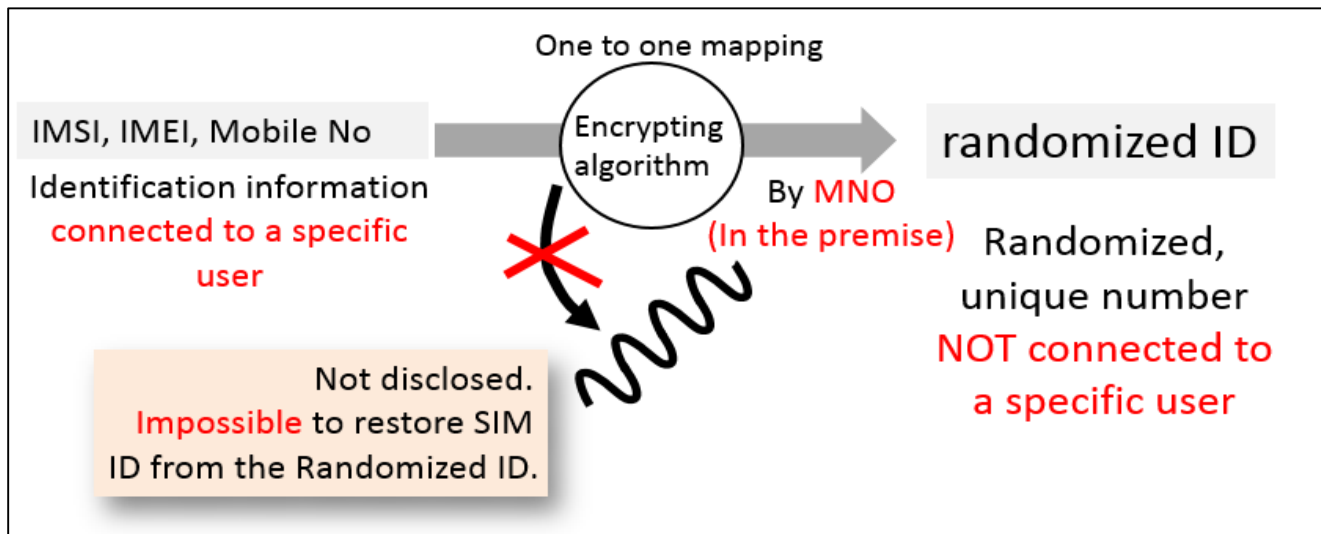Districts —A —B —C —D —E —F —G
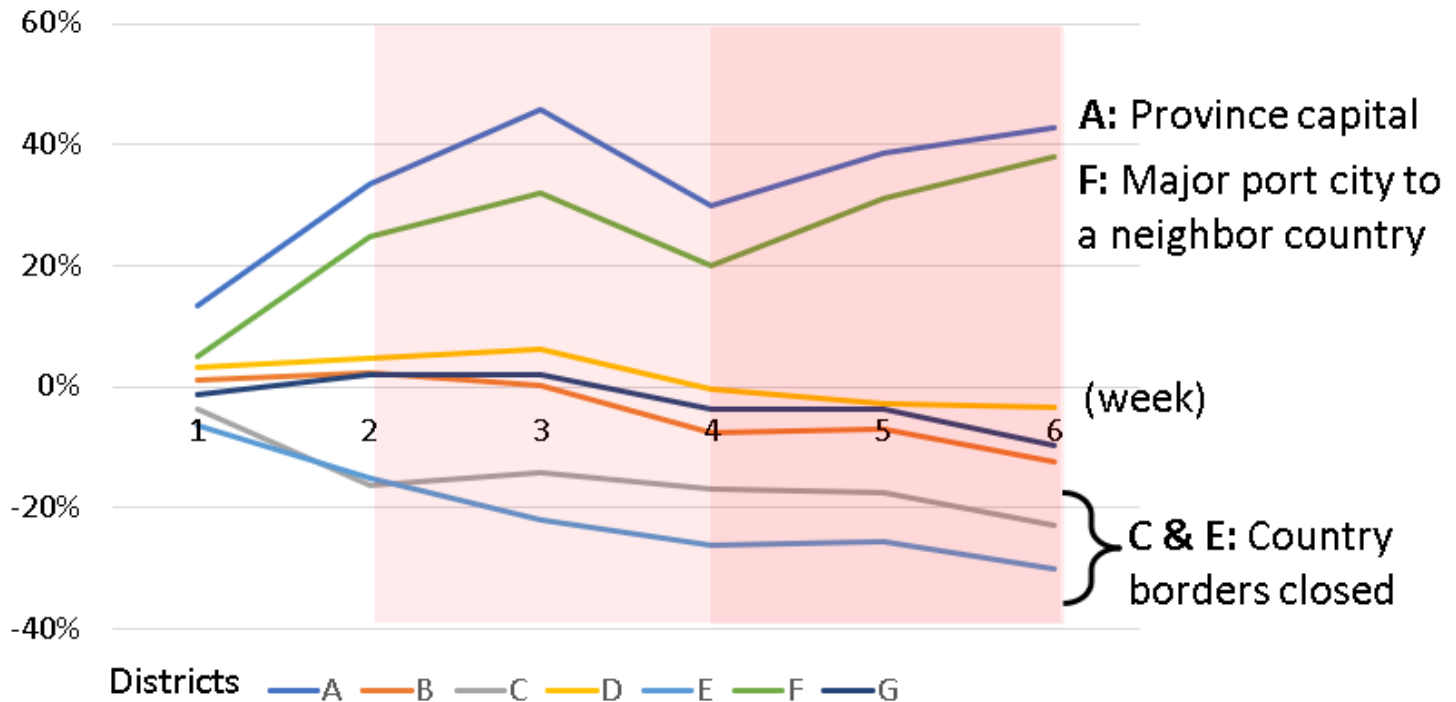
- This province is not directly connected to the capital province
- Districts C & E face borders that were shutdown in Week 0

Anonymized CDR Data : Privacy is completely preserved

All the data handling is conducted on the premise of Regulator and MNOs
And technical on-line training and support is made by the University of Tokyo

One to one mapping

IMSI, IMEI, Mobile No

Identification information
connected to a specific
user

Encrypting
algorithm

By MNO
(In the premise)

randomized ID

Randomized,
unique number
NOT connected to
a specific user

Not disclosed.
Impossible to restore SIM
ID from the Randomized ID.

Example of data after anonymization

Attribute	Original value	algorithm	Encrypted value
Phone No	654003453	SHA256	7cdab53309c015854b433f0f34d6cbc015104f9c42e36539b35ef974b26122d9
IMSI	611050105799949	SHA256	5c0c2c3675e41471d746fbe721e435e9ac4cdcba3406d78be89e5a87cab2d5f9
IMEI	865760021379230	SHA256	1341a37ec42db25140af0c6f7cc6e28b2b45f5d66832f6337fd6995e0d1f1582

Impossible to extract phone no and other
private information from encrypted
values