

# RecureShare

Internet-less application distribution mechanism  
for internet-less emergency communication systems

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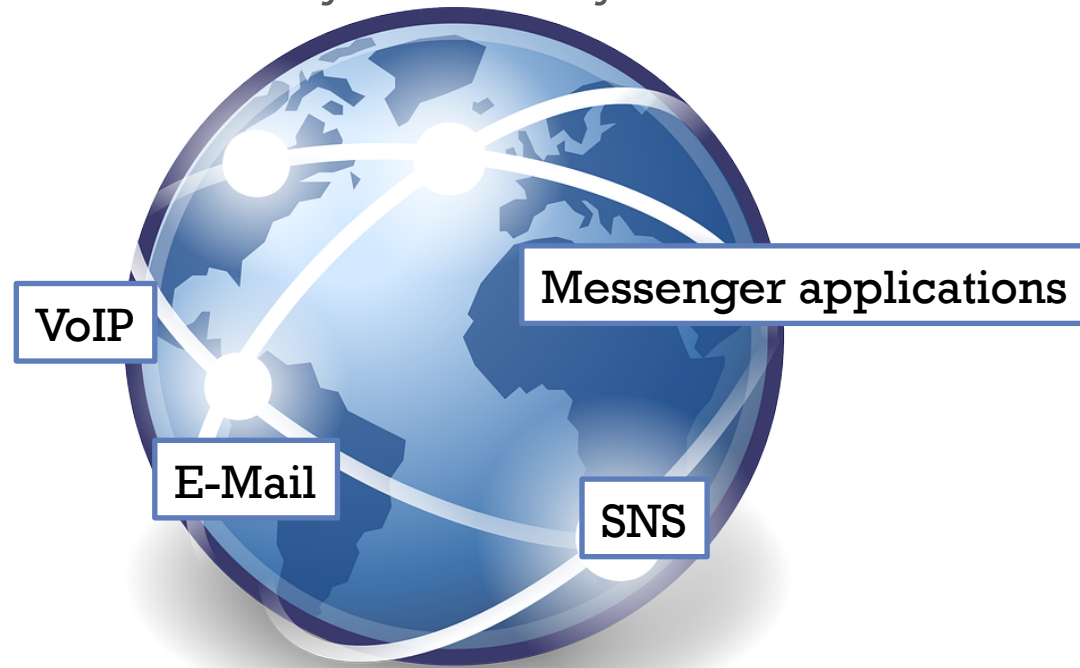
1. Background and Related Works
2. Problems
3. Proposed System
4. Evaluation
5. Conclusion and Future Work



1. Background and Related Works

# + Background

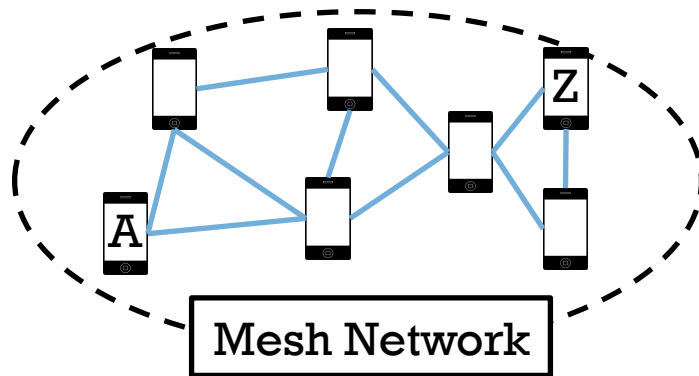
- People can use the mobile broadband Internet anywhere and anytime.
- Many communication systems rely on the Internet



➔ What should we do in case the Internet is unavailable during disaster situations?

# + Communication app in disaster situation

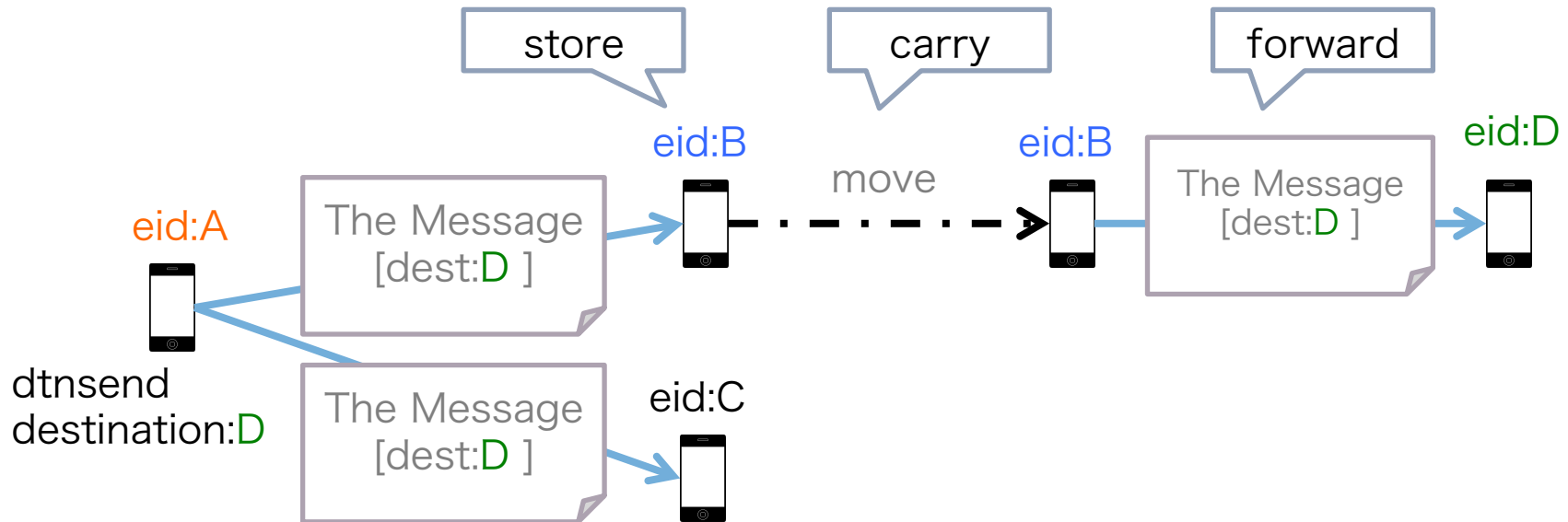
- FireChat (Open Garden Inc.)
  - Chat application without the Internet
  - Constructs a mesh network using Bluetooth
- Was used during the student demonstrations in Hong-Kong (2014)
  - Gov't disabled mobile networks
  - Used by 30,000++ people



# + Internet-less communication technology

- Delay/Disruption Tolerant Networks (DTN)
  - Technology that tolerates physical network disruption.
  - Each node has an Endpoint ID (eid)
  - Store-carry-forward mechanism

Internet is unavailable



# + DTN Application

## ■ IBR-DTN

- Open source software for Android
- Available in the Google Play Store

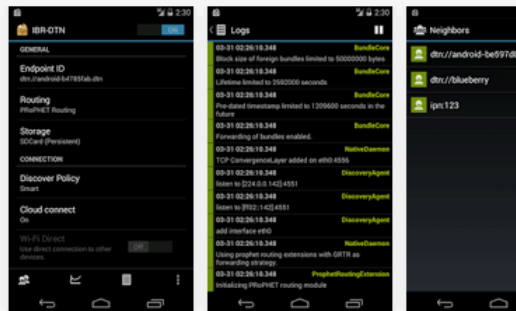
Google play

**IBR-DTN**  
IBR, TU Braunschweig - 2014年6月14日  
通信

インストール

★★★★☆ (86)

+98 Google でおすすめる



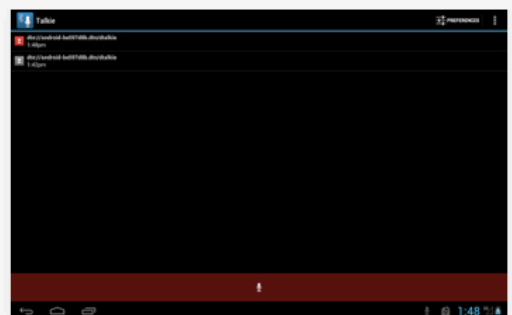
Google play

**Talkie**  
IBR, TU Braunschweig - 2014年3月31日  
通信

インストール

★★★★☆ (153)

+192 Google でおすすめる



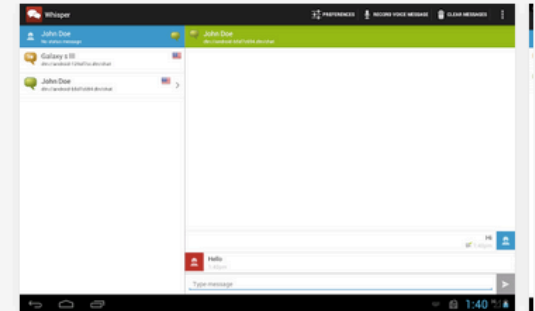
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IBR, TU Braunschweig - 2014年3月31日  
通信

インストール

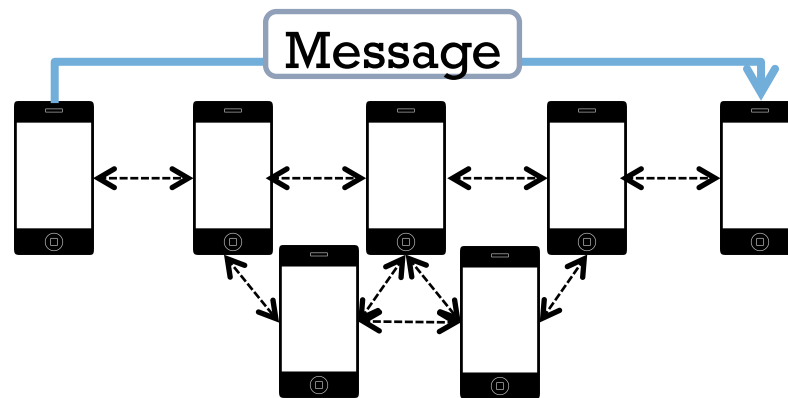
★★★★☆ (74)

+134 Google でおすすめる



# + Relay-by-Smartphone (Tohoku University) [1]

- Mobile terminals relay messages without the internet
  - Automatically switches between DTN and MANET
  - Test Application allows long distance communication (1.55 mi)



MANET (Mobile Ad-Hoc Network)

1. Background and Related Works
2. **Problems**
3. Proposed System
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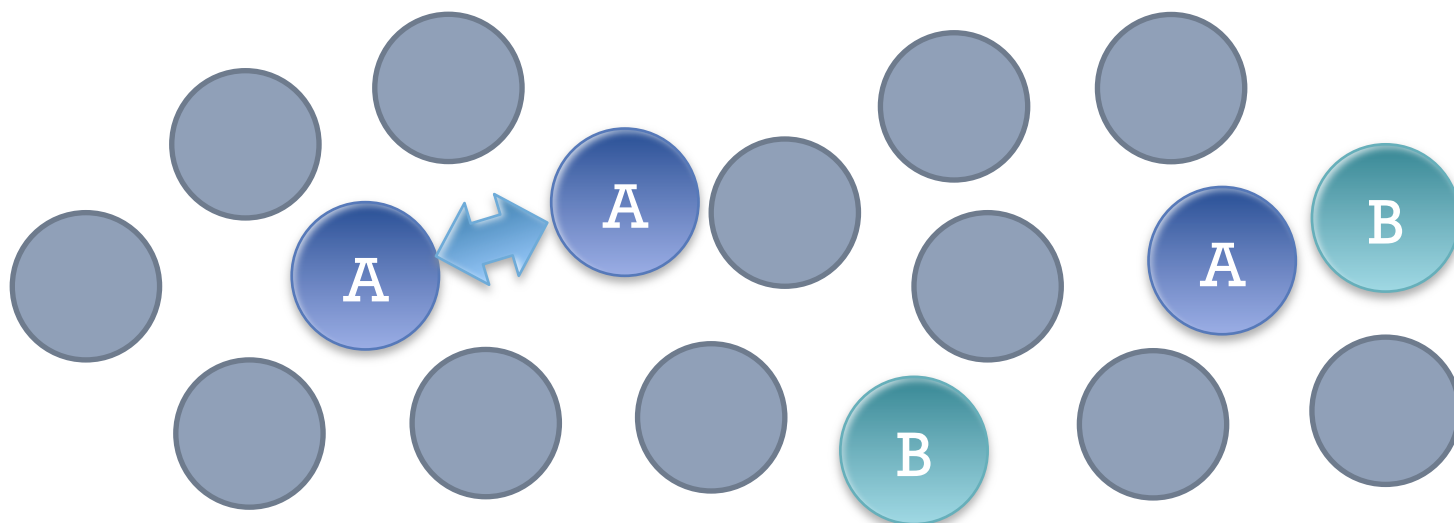
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2. Problems



## + Required condition of internet-less apps.

- Disaster evacuees must have installed apps prior to the disaster



## + Past approach

- Twitter in disaster mode[1]
  - ad-hoc communication by DTN for disaster situation
- To attach disaster communication function to popular apps
  - Apps for disaster will be installed before disaster occurs
  - We can't obtain this app after disaster occurred.

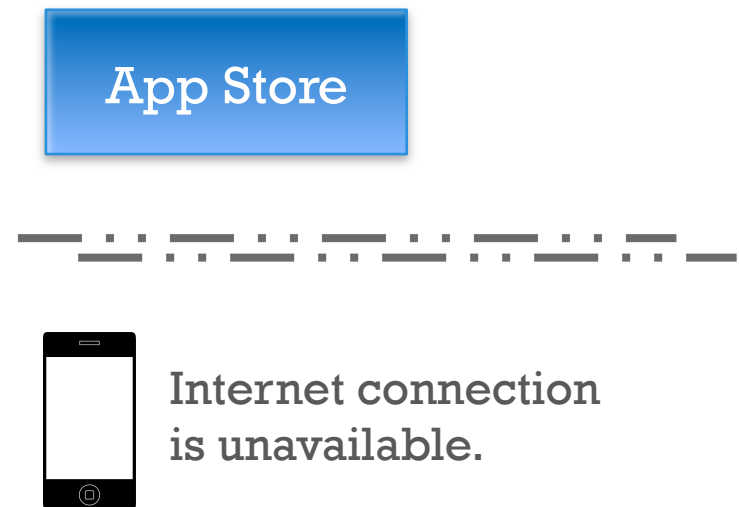
# + To obtain the smartphone apps

- Download from App Store
  - Requires Internet connection

In usually situation



In disaster situation



**Apps for disaster is not available in disaster situation.**

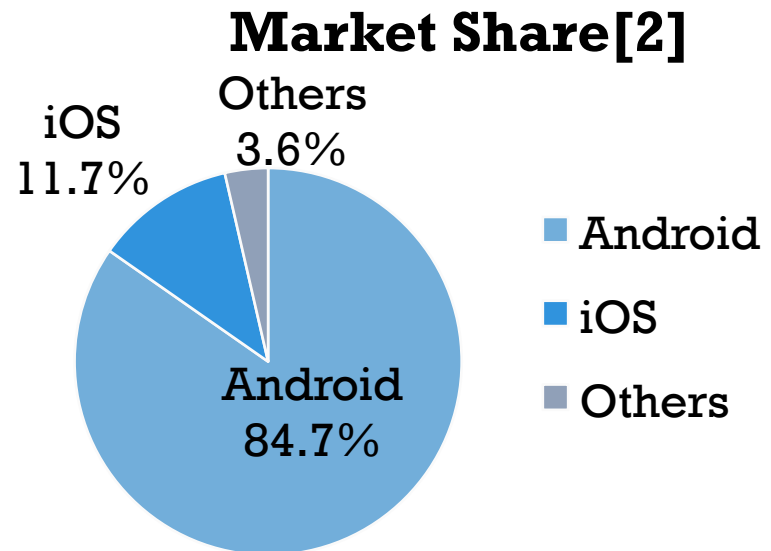
# + How to get the smartphone apps

## ■ iOS (Apple)

- Download from App Store
- Distribution function for developer device
- **Requires Internet**

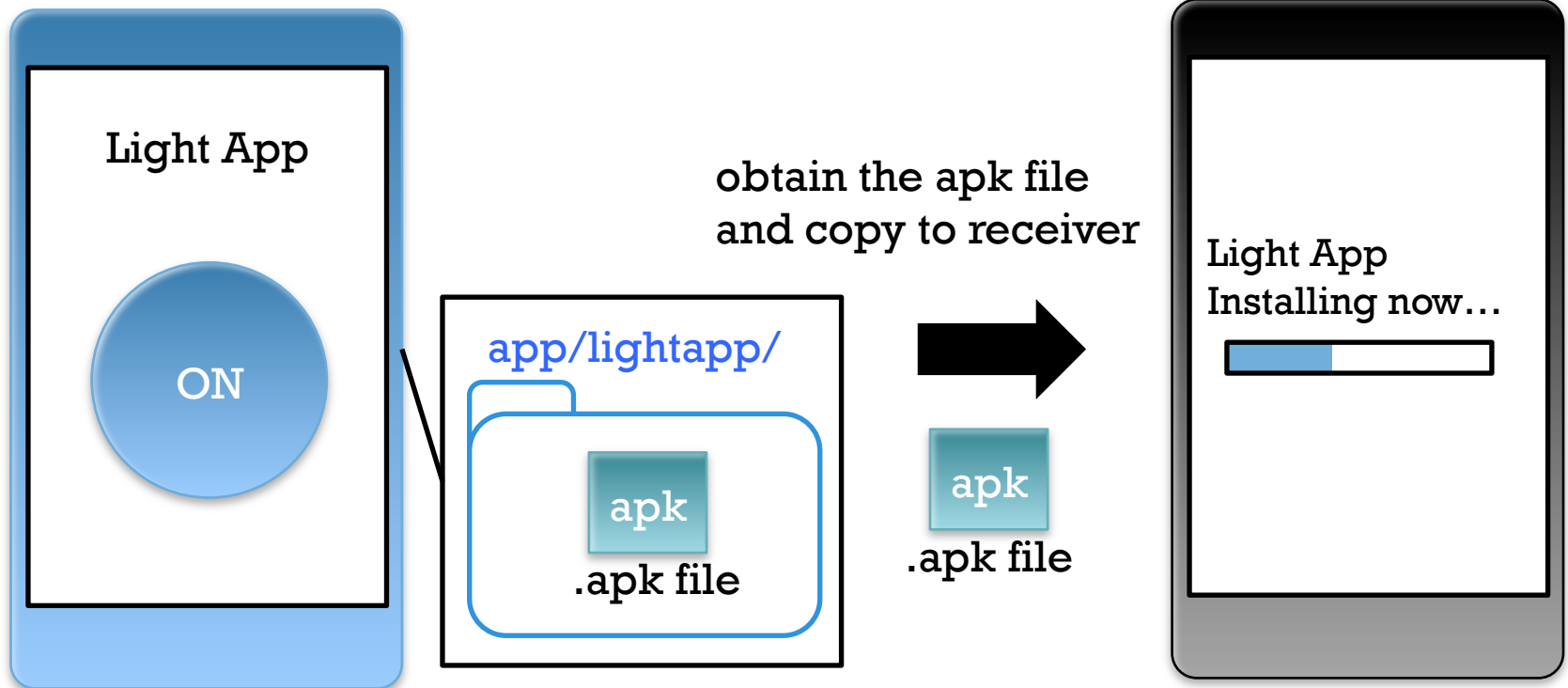
## ■ Android (Google)

- Download from Play Store
- Other app stores
- **Installation using apk files**



# + What is the apk file?

- The package file of Android application
  - can be installed without the Internet
- The apk file is placed on system directory



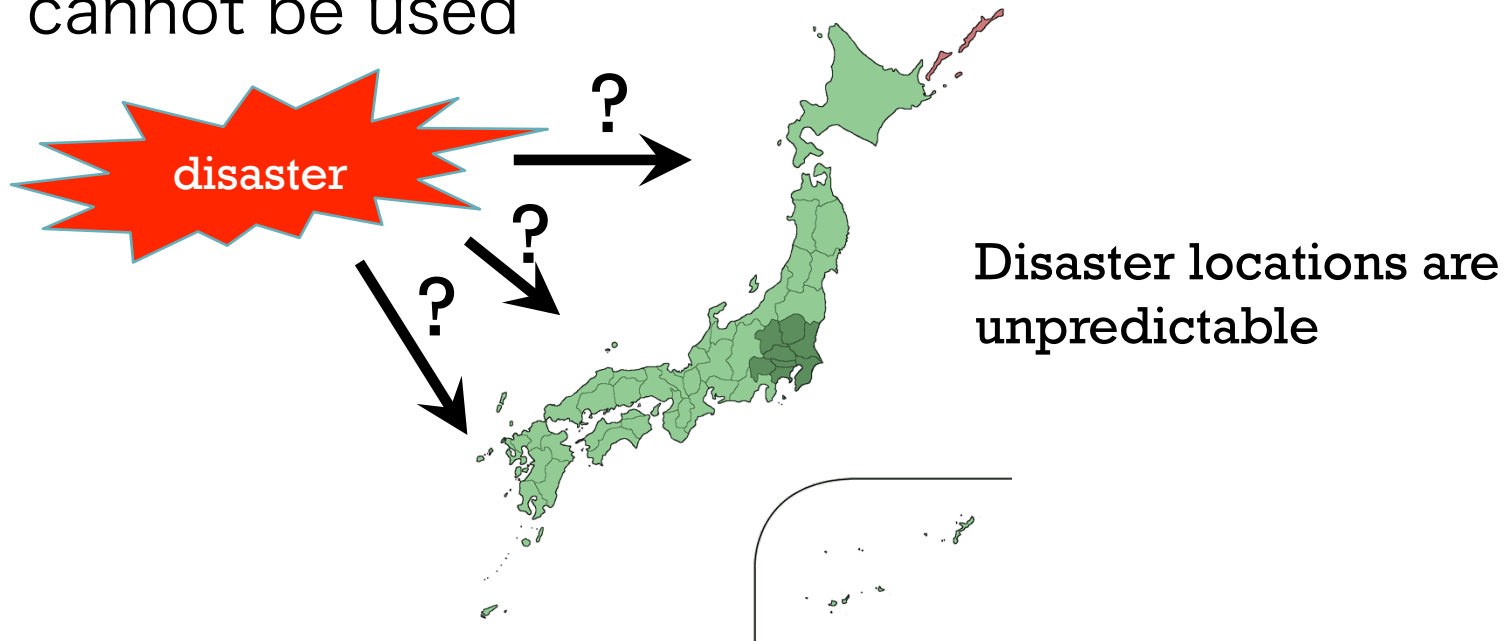
## + Where do we get internet-less apps

### ■ Where we obtain the apps?

- Where we should place the apk file distribution facility?

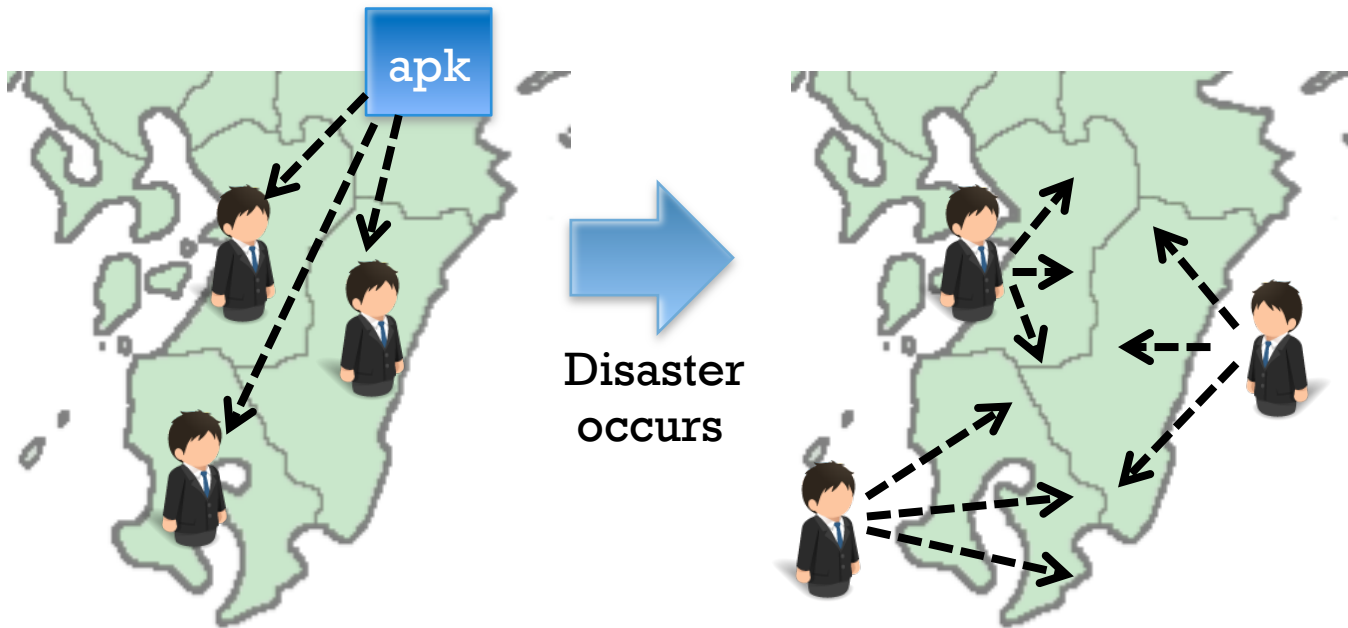
### ■ How we obtain the apps?

- The special application to receive the apps cannot be used



# + To get the apk file from others

- Government officer prepare the apk file in advance.
- Disaster evacuees get emergency applications from them.



prepare the apk file in advance

They distribute the apk file

# + How to transfer apk files

## ■ To use existing transfer function is difficult

### ■ Physical storage media

Requires special App

- Android does not have file management applications

### ■ Wi-Fi direct or Bluetooth

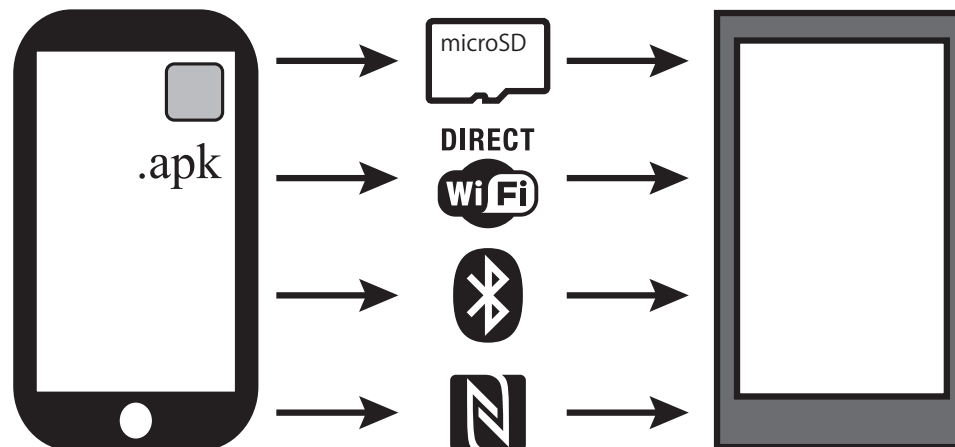
Requires special App

- Android does not have file receiving applications

### ■ NFC (Near Field Communication)

Inefficient distribution

- Transmission speed is quite slow
- one-to-one communication





## + Requirements

1. Doesn't use Internet
2. Can distribute the apk file to users
3. Doesn't need a Receiver application

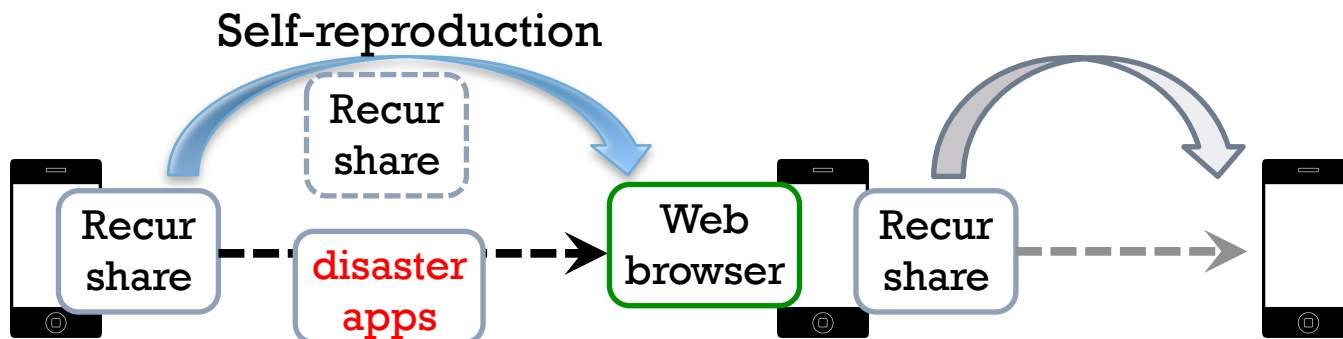
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## 3. Proposed System

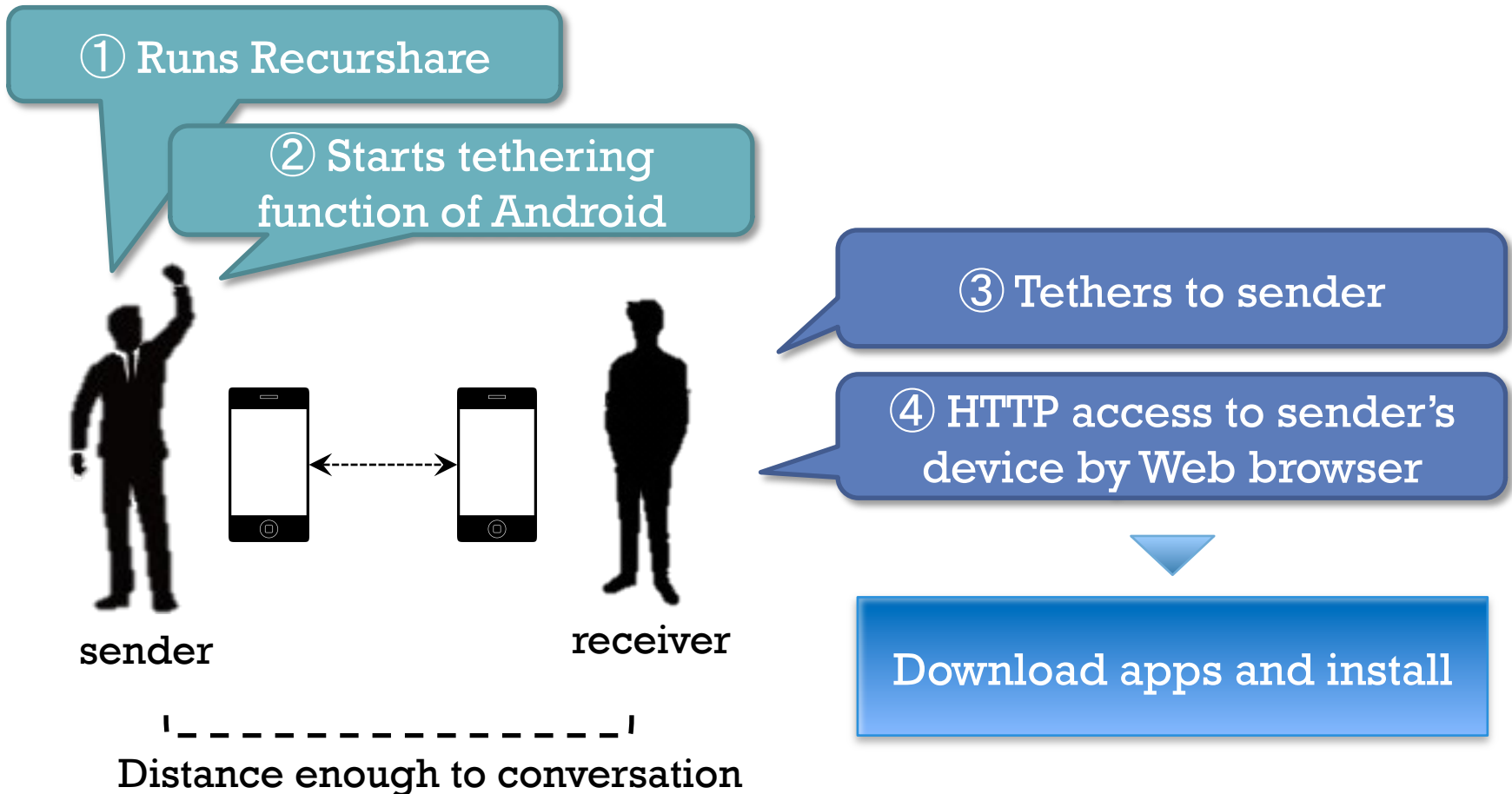
# + RecurShare

- RecurShare distributes emergency applications recursively.
- Sending apk file using HTTP protocol.
  - Only requires a Web Browser
- A recursive distribution mechanism based on a self-reproduction technique.



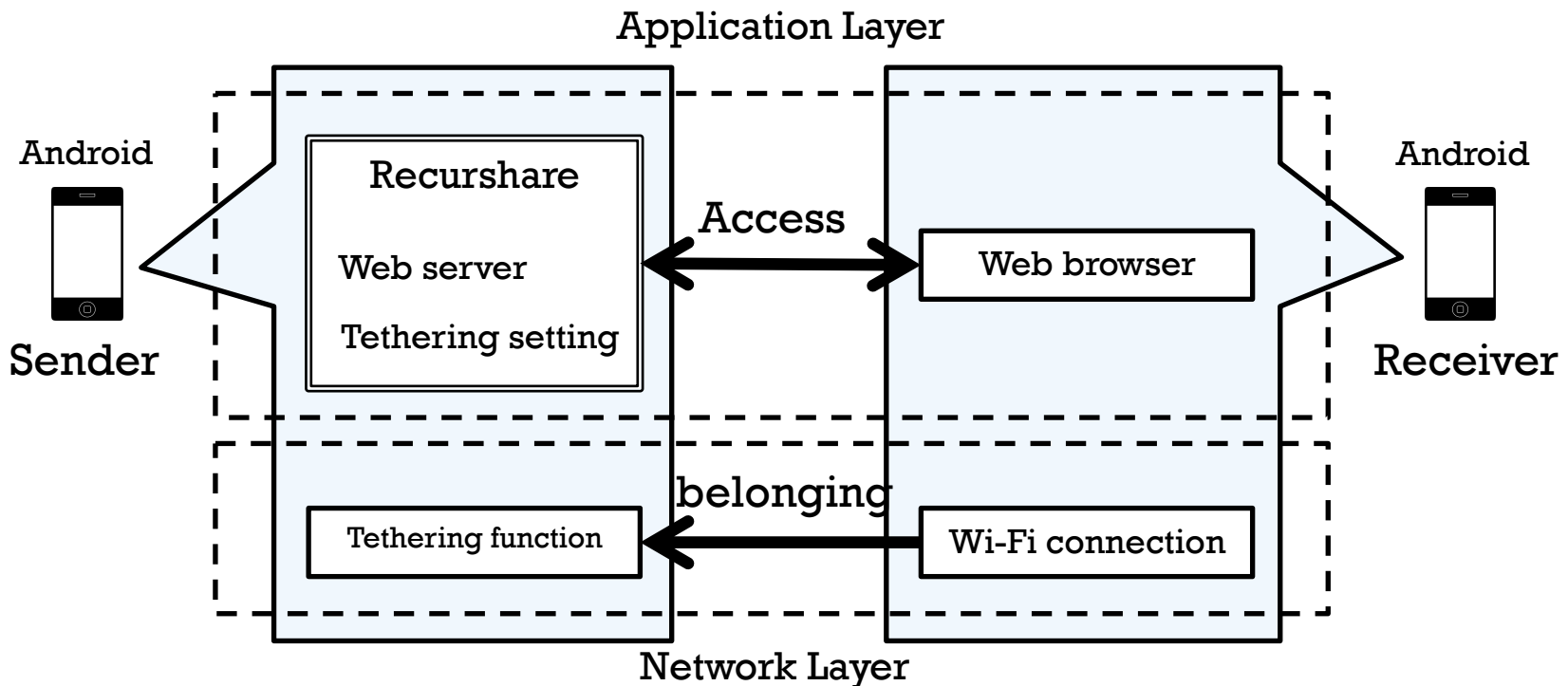
# + The flow of apps distribution

- All operations are shown on RecurShare



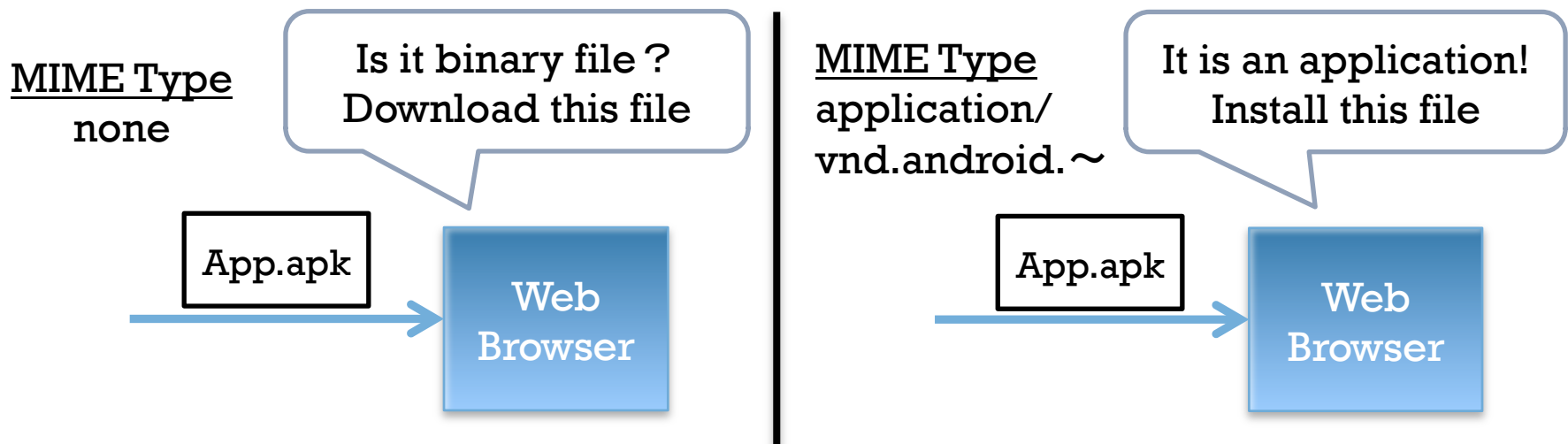
## + How users belong to same network

- The tethering function of Android
  - Access point with DHCP.
    - IP Address of Base unit is fixed as 192.168.43.1/24



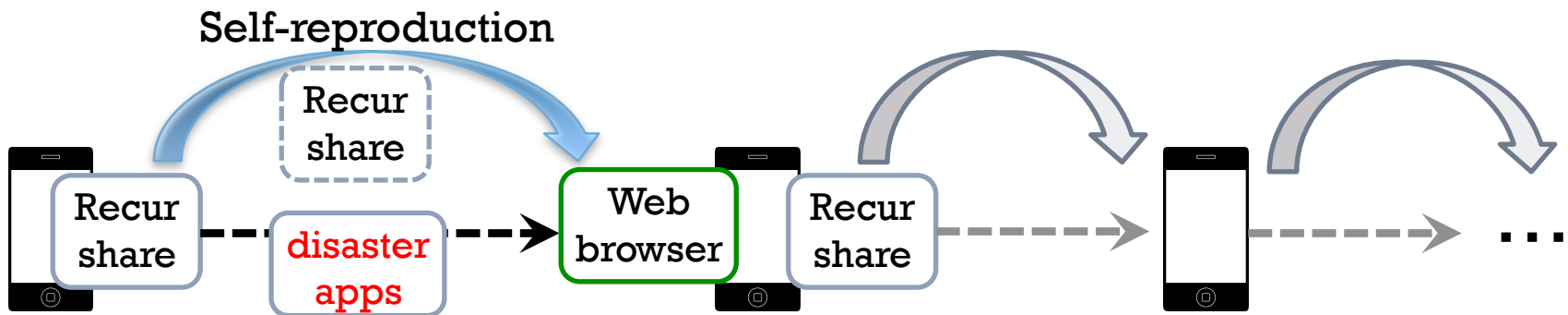
# + Transfer the apk file by HTTP

- Using [NanoHttpd](#) as Web server
  - lightweight Web server (JAVA)
- Custom MIME type
  - We have customized MIME type to change behavior of web browser.
  - This Custom MIME type that urges user to install application to Android
    - `application/vnd.android.package-archive`



## + Application distribution

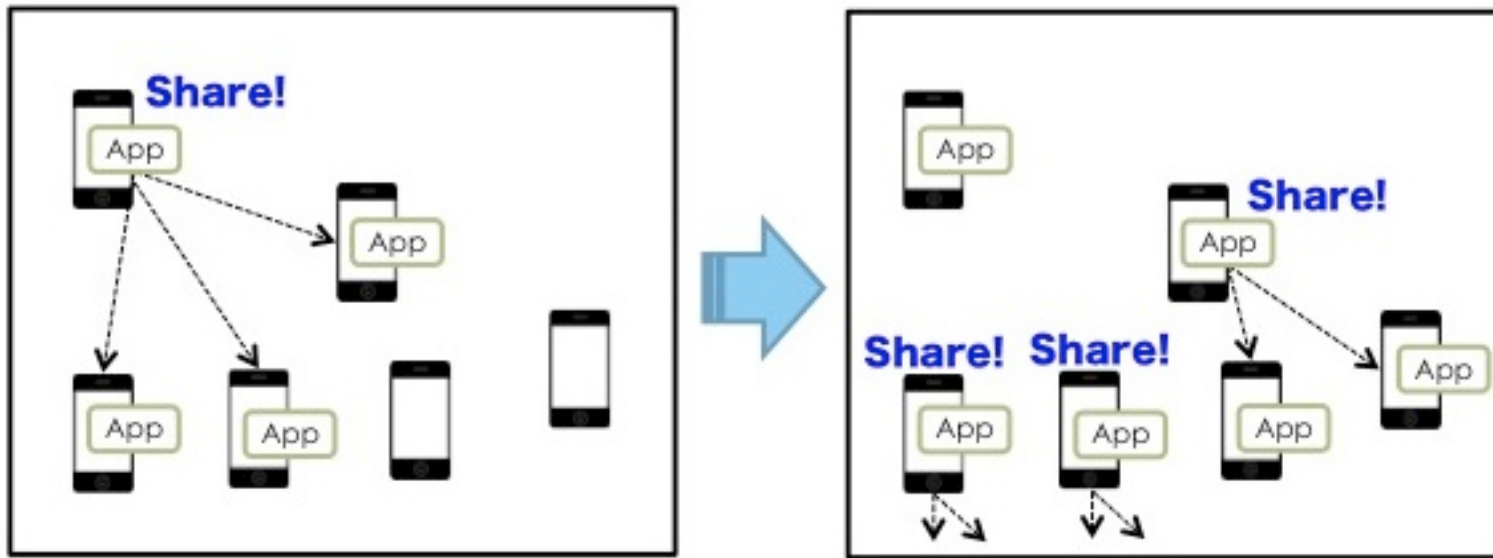
- Recurshare needs to distribute apps widely.
- Self-reproduction
  - Recurshare duplicates and sends its apk
  - Recurshare population increases.



Receiver becomes to sender at next time.

# + Application Distribution

- Recurshare can distribute one-to-many
  - Tethering function can connect to multiusers
  - Increases in geometric progression.



Receiver becomes to sender at next time.



# + First-time user support

- Recurshare must be beginner-friendly.
- Operational instructions are displayed
  - Reduces misunderstandings
- Simplified procedures
  - To prevent typing error
  - QR code

Receiver can connect to the following **SSID** by Wi-Fi.

**SSID** : Recurshare01

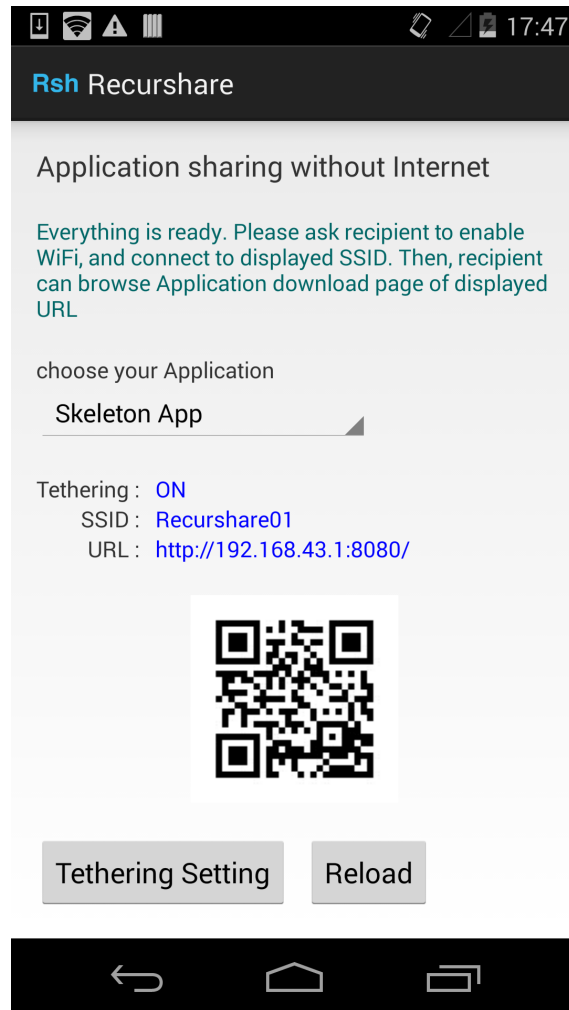
**URL** : http://192.168.43.1:8080



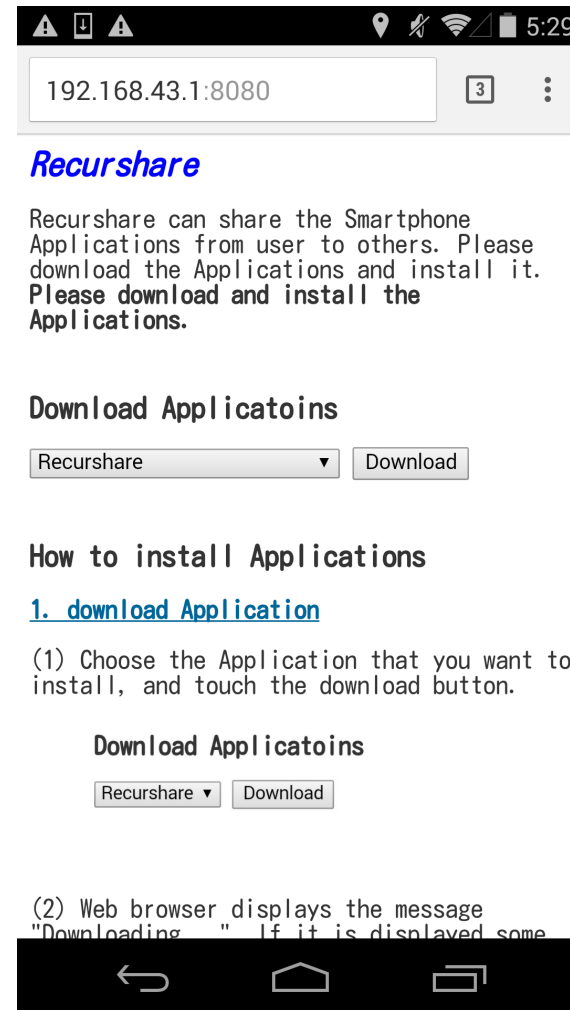
Ex ) The operational instruction  
for sender

# + Screenshot of Recurshare

## Recurshare (side of sender)

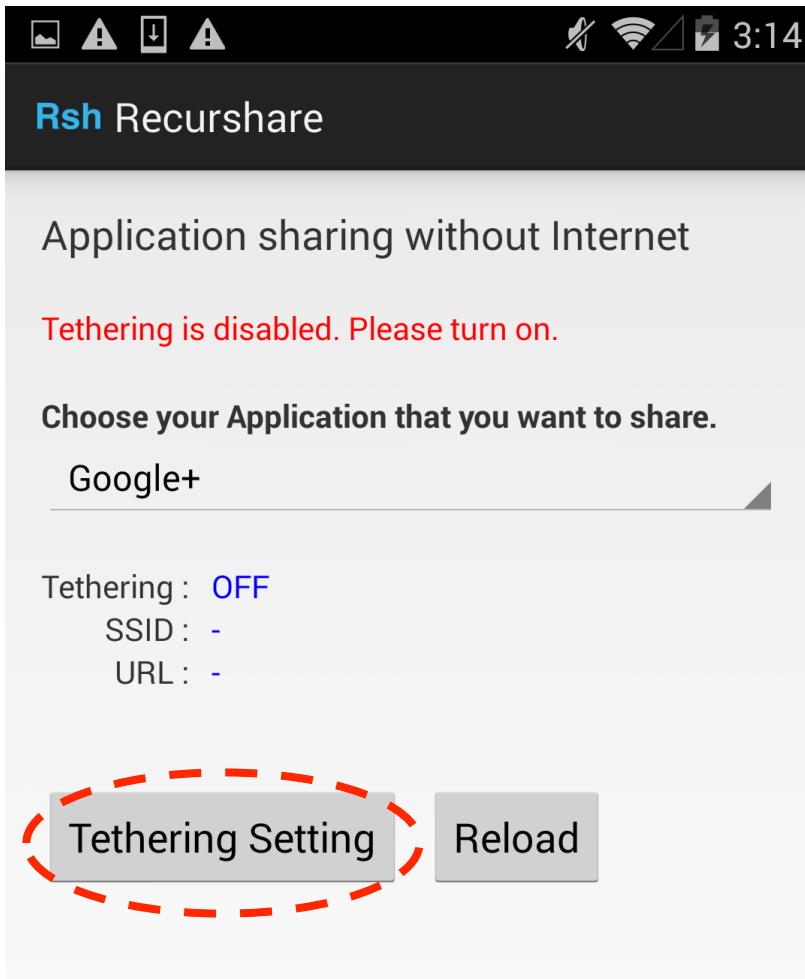


## Web browser (side of receiver)

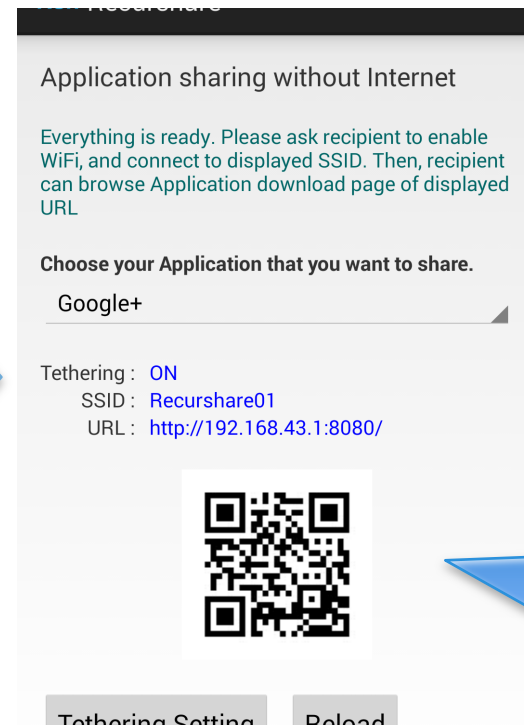


# + The tethering setting screen

Sender : Main screen



- Sender sets up tethering
  - ❖ switch to wait state after setting



SSID,  
 QR code,  
 URL

# + Wi-Fi connection

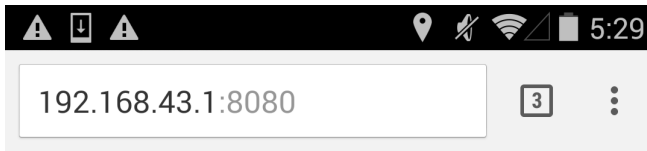
Receiver: Wi-Fi setting



- Receiver tethers to sender
- Sender tells the passphrase to receiver

# + Download page

## Receiver's Web browser



### *Recurshare*

Recurshare can share the Smartphone Applications from user to others. Please download the Applications and install it. **Please download and install the Applications.**

### Download Applicatoins

Recurshare ▾ Download

## How to install Applications

### 1. download Application

(1) Choose the Application that you want to install, and touch the download button.

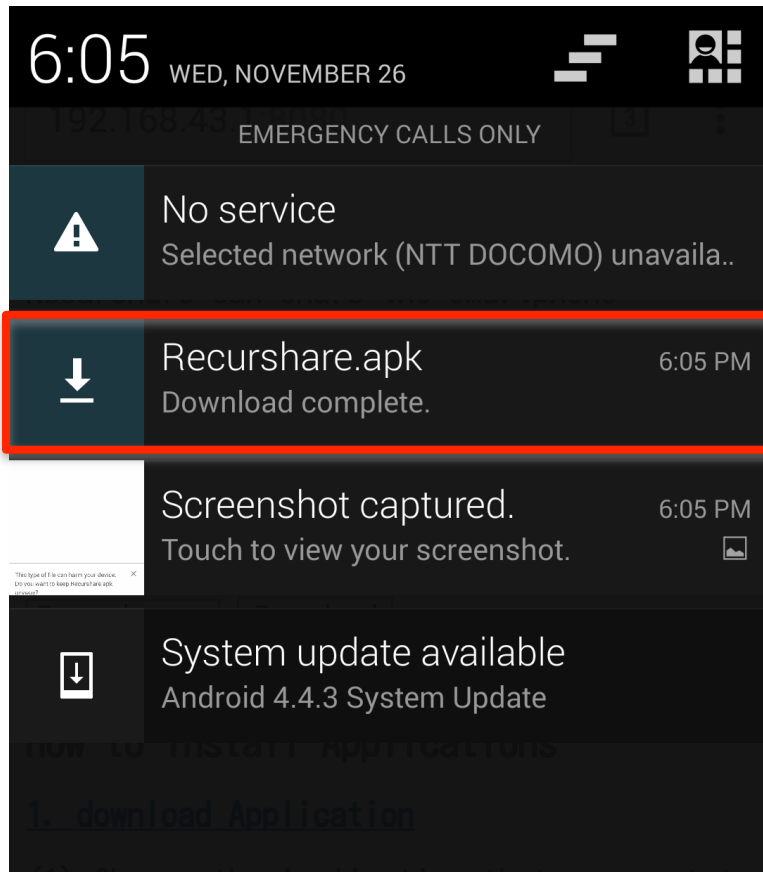
### Download Applicatoins

Recurshare ▾ Download

- Receiver accesses sender's IP address
  - 192.168.43.1/24
- Receiver chooses application

# + Download and install

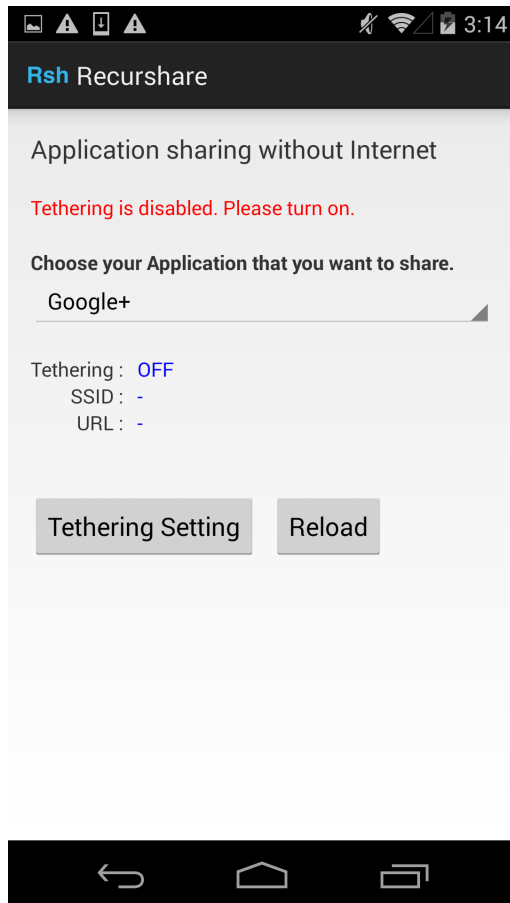
## Receiver's status bar



- Tap download notification
- Installation begins
- Permit installation of unknown application

# + Installation is finish

## Receiver : Main screen

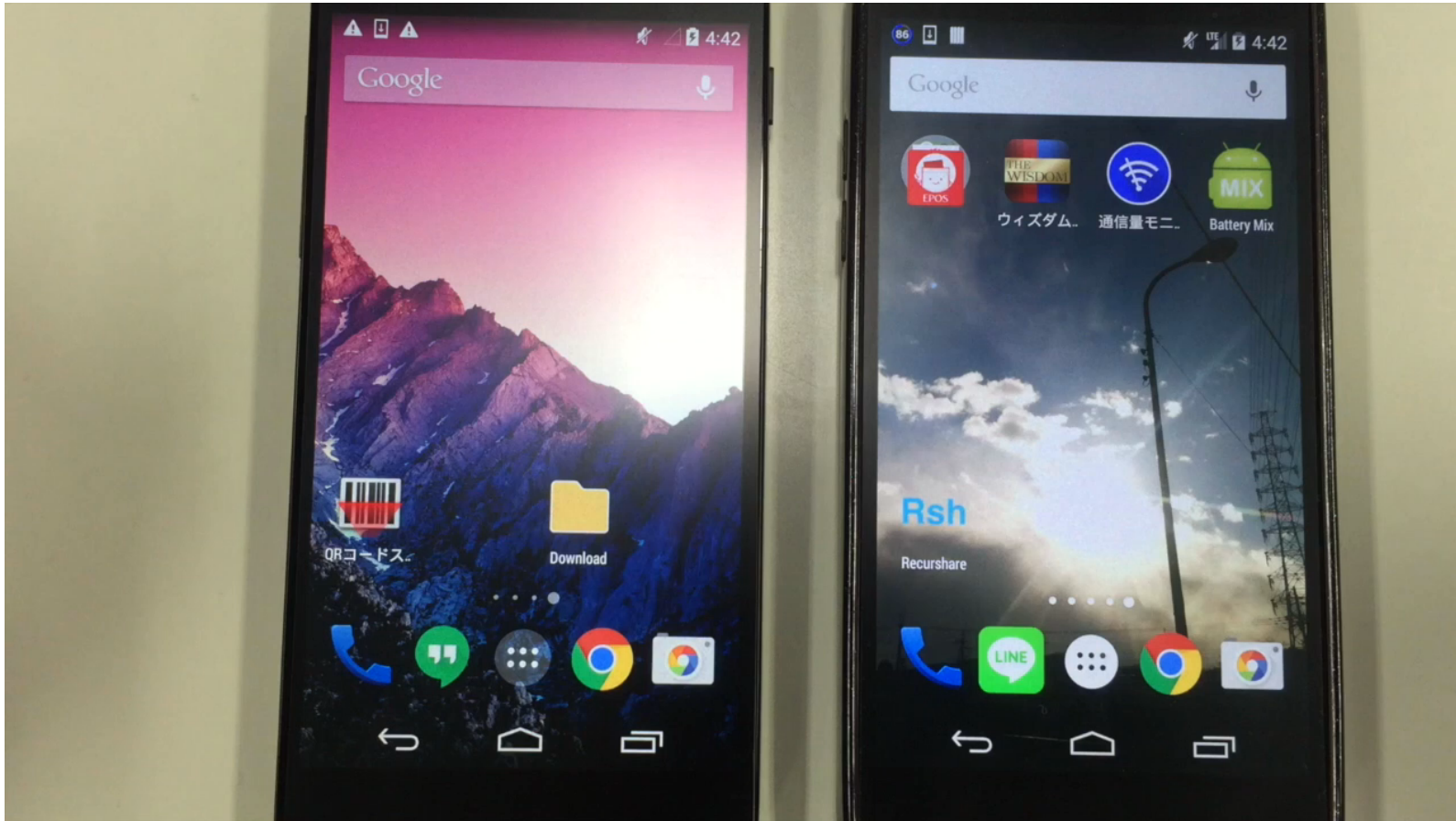


- This device became a sender

# + demonstration

receiver

sender



Receiver becomes sender



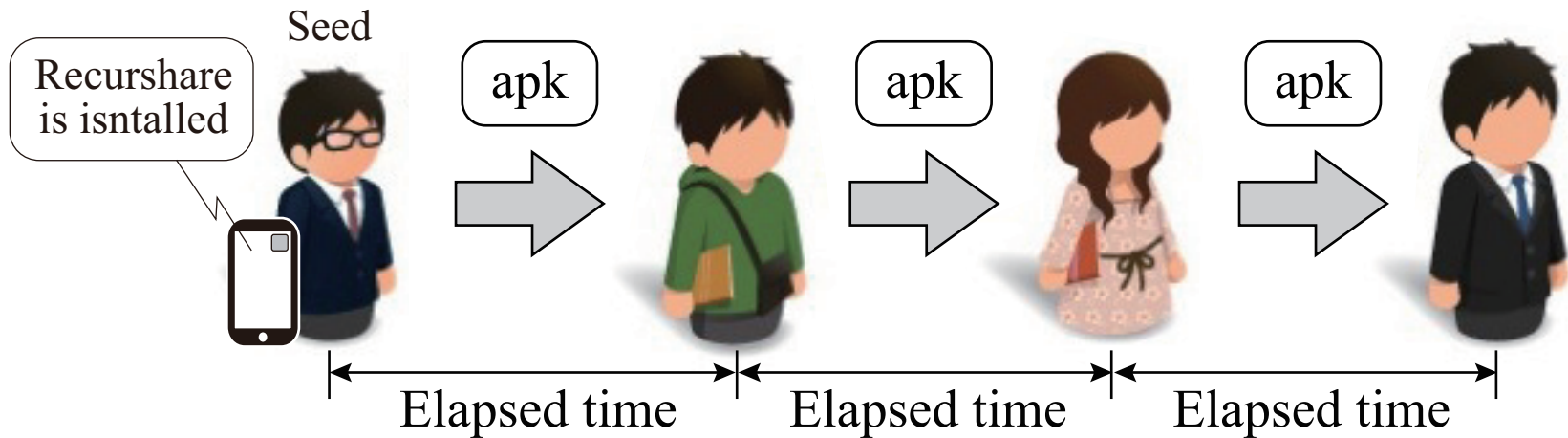
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4. Evaluation

# + Feasibility Evaluation

- Measure the time of distribution
  - Four participants who have no previous knowledge about Recurshare



- Took a questionnaire about feasibility of Recurshare

## + Results

- All the participants correctly distributed the application
- The average elapsed time is **111 sec**
  - Best time is 82 sec, worst time is 166 sec
  - Three participants used QR code
- We got some comments as results of questionnaire.
  - In a disaster, the usefulness is more important than the security risks.
  - I want to use Recurshare in normal situation. But I'm afraid to use this with unknown people.

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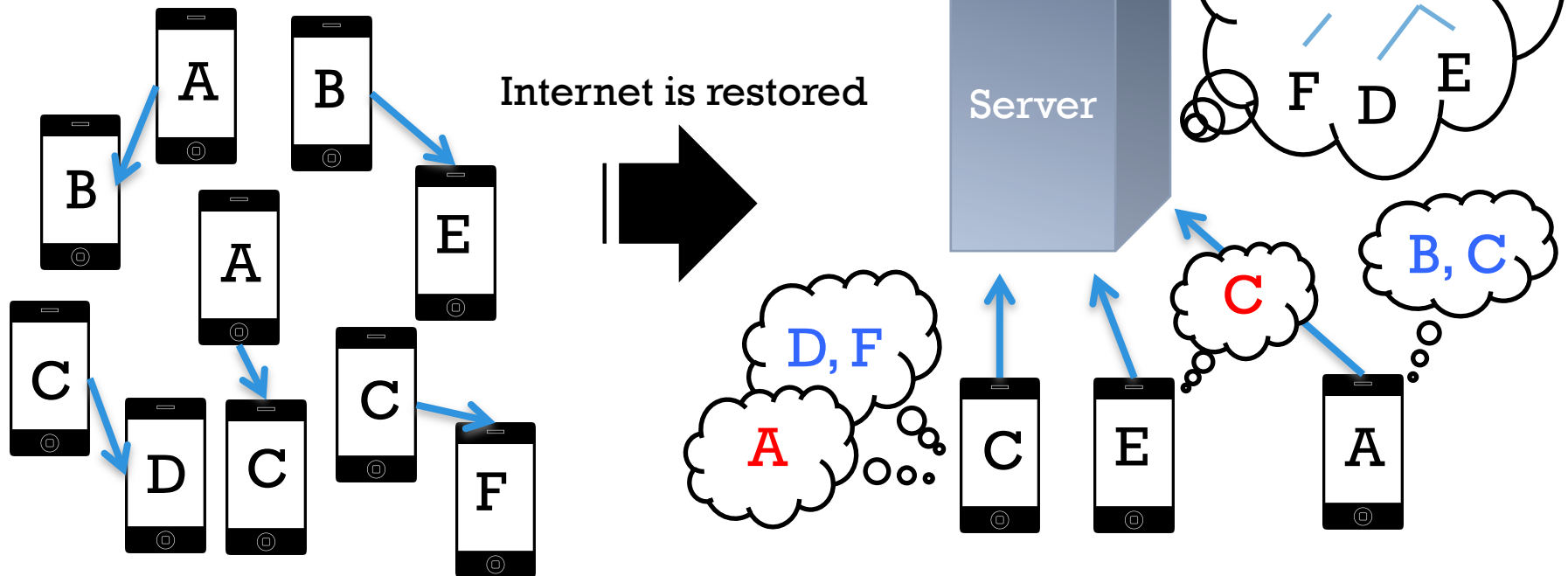


5. Future Work and Conclusion

# + Address security problems

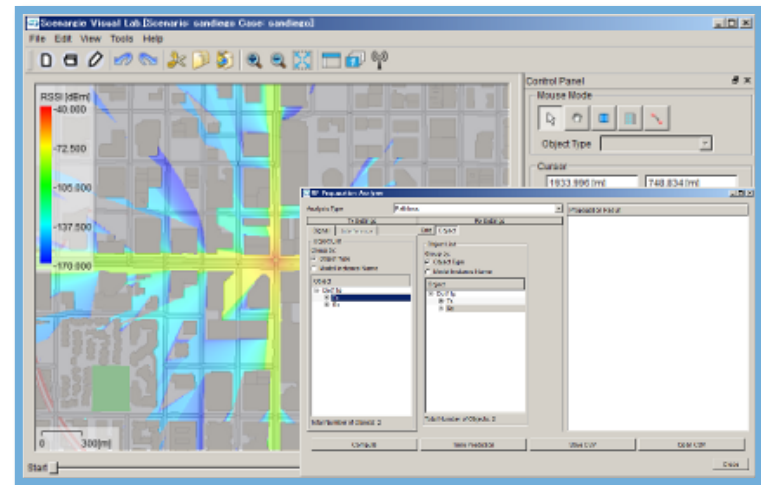
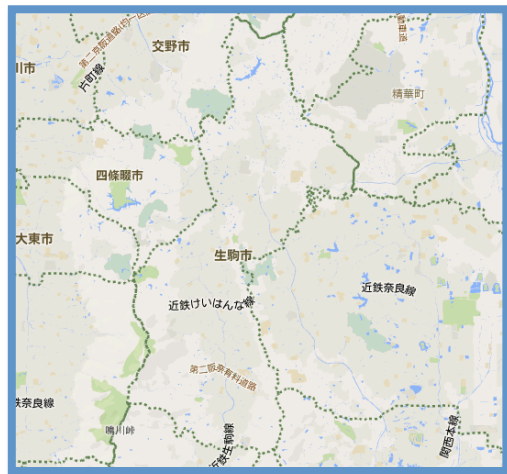
- Activation mechanism for the redistribution function
  - To prevent the undesired distribution of applications
  - Management of distribution routes

✘ Receiver informs own MAC address to sender



# + Simulation experiment

- Simulation experiment assuming real disaster
- Nara Province Ikoma
  - population : about 12 million people
  - Scenargie simulator Multi-Agent Extension



# + Conclusions

- mechanism for distributing Android applications that does not require the Internet
  - Proposed system : Recurshare
- All the experiment participants correctly operated *Recurshare* and distributed the application
- Future works
  - Prevent the security risks
  - Simulation experiment



Thank you for your attention