A Platform for IoT and Social Big Data

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Main theme

People as Sensors

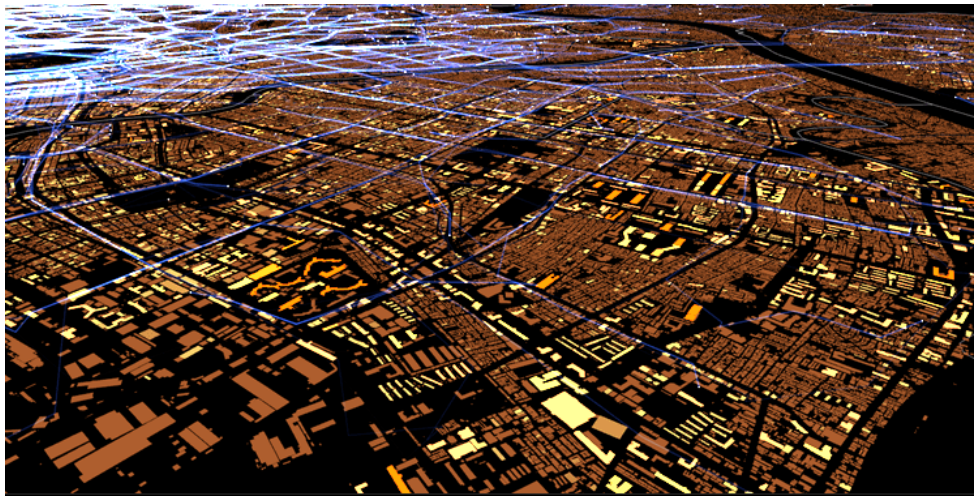
Keywords

IoT (Internet of Things) **Social Media (SNS)** **Big Data**

A Platform for **IoT** and **Social** **Big Data**

Background

- Trend: Big data applications with social benefits
  - Ex) disaster management, crime prevention, urban design, safety/autonomous driving
- IoT and Social media play important role as data sources.



NHK Special: “Disaster Big Data”

IoT and Social media

- IoT (M2M, Sensors, etc.) and Social media (Twitter, Facebook, flikr, etc) will not lead us to **Cold (Human-less) World**.
- Rather, make **people** more visible to ICT systems, i.e., better involved in Big Data applications.

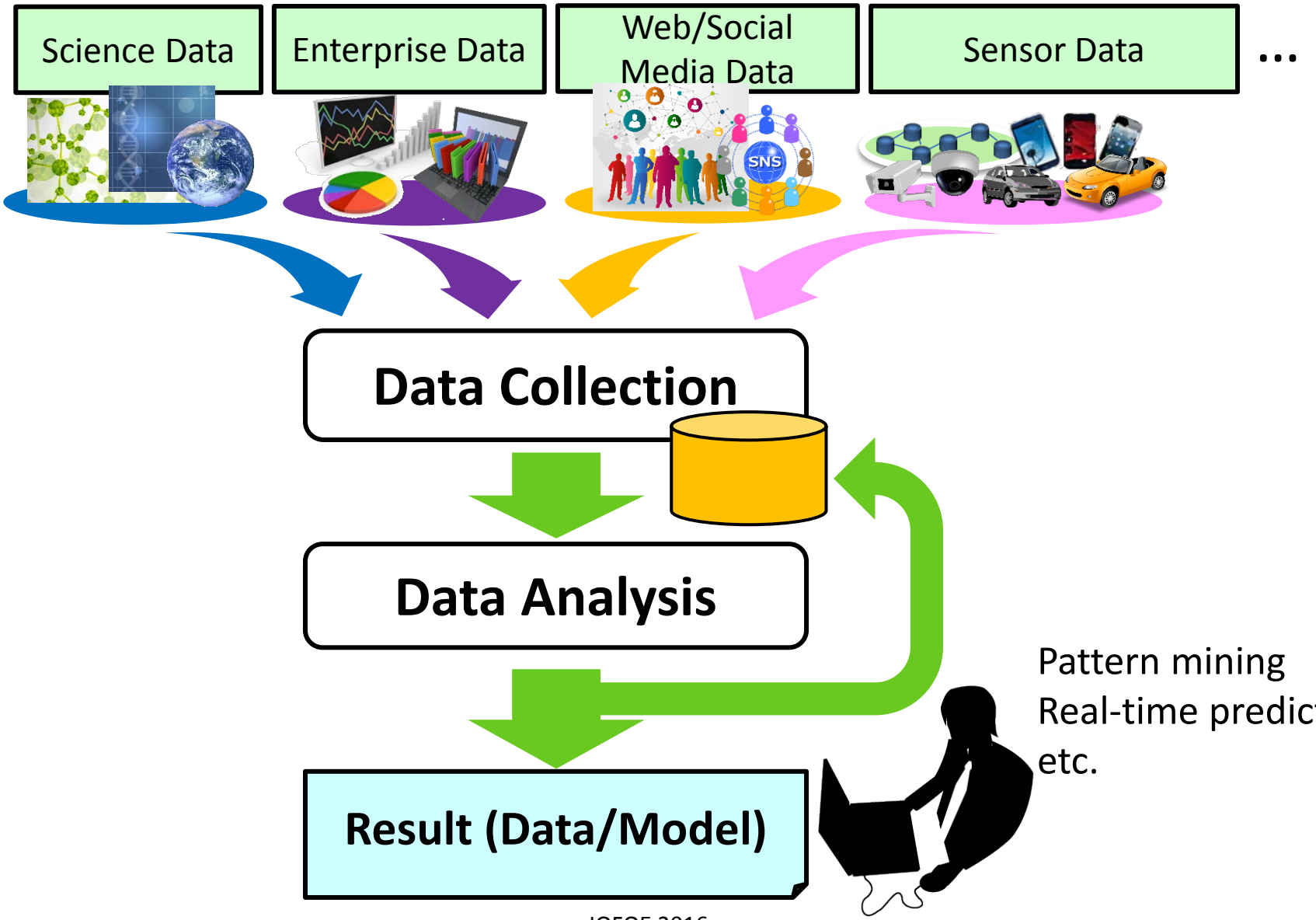
IoT

Mobility/Behavior tracking,
Situation (context) awareness, etc.

Social media

Event detection, Sentiment analysis,
Trend analysis, etc.

Flow of IoT/social big data analysis



Characteristic of IoT/Social big data

- IoT/Social media enable real-time real-world analysis
  - **Characteristic:** Data come from different data sources.
    Ex) sensors, service logs, social media data

- Two main challenges
  - Parallel computing framework for IoT/social Big Data
    - IoT data: have various spatial/temporal properties.
    - Social data: require heavy computation.
  - Open-data framework for sharing IoT/social Big Data

Frameworks for sharing IoT Big Data

- Existing frameworks
  - SODA (Keio Univ.): Framework for leveraging social big data for open smart cities
    - Tools for crowdsensing, time-series analysis, indoor positioning, etc.
  - TAREEG (Univ. Minnesota): Web-service for sharing a large volume and variety of spatial data
    - MapReduce-based techniques for efficient data processing
  - Many open data directories are available.

- **What are missing?**
  - No framework aims to share social media analytical results (**Social Sensor Data**), while useful for other applications.

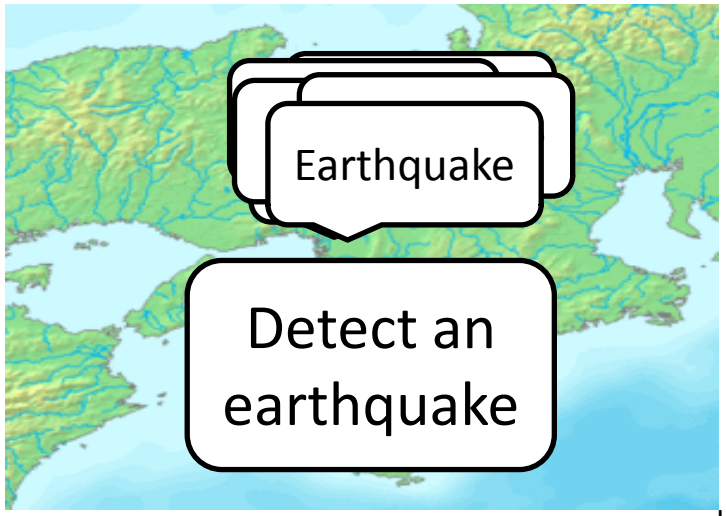
Social media as data sources

- Social media (e.g., twitter) are important data sources for detecting real-time events.
  - Current situation for disaster management:
    Over 20M messages posted during Hurricane Sandy and Haiti earthquake, only 100K messages were actually processed by the government agencies.

Motivation

- A large number of studies on Social media mining
  - Event detection, Trend analysis, Sentiment analysis, etc.
    Social Sensor !
  - **Most studies do not reuse the analytical results. (sole app)**
- **Goal:** Building a platform integrating (ordinary) sensor data and social sensor data
  - Reuse of social media analysis

Ex. Event detection from Twitter posts



Useful for developing Big Data applications using people as sensors.

Research challenges

- Creating social sensor data from Social media data

Sensor reading | *Location* | *Time*

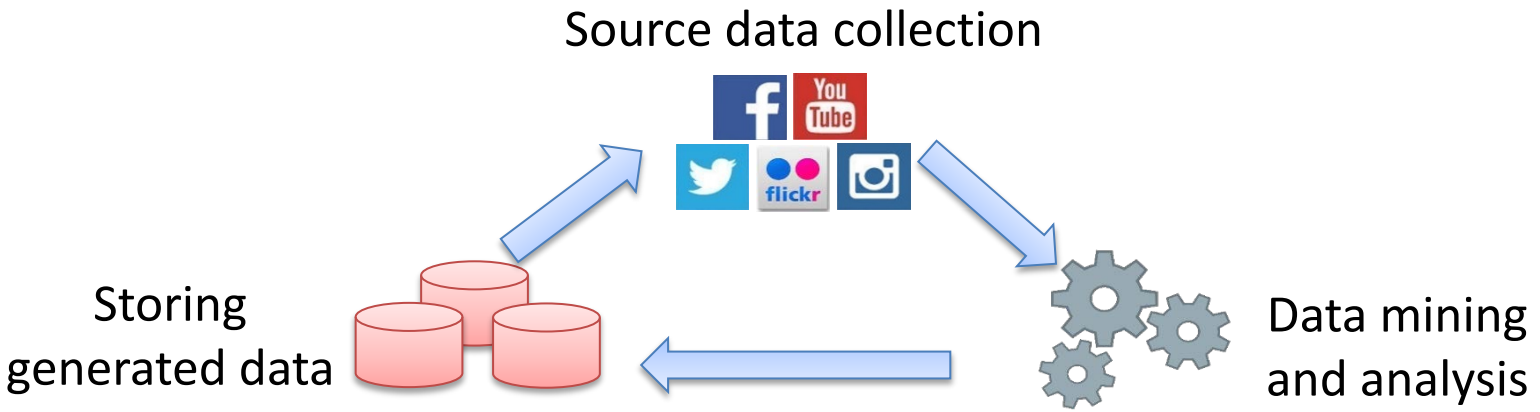
Social Media Analysis
Local event detection,
Trend/Sentiment analysis

+

Geocoding
Attaching location info.
to Social media data

+ **Time**

- Developing a framework for sharing (reusing)
  Social media analytical result (Social Sensor data)



Creating social sensor data from Social media data

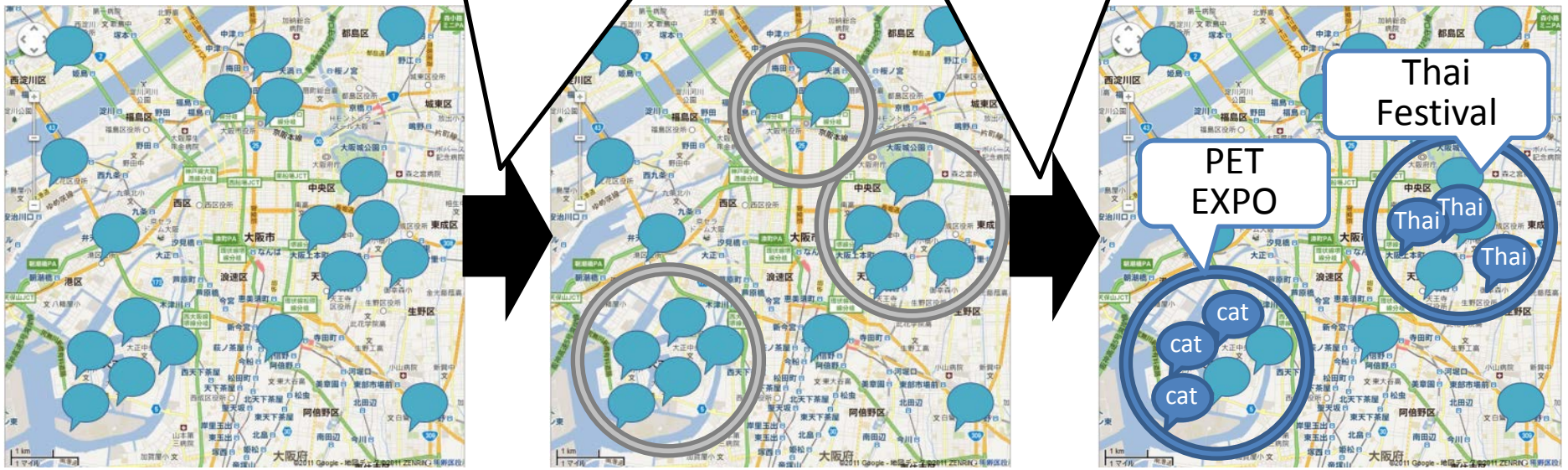
Creating Social Sensor data

Step 1: Generating Social Sensor reading

(Ex) Local event detection using geotagged tweets

Using spatiotemporal locality of geotagged tweets.

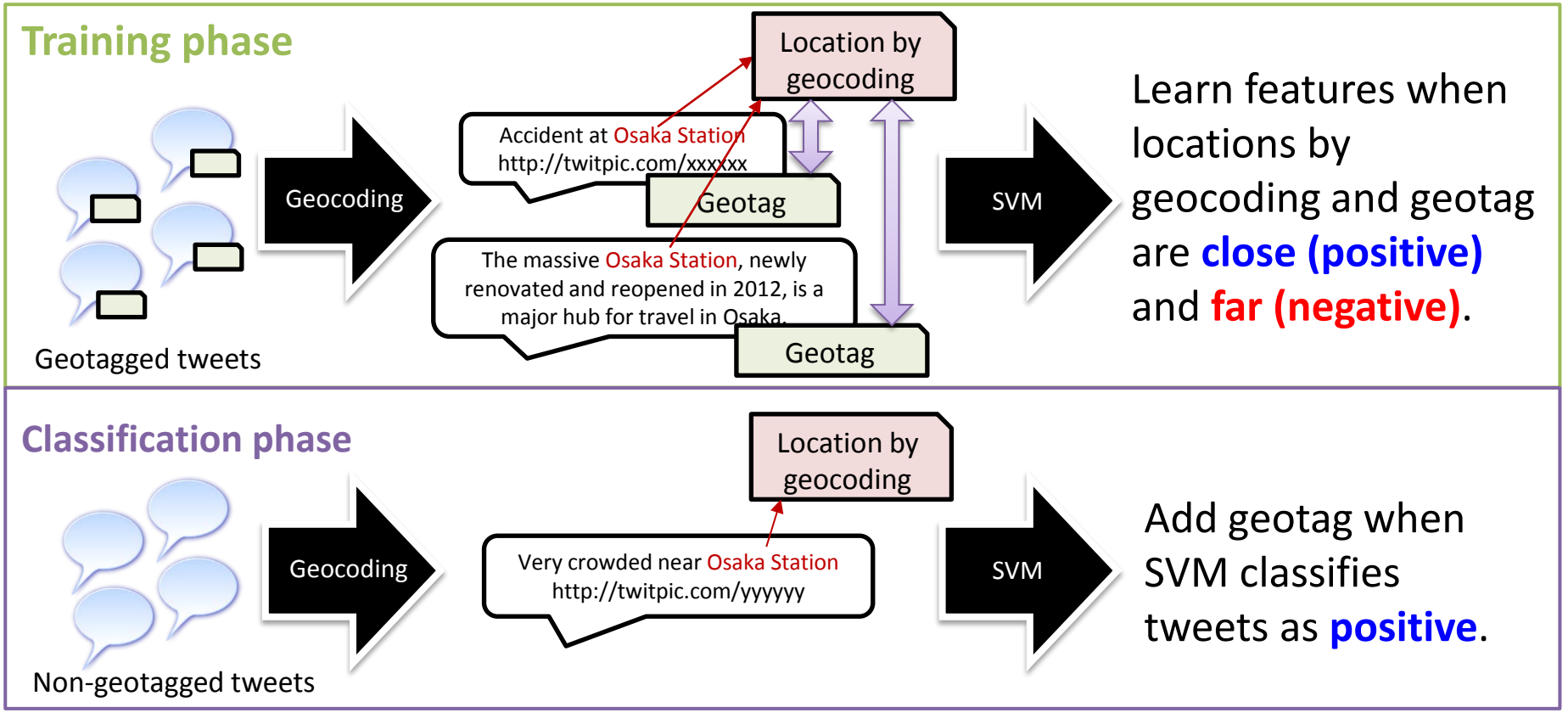
1. Find clusters where many users posted tweets in a certain period of time.
2. Detect key term co-occurrences in each cluster that represent the event.



Geotagged tweets

Creating Social Sensor data
Step 2: Geocoding (location identification)

Learn patterns when a place name in a tweet indicates user's location.
Massive geotagged tweets can be used as training data.



Reusing (sharing) results of Social media data analysis

How to reuse social media analysis?

- **Basic: Reuse of analytical result**
  - Challenge: Making result accessible (e.g., by search)
    - Formal (type) definition of the result as SS data
      Ex) SS name, data source, analytical methods.
- **Advanced: (Partial) Reuse of analytical method**
  - Challenge: Making procedures accessible and editable
    - Code sharing in an open source manner
    - Platform independent language

Code sharing (Open source)

SS Name: Local Event
Source: Twitter
Method: …

Social media data

Analytical procedure (program)

```
class createData(){
  public void getSNS(){
    function for getting
    SNS posts
  }
  ....
main(){
  ....
}
```

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Analytical result (SS data)

- L1, T1, Fire
- L2, T2, Surprise Live
- L3, T3, Car accident
- L4, T4, Guerrilla rain
- ⋮

Our idea: Dividing code into 3 files

- **Social Sensor Type Def. (SSTD):** XML
  Defs of function names for SS Data generation

```
getSNS()
analyzeSNS()
```

- **SS Function Def. (SSFD):** Java
  Procedures of the functions

```
public void getSNS(){
   SNS post getting procedure
 }
public object analyzeSNS(){
   topic generation procedure
 }
```

- **SS Output Config. (SSOC):** XML
  Output DB names and others

```
Database config.
etc.
```

Syntactic Parsing

Runtime Program for generating SS Data

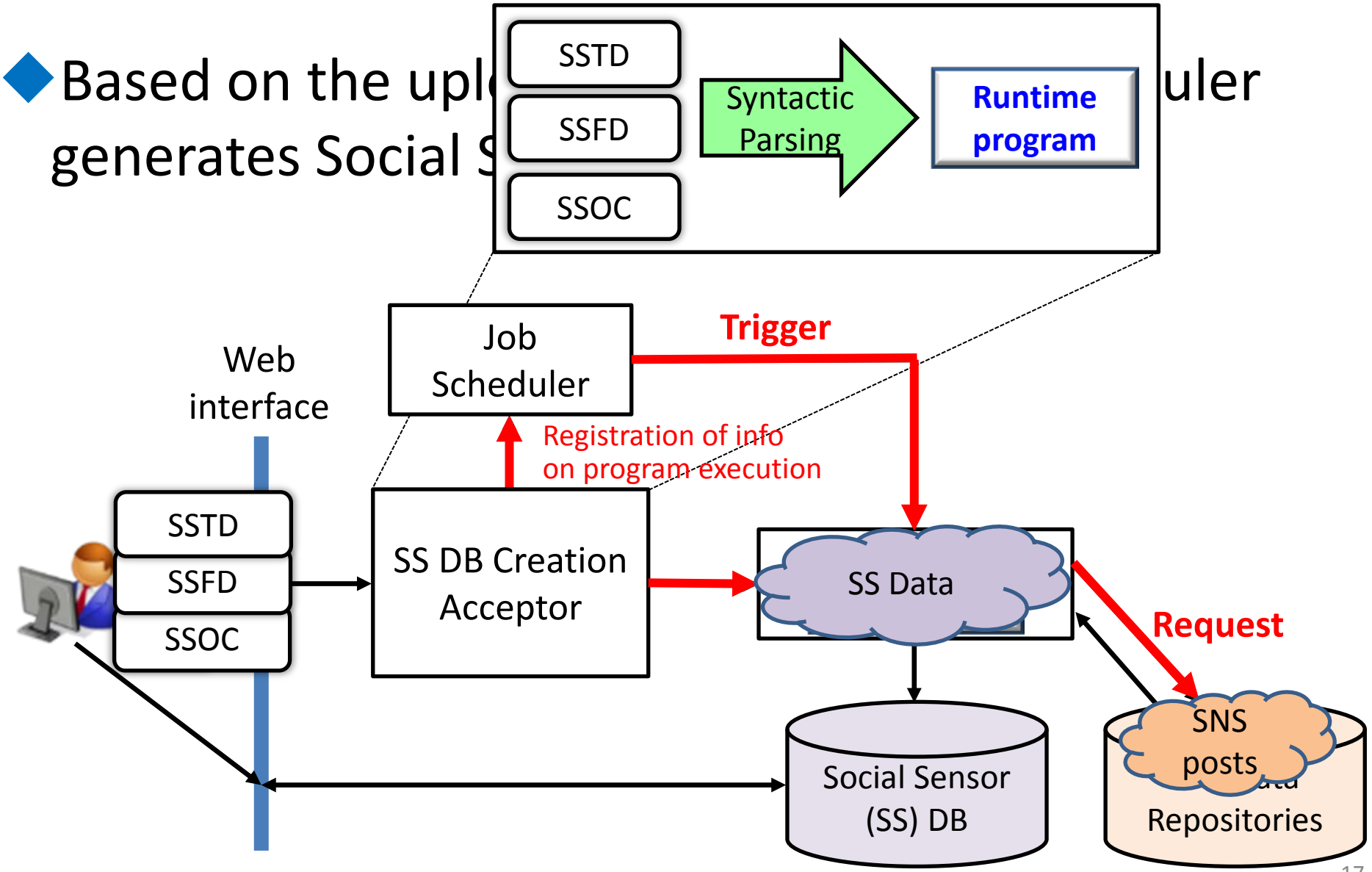
```
class createData(){
  public void getSNS(){
    function for getting SNS posts
  }

  public object analyzeSNS(){
    topic detection procedure
  }

  public static void main(){
    …
  }
}
```

Our idea: Platform to generate SS Data

- Based on the upl… uler generates Social S…



Summary: What we did so far

- Developed the minimum system functions to share Social Sensor data (Social media analysis).
  - i.e. program upload, execution, storing the result, making program and result available.

- Of course, many things to be considered…

Future directions (Open issues)

- How to collect missing data necessary for analysis?
  - **Solution:** **Crowdsesing:** Giving tasks for data collection to ordinary people.
  - **Benefit:** Useful for other applications
- Ownership/Copyright problem

  Who is the owner of SS data generated from multiple data sources, e.g., tweets? (message authors? analyst?)
  - **Solution:** Development of lows + **Data traceability**
  - **Benefit:** Encouraging **open data** and **data distribution**
- Credibility problem

  How can we know/guarantee the credibility of SS data?
  - **Solution:** Standardization of performance metrics + **automatic generation**
  - **Benefit:** **Making SS data comparable** + Quality improvement
- (Privacy problem)