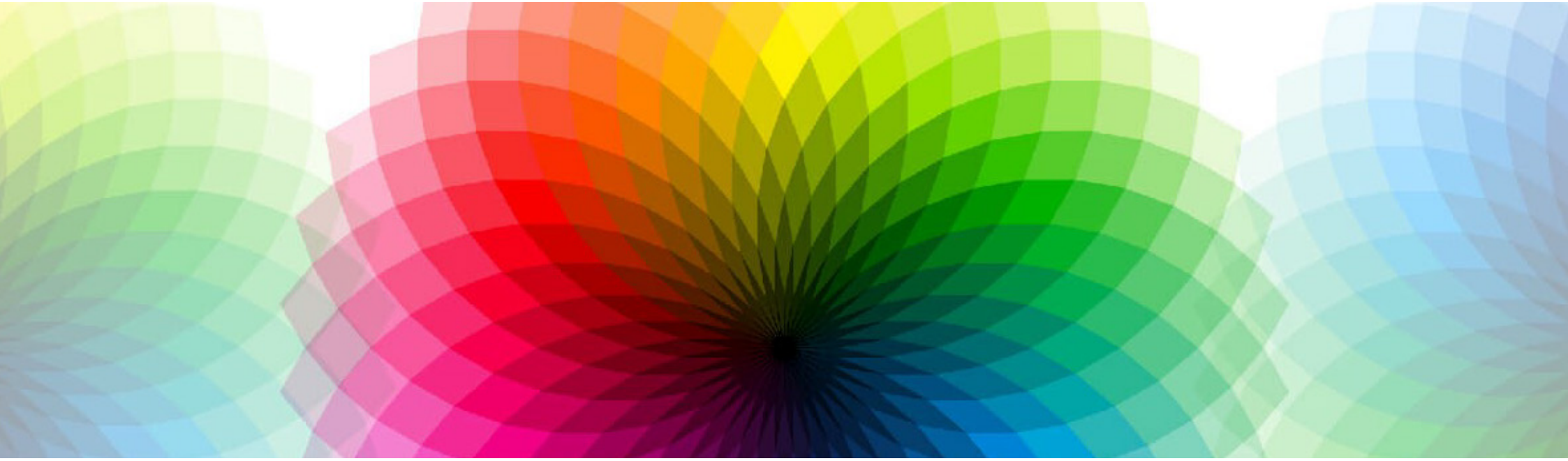


Towards Interoperable Smart City Platform

Takuro Yonezawa

Nagoya University, JAPAN

Levent Gurgen

Kentyou / UTA Founder

Takuro Yonezawa

Associate Professor, Graduate School of Engineering, Nagoya University (from Mar. 2019)

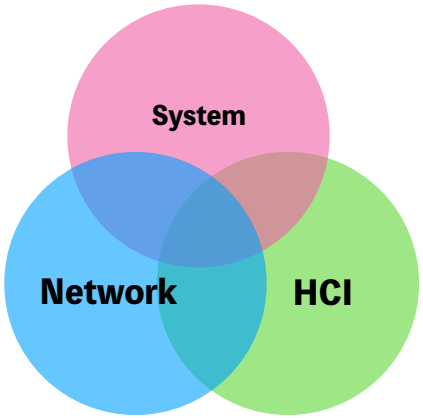
Ph.D from Keio University (2010)
Research Assistant Professor / Associate Professor in Keio University (2011-2019)
Visiting researcher / Carnegie Mellon University (2012)

Interest：Cyber-Physical System, Urban Computing, Middleware, Human-Computer Interaction

Room

Building
Campus

City



Understanding context of real world
Actuation and behavior change

People's behavior and reactions
When use of new technologies

Research and development of new technologies
with increasing the affinity and acceptance of the technologies for society

R&D Experiences in Smart City Project

2013-2015 2016-2018 2019-2020

I was in Keio Univ.

CLOUT

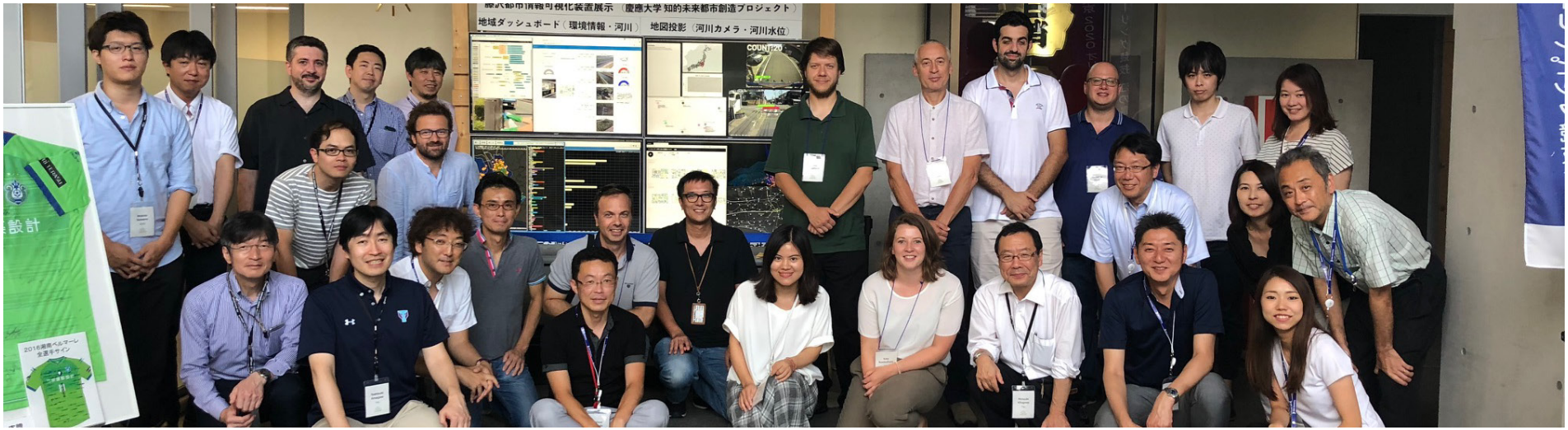
BIGCLOUT

Moved to Nagoya Univ.

CityFeder

Fujisawa, Mitaka, Tsukuba (Japan)
Santander, Genova, Grenoble, Bristol (EU)

Nagoya, Fujisawa (Japan)



R&D Experiences in Smart City Project

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I was in Keio Univ.

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R&D in Fujisawa City, Japan

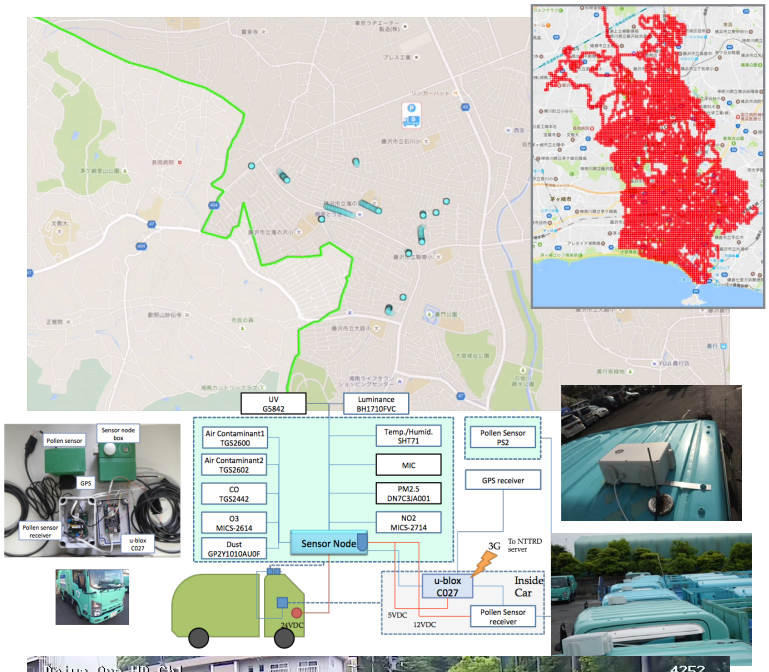
R&D in Nagoya City, Japan

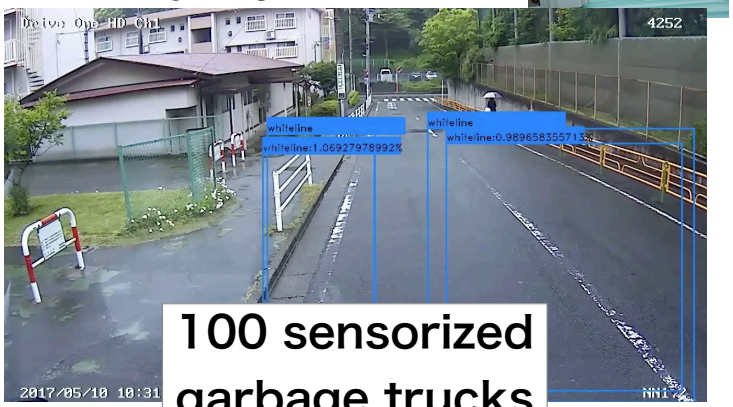
Urban Technology Alliance

https://www.urbantechnologyalliance.org

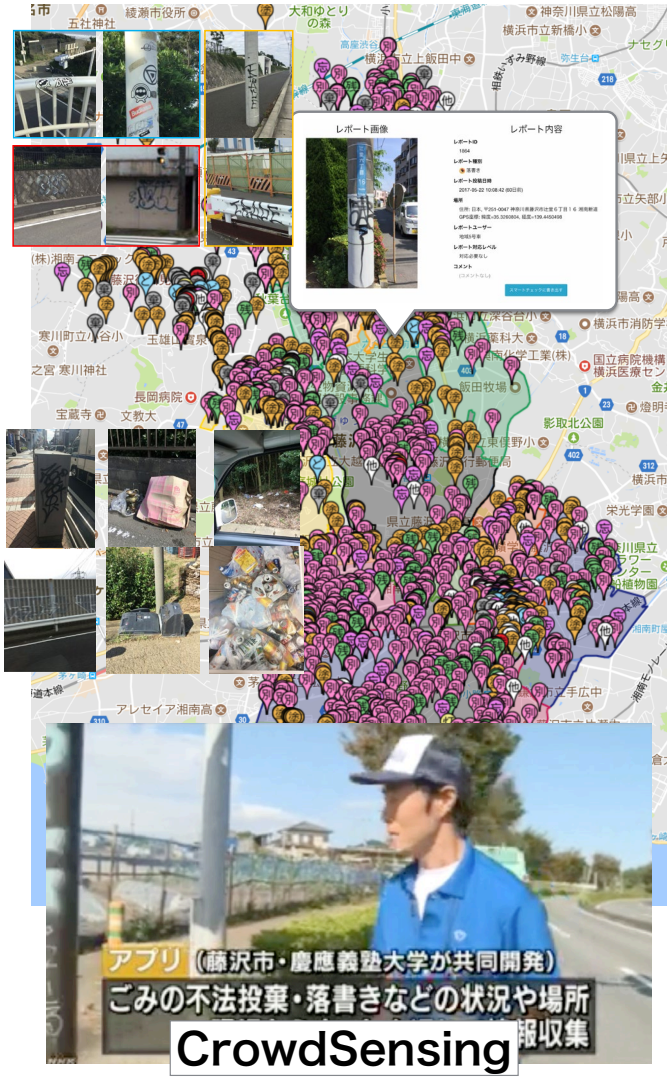
and more..

Smart City R&D in Fujisawa City - Sustainable ways for city sensing

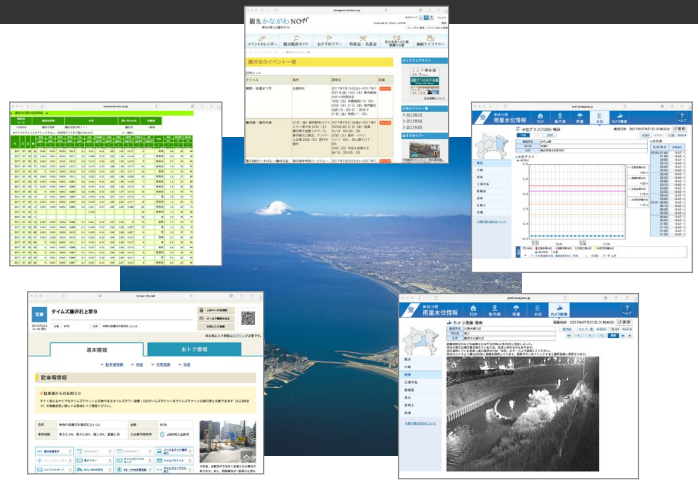


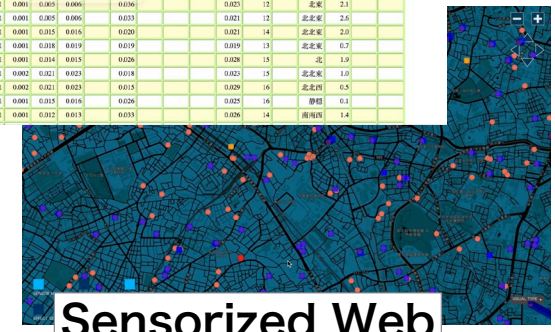


100 sensorized garbage trucks



CrowdSensing





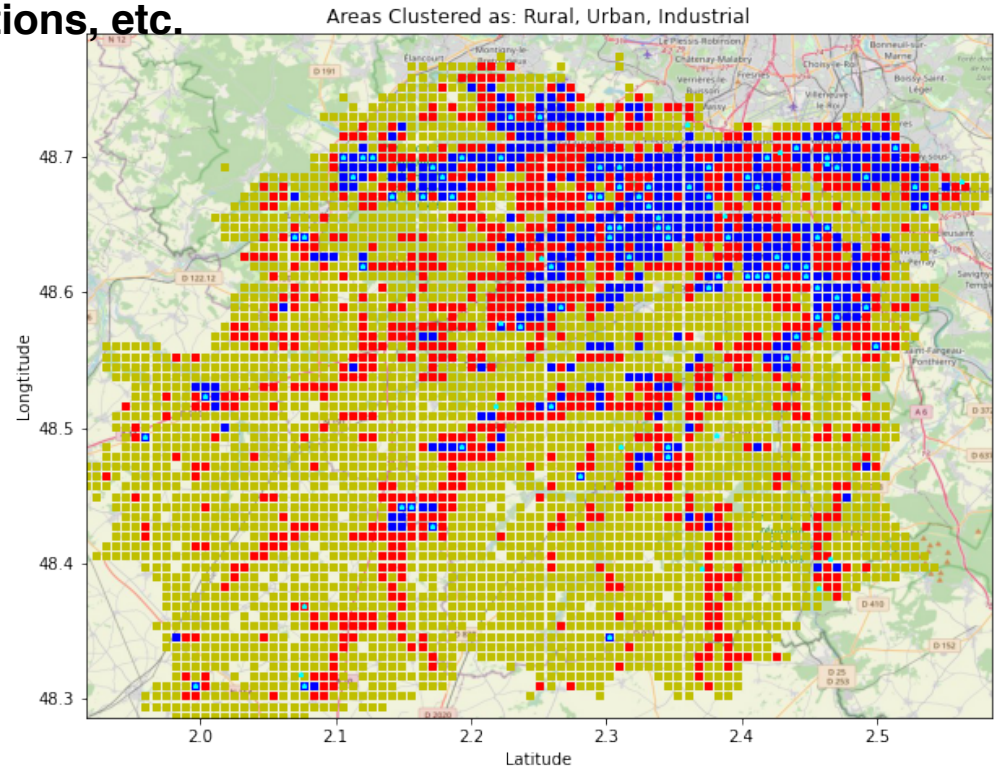
Sensorized Web

OPTIMIZING LOCATION OF SOFT MOBILITY STATIONS

PARIS SACLAY
Communauté d'agglomération

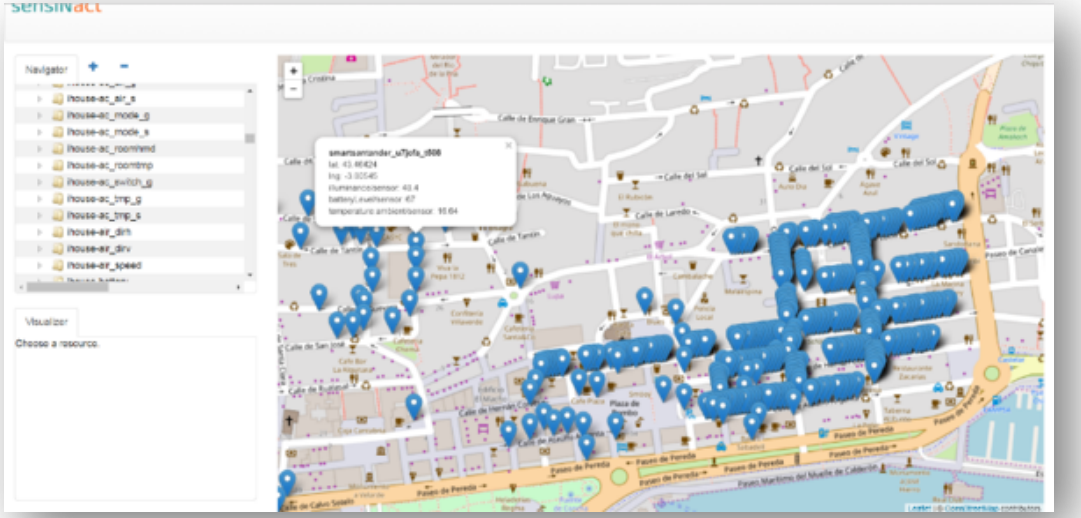
Ajuntament de Barcelona

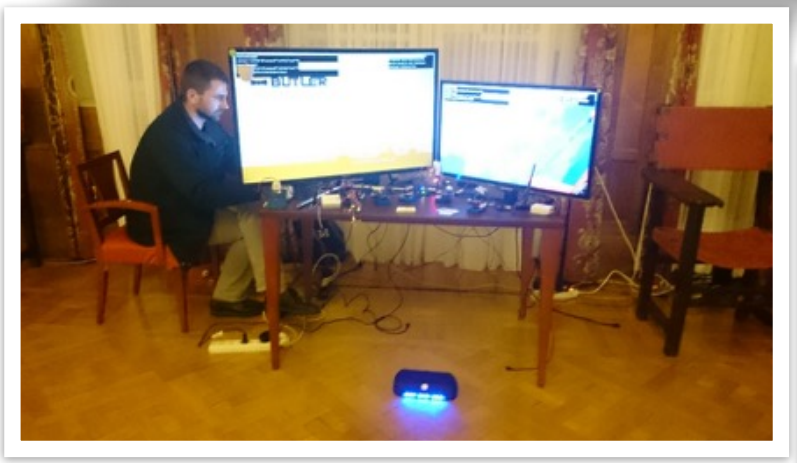
AI using multiple factors of decision, including cultural aspects, traffic patterns, weather conditions, historical and real-time usage of bicycles, the locations of the electric vehicle charge stations, etc.



SMART PARKING

SANTANDER CIUDAD





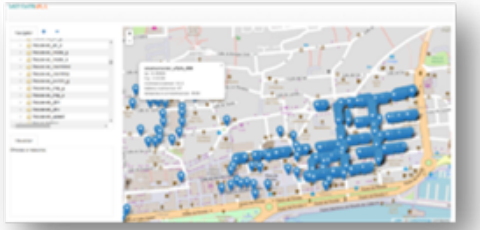
ROAD CROSSING SAFETY

COMUNE DI TRENTO

- **Detection of dangerous situations**
- **Alert of road users**
- **Managing diversity of road users (cars, pedestrians, bikes, other soft mobility...)**
- **Privacy preserving technology**

SMART INTERSECTIONS

sensiNact Studio for smart city experimenters

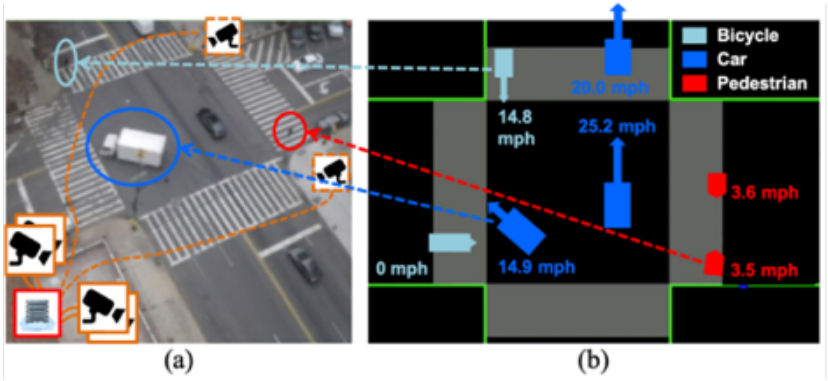


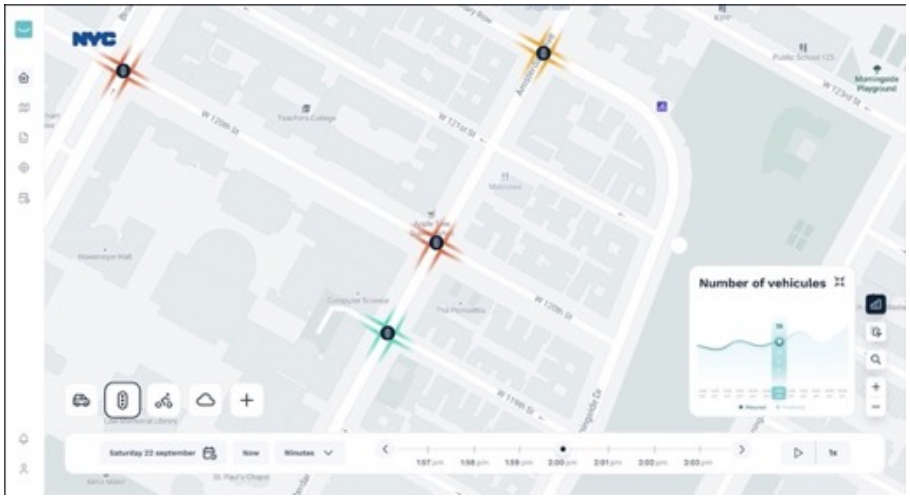
kentyou

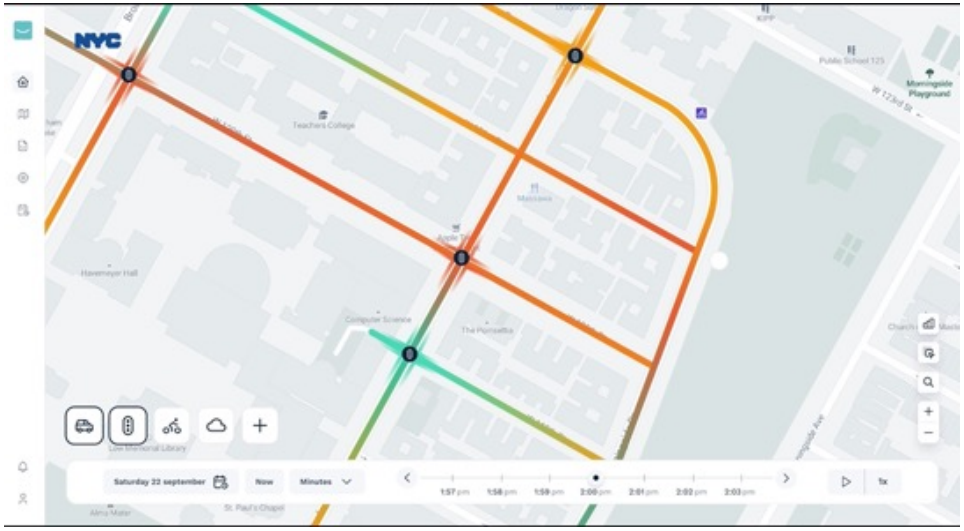
sensiNact urban data platfom

COSMOS

COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK







Today's topic

- Our activities related to Interoperability

1. SensiNact project lead by Levent

   - Interoperability for protocols, data formats

2. CityFeder project lead by me

   - Interoperable policy making among cities

KENTYOU'S HORIZONTAL OPEN APPROACH

sensiNact

Fostering efficiency and innovation

CONNECT SEAMLESSLY

Integrate rapidly heterogeneous applications and infrastructures.

GET MORE FROM YOUR DATA

Access instant insights from various data sources

INVOLVE LOCAL INNOVATORS

Create and customize your app ecosystem with open innovation

sensiNact app platform — **City app store for applications developed by the community**

sensiNact analytics — **Advanced data analytics, machine learning and AI**

sensiNact data platform — **Unified access to real-time and historic data via well-defined APIs and data structures**

- Transport
- Parking
- Waste
- Water
- Energy/ Lighting
- Security
- Urban plannin g
- Economy
- Air/climate

EXAMPLE FROM THE MOBILITY DOMAIN

sensiNact

Optimal soft mobility terminal locations

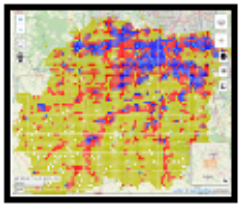
Traffic Flow management

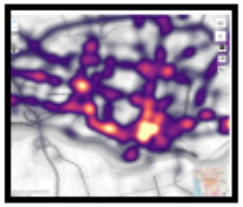
Smart Parking

Carbon impact monitoring

....

sensiNact app platform





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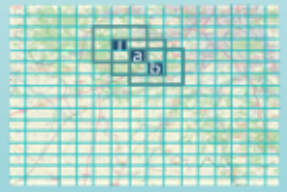
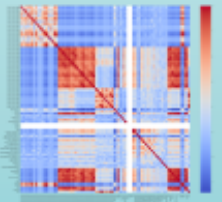
sensiNact analytics





Spatial Analysis

Temporal Analysis

Clustering/optimisation

Correlation Analysis

Prediction Analysis

....

sensiNact data platform

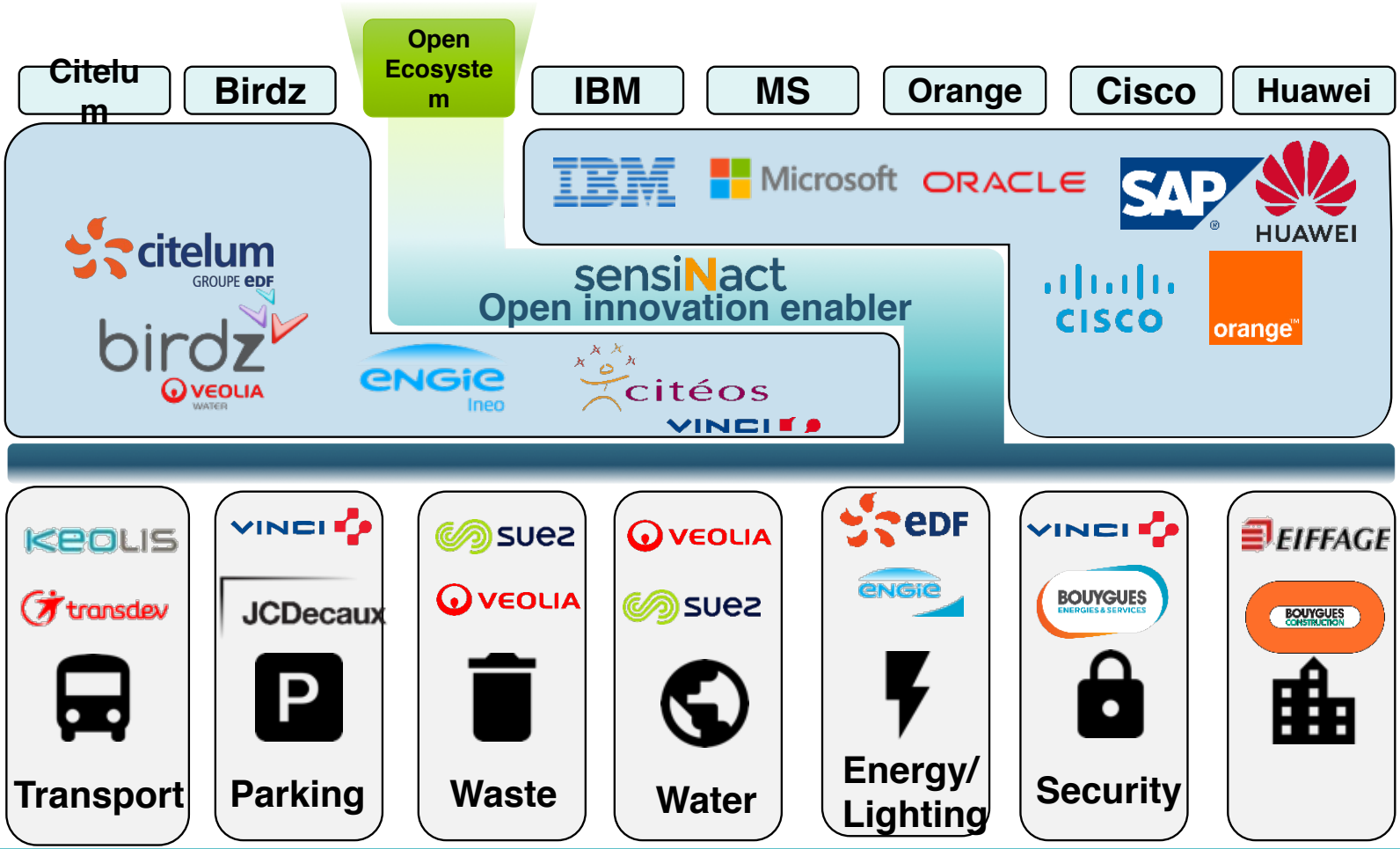
Unified access to real-time and historic data via well-defined APIs and data structures

....

EASY INTEGRATION INTO THE EXISTING INFRASTRUCTURE

sensiNact

KENTYOU AS AN OPEN INNOVATION ENABLER, BREAKING THE SILOS
LOOSELY-COUPLED APPROACH TO GUARANTEE THE REVERSIBILITY



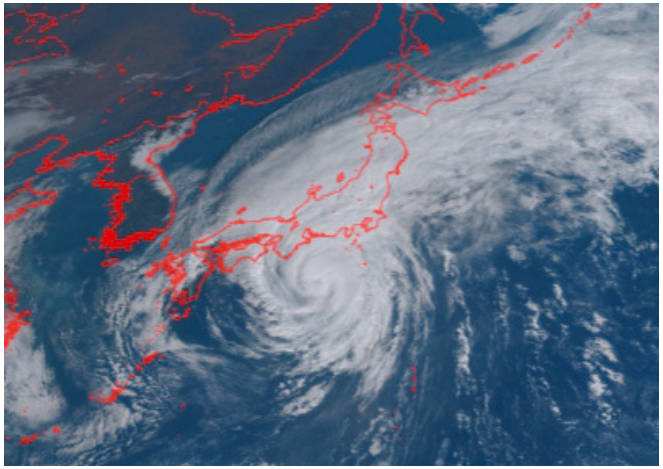
- Developing connectors in hours instead of weeks
- Analytics and prediction based on data
- Open, modular and extensible

Policy making for dynamic data/service sharing among cities

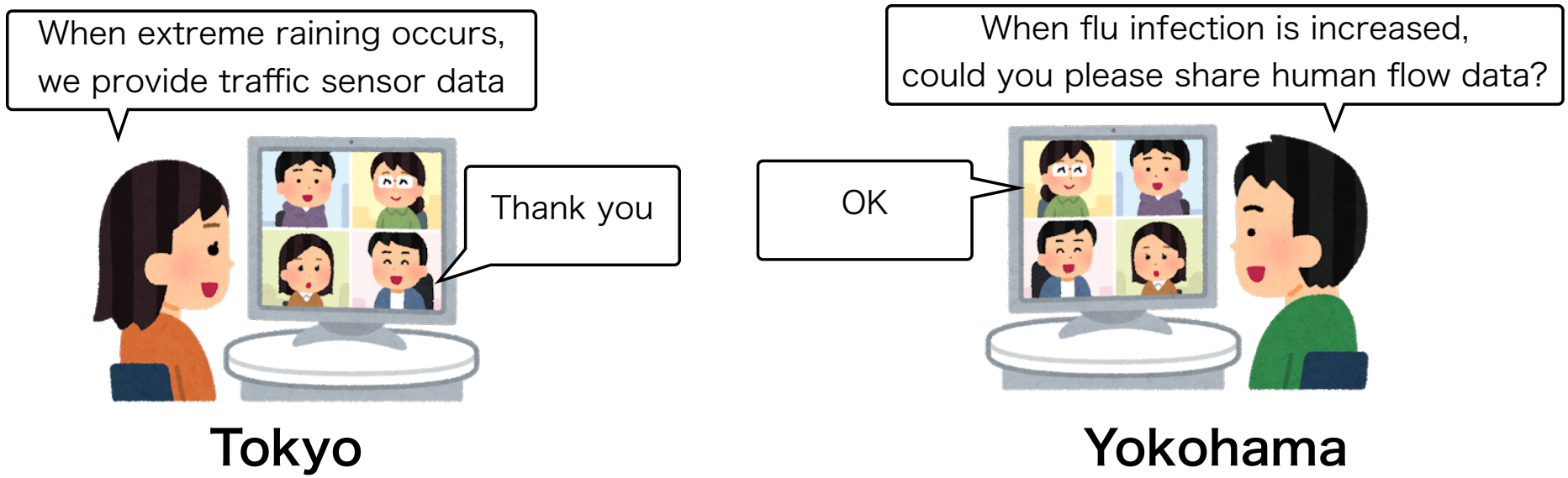
Policies for sharing

- Data that you can usually share openly
- Data that you can share when special events happen (i.e., disaster, pandemic ..)
- Data that you can share if paying for it
- Data that can never be shared out

Japan, as a country with rich disasters



policy making among cities could be manually decided

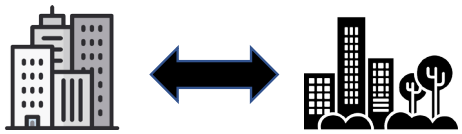


Data is real-timely generated, and social context is dynamically changing

Dynamic data sharing/non-sharing based on social situation

data flow is automatically controlled by the policy

Goal of the CityFeder project



Designing meta-architecture that enables easy interconnection between smart cities according to social conditions.

II

Programmable Federation Architecture

Emergency Level

4

3

2

1

警戒レベル	避難行動等	避難情報等
警戒レベル4 全員避難	速やかに避難先へ避難しましょう。公的な避難場所までの移動が危険と思われる場合は、近くの安全な場所や、自宅内のより安全な場所に避難しましょう。	避難勧告 避難指示(緊急) ※3 (市町村が発令)
警戒レベル3 高齢者等は避難	避難に時間を要する人(ご高齢の方、障害のある方、乳幼児等)とその支援者は避難をしましょう。その他の人は、避難の準備を整えましょう。	避難準備・高齢者等避難開始 (市町村が発令)
警戒レベル2	避難に備え、ハザードマップ等により、自らの避難行動を確認しましょう。	洪水注意報 大雨注意報等 (気象庁が発表)
警戒レベル1	災害への心構えを高めましょう。	早期注意情報 (気象庁が発表)

※3 地域の状況に応じて緊急的又は重ねて避難を促す場合等に発令

To other cities:

⟷ All data is shared

⟷ Evacuation place information is shared

⟷ Traffic information is shared

⟷ Environmental information is shared

Dynamic access control to each data according to social contexts

Algorithm to recognize social context

Registration

CityFeder

Server

Social Context Recognition

Social Context

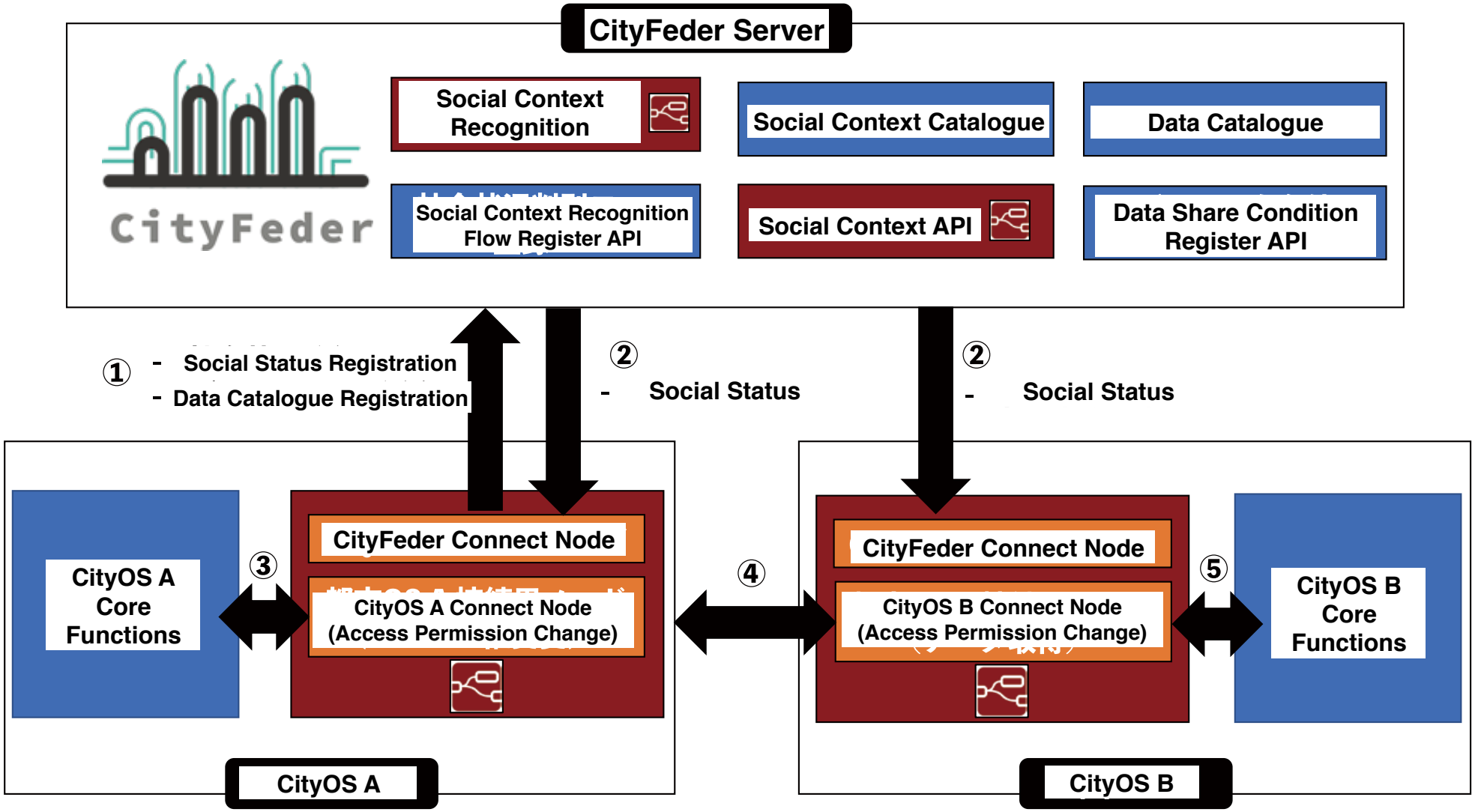
Social Context Notification

Catalogue of data and access method

Data Provider

Data

Data Receiver


CityFeder Server
CityFeder
Social Context Recognition
Social Context Catalogue
Data Catalogue
Social Context Recognition Flow Register API
Social Context API
Data Share Condition Register API
① - Social Status Registration
- Data Catalogue Registration
② - Social Status
② - Social Status
CityOS A Core Functions
③
CityFeder Connect Node
CityOS A Connect Node (Access Permission Change)
④
CityFeder Connect Node
CityOS B Connect Node (Access Permission Change)
⑤
CityOS B Core Functions
CityOS A
CityOS B

Example Scenario:
When a disaster is happened, each smart city platform (Tokyo:FIWARE, Nagoya:Synerex) receives the social context from CityFeder. FIWARE platform automatically opens the access role to the data, and Synerex receives the Tokyo's data.

フェーズ3:
社会状況の変化に対応したアクセス権自動制御

Conclusion

- Towards a realization of interoperability among cities
  - Protocol/data format interoperability → SensiNact
  - Policy making among cities → CityFeder
- Future works/questions
  - Real deployment
  - Killer scenario / applications ?

sensiNact

Thank you !

takuro@nagoya-u.jp