Challenge to Cross Industry Open Collaboration

18 December 2020

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1 Introduction

Introduction

Okinawa Open Laboratory (OOL)

Vision: Social Innovation x Digital Technologies

Approaches: Open Technologies x Open Collaboration

Experiences: Technology Verification x Use Case Studies in Okinawa

5G x IoT

End to End Network Slicing

Next Generation Smart City

Data Utilization

Open Data Platform

Collaboration for Various Use Cases in Data Utilization

OOL Contributes to Innovation for Society, Business and Personal Life
in the New Normal Era
through its Open Approaches and Rich Experiences
Looking ahead to Beyond 5G

2 Transit and Tourism Open Data

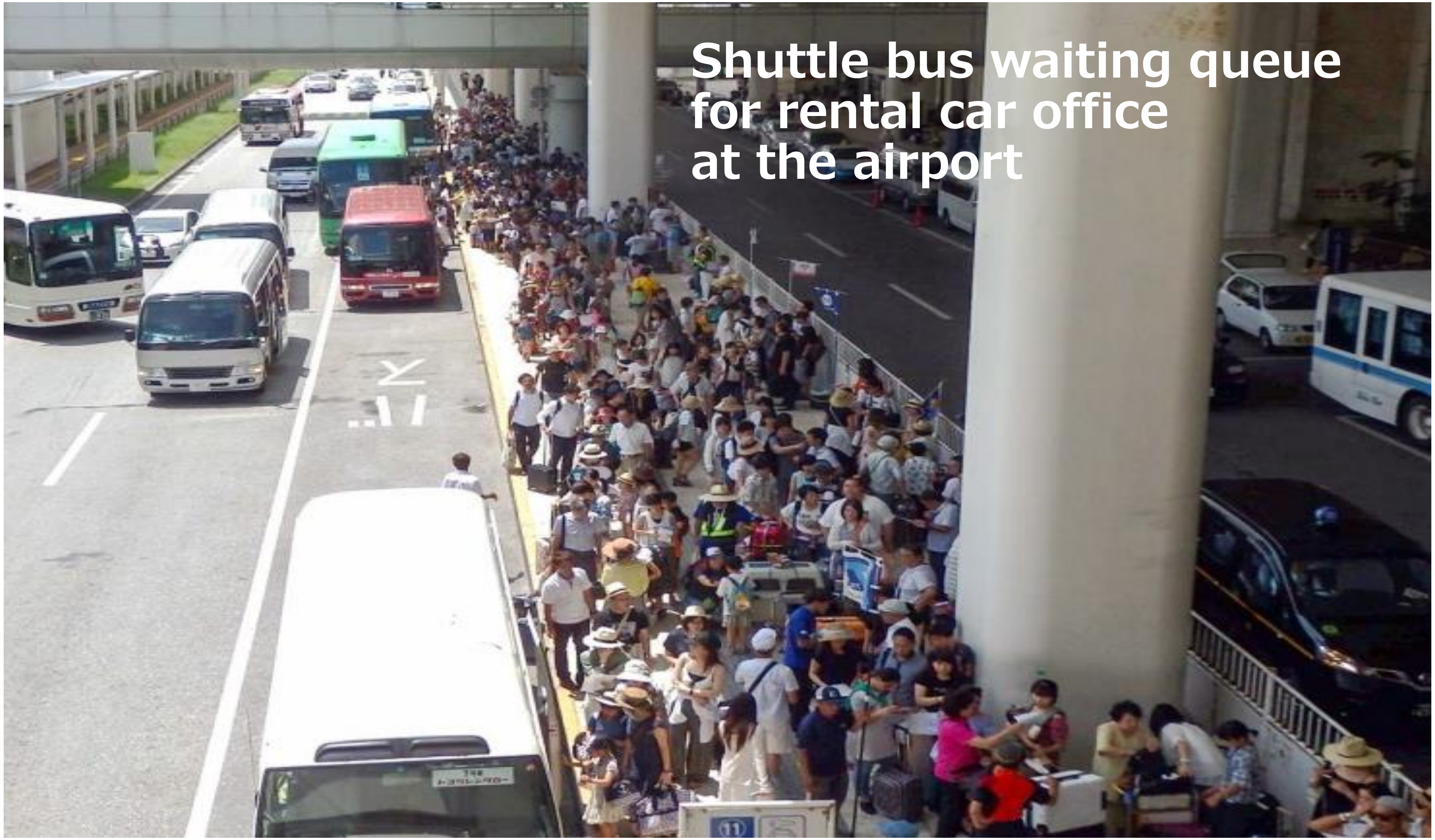
OKINAWA
OPEN
LABORATORY

Issues for Tourists

- Difficult to find the route data for travelling by public transportation like bus or monorail

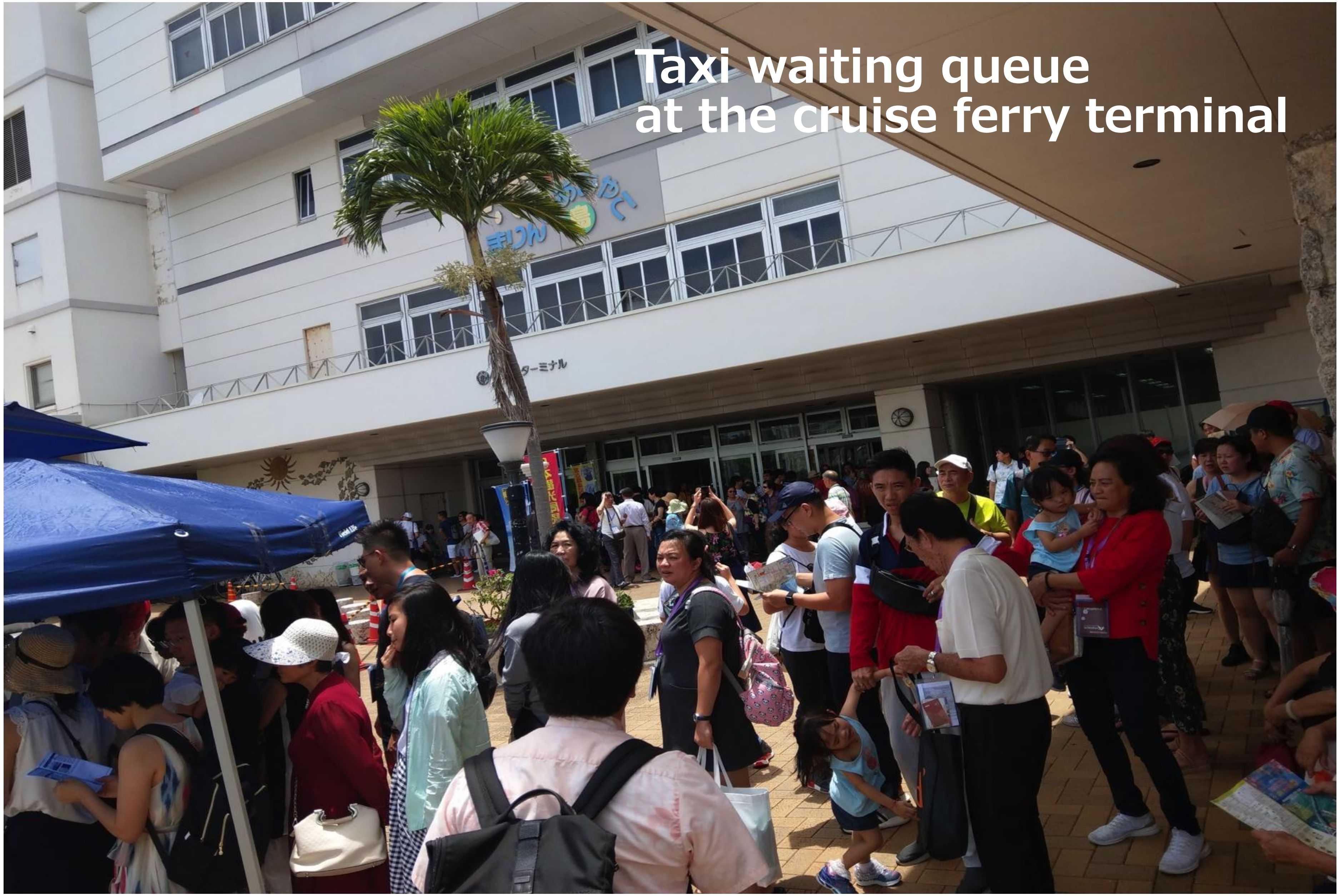
- Poor information appeared on the well used web service like Google Maps

To Use Rental Car



Shuttle bus waiting queue
for rental car office
at the airport

To Use Taxi



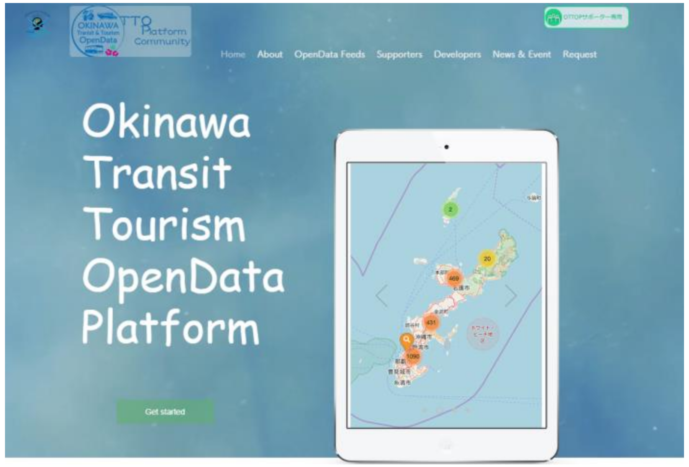
Taxi waiting queue
at the cruise ferry terminal

Create an Open Data Platform

Open the OTTOP web site in August 2019

Okinawa Transit and Tourism Open data Platform

OKINAWA
Tranisit & Tourism
OpenData
TTO
Platfrom
Community


OKINAWA
Tranisit & Tourism
OpenData
TTO
Platform
Community
OTTOPサポーター専用
Home
About
OpenData Feeds
Supporters
Developers
News & Event
Request
Okinawa
Transit
Tourism
OpenData
Platform
Get started

Publish and maintain the open data like

- Timetables
- Location of bus stops, stations, ports
- Route data

for

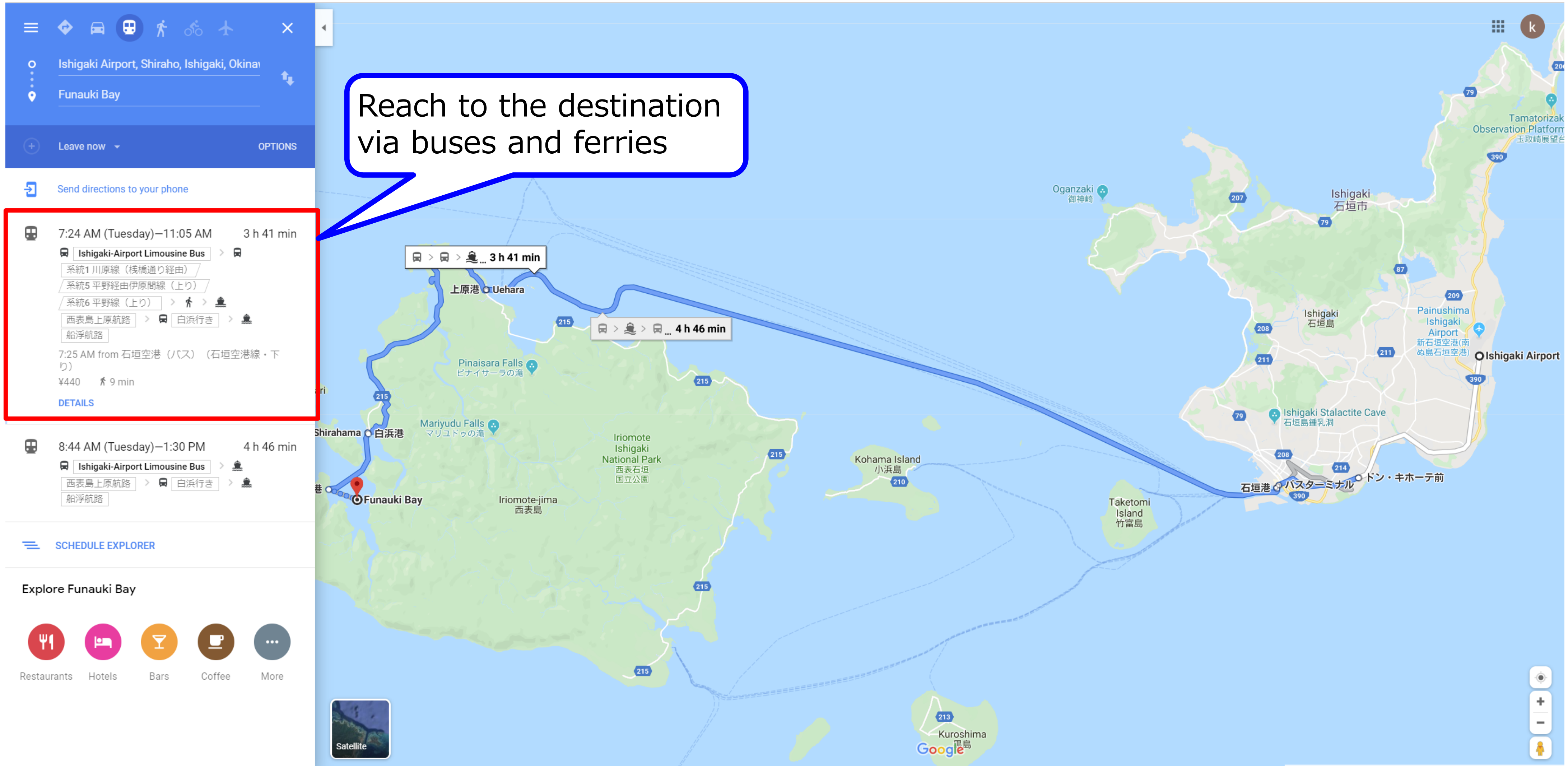
- Buses
- Monorail
- Ferries

in Okinawa

Data from 53 operators are published among 55 operators in Okinawa

After Publishing Open Data

Route data can be searched in Google Maps including ferries.



Ishigaki Airport, Shiraho, Ishigaki, Okinaw

Funauki Bay

Leave now

OPTIONS

Send directions to your phone

7:24 AM (Tuesday)—11:05 AM 3 h 41 min

Ishigaki-Airport Limousine Bus > 系統1 川原線（桟橋通り経由）/ 系統5 平野経由伊原間線（上り）/ 系統6 平野線（上り）> > 西表島上原航路 > 白浜行き > 船浮航路

7:25 AM from 石垣空港（バス）（石垣空港線・下り）

¥440 9 min

DETAILS

8:44 AM (Tuesday)—1:30 PM 4 h 46 min

Ishigaki-Airport Limousine Bus > 西表島上原航路 > 白浜行き > 船浮航路

SCHEDULE EXPLORER

Explore Funauki Bay

Restaurants
Hotels
Bars
Coffee
More
3 h 41 min
4 h 46 min
上原港 Uehara
Pinaisara Falls
ピナイサーラの滝
Mariyudu Falls
マリユドゥの滝
Shirahama 白浜港
Funauki Bay
Iriomote Ishigaki National Park
西表石垣国立公園
Iriomote-jima
西表島
Kohama Island
小浜島
Taketomi Island
竹富島
Kuroshima
黒島
Oganzaki
御神崎
Ishigaki
石垣市
Ishigaki
石垣島
Tamatorizaki Observation Platform
玉取崎展望台
Painushima Ishigaki Airport
新石垣空港(南ぬ島石垣空港)
Ishigaki Airport
Ishigaki Stalactite Cave
石垣島鍾乳洞
石垣港
バスターミナル
ドン・キホーテ前
Satellite
Google

Reach to the destination via buses and ferries

Gathering Tourist Spots Data

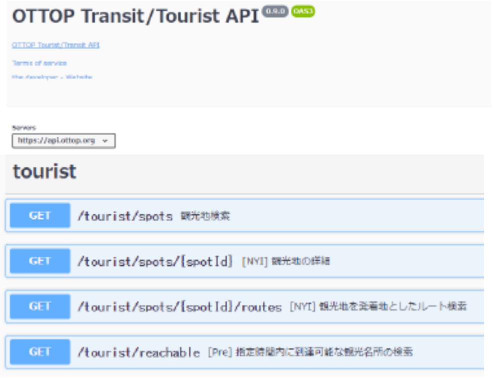
OOL has gotten approval from all of cities, towns and villages in Okinawa (total 41 municipalities) to publish tourist spots data on the OTTOP gathered from local tourism associations which are published on the local websites respectively

Some of the gathered data can be gotten through APIs like

- A list of tourist spots
- Their detail data
- Reachable spots within a certain time period

These data will be added and expanded by discussing related parties and local associations

APIs on the OTTOP



OTTOP Transit/Tourist API 0.9.0 OAS3

OTTOP Tourist/Transit API

Terms of service

Servers
https://api.ottop.org

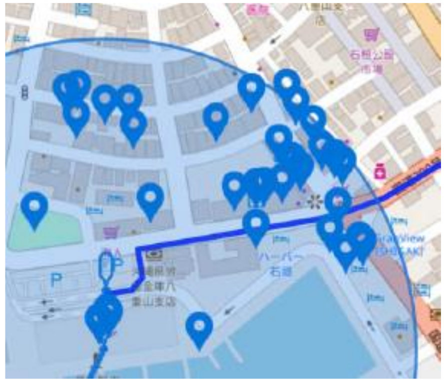
tourist

GET /tourist/spots 観光地検索

GET /tourist/spots/{spotId} [NYI] 観光地の詳細

GET /tourist/spots/{spotId}/routes [NYI] 観光地を発着地としたルート検索

GET /tourist/reachable [Pre] 指定時間内に到達可能な観光名所の検索



By using APIs, tourist spots and their detail data can be gotten and used by applications for tourist services like reachable spots within a certain time range

OTTOP Hackathon

To facilitate the usage of OTTOP, a Hackathon had held in December 2019 with 31 participants including young engineers and students

OKINAWA Tranisit & Tourism OpenData TTO Platfrom Community

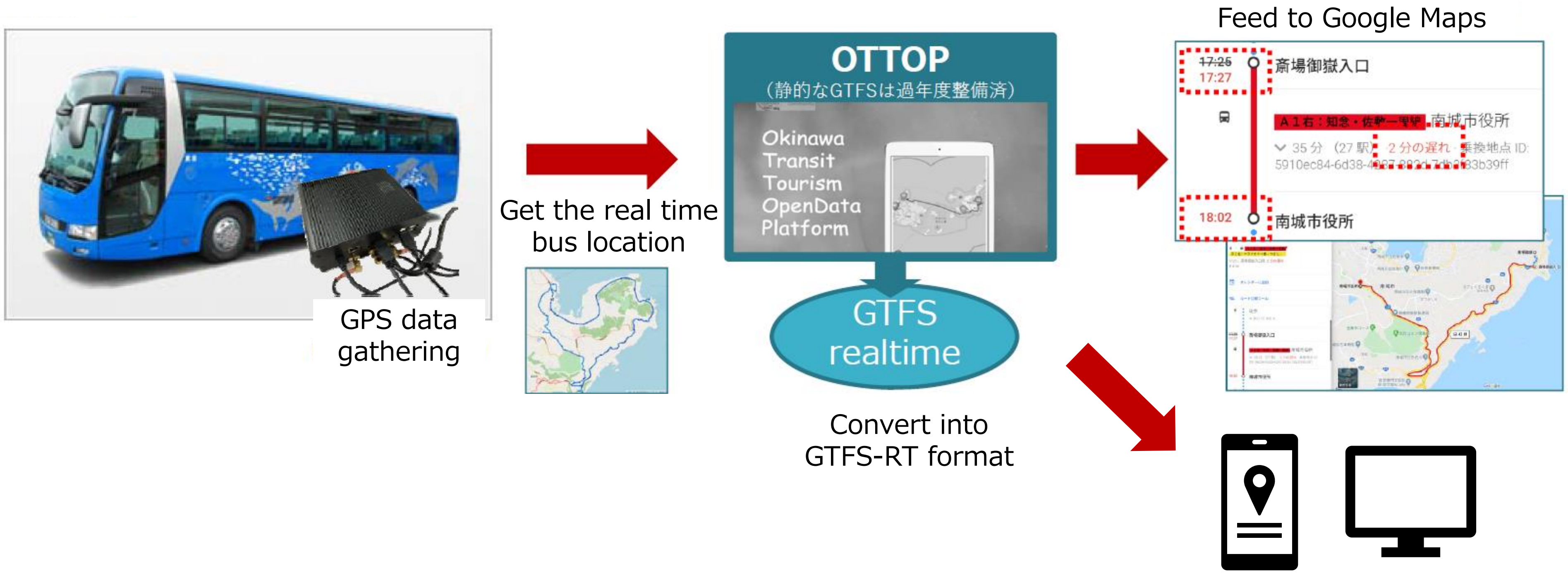
Hackathon

Following applications have developed in this hackathon

- Utilize free time for tourists
- My timetables
- Bus navigation for events
- Vacant parking space navigation
- Bus collection
- Smart bus navigation

Realtime Data Gathering

Realtime bus location data gathering feature will be added to OTTOP in FY2020 for the bus routes mainly used by tourists

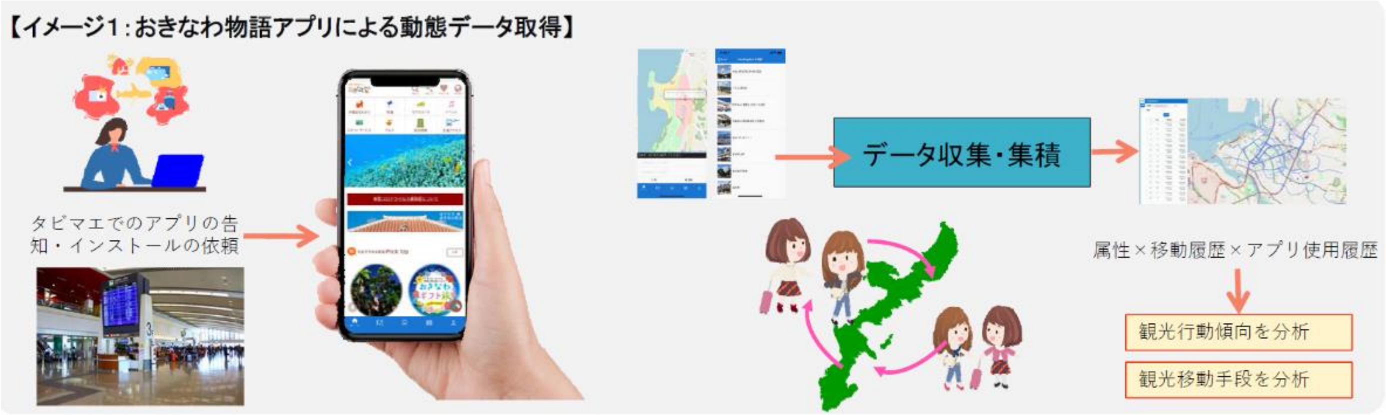

GPS data gathering
Get the real time bus location
OTTOP
（静的なGTFSは過年度整備済）
Okinawa Transit Tourism OpenData Platform
GTFS realtime
Feed to Google Maps
~~17:25~~
17:27
斎場御嶽入口
南城市役所
35 分 （27 駅）
2 分の遅れ
乗換地点 ID:
18:02
南城市役所

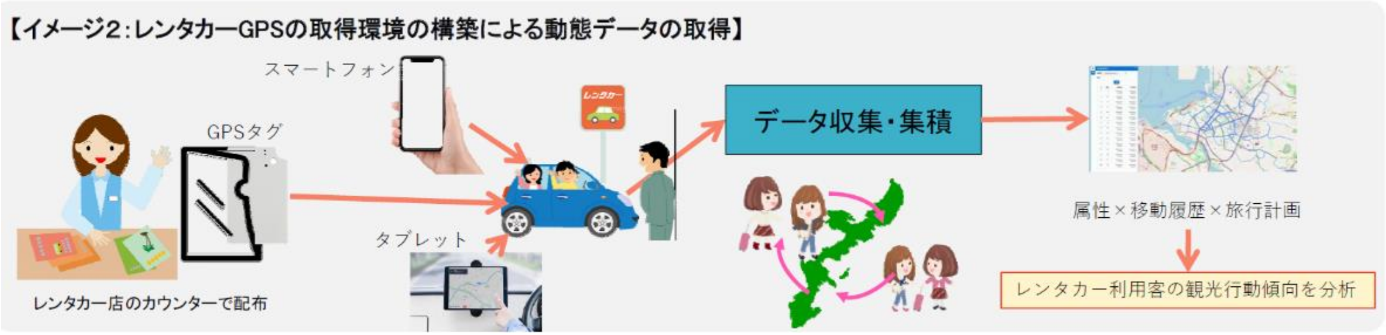
Convert into GTFS-RT format

Open to the public usage as an open data

Tourists Travelling Data Gathering

Tourists travelling data are planned to be gathered in FY2020 to find out issues and to consider the future enhancement of data utilization


【イメージ1：おきなわ物語アプリによる動態データ取得】
タビマエでのアプリの告知・インストールの依頼
データ収集・集積
属性×移動履歴×アプリ使用履歴
観光行動傾向を分析
観光移動手段を分析

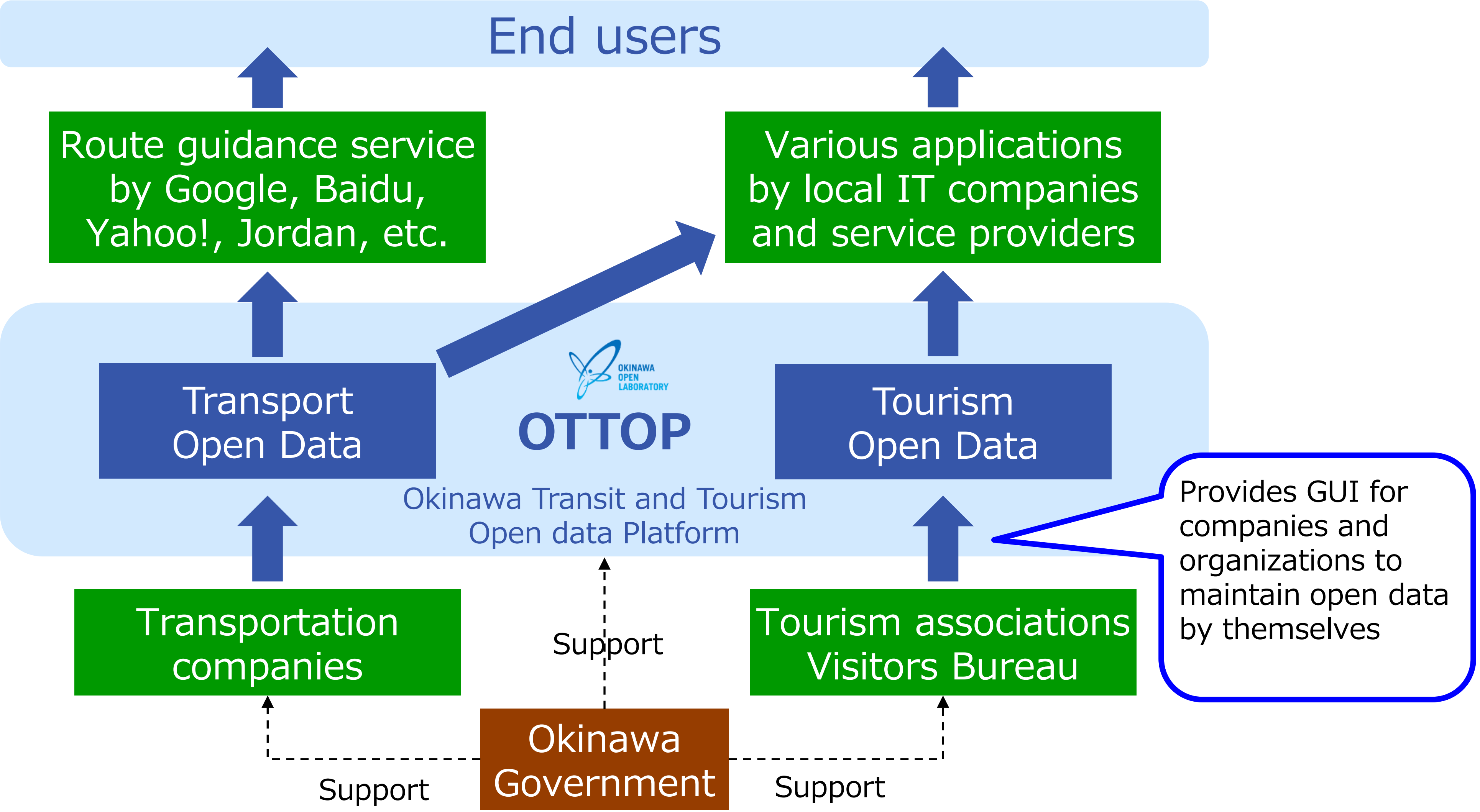

【イメージ2：レンタカーGPSの取得環境の構築による動態データの取得】
スマートフォン
GPSタグ
タブレット
レンタカー店のカウンターで配布
レンタカー
データ収集・集積
属性×移動履歴×旅行計画
レンタカー利用客の観光行動傾向を分析

- Request for tourists to install a tour guidance application
- Get approval to acquire location and personal attribute data
- Gather personal attribute and GPS data through the application

- Lent a smartphone or tablet for rental car users
- Get approval to acquire location and personal attribute data
- Gather personal attribute and GPS data for rental car users

OTTOP Summary

Provide convenient services to end users
by open collaboration between cross industries



End users
Route guidance service by Google, Baidu, Yahoo!, Jordan, etc.
Various applications by local IT companies and service providers
Transport Open Data
OKINAWA OPEN LABORATORY
OTTOP
Okinawa Transit and Tourism Open data Platform
Tourism Open Data
Transportation companies
Support
Tourism associations Visitors Bureau
Okinawa Government
Support
Support

Provides GUI for companies and organizations to maintain open data by themselves

3 Data Utilization Use Cases Collaborating with NEC

Planned in FY2021

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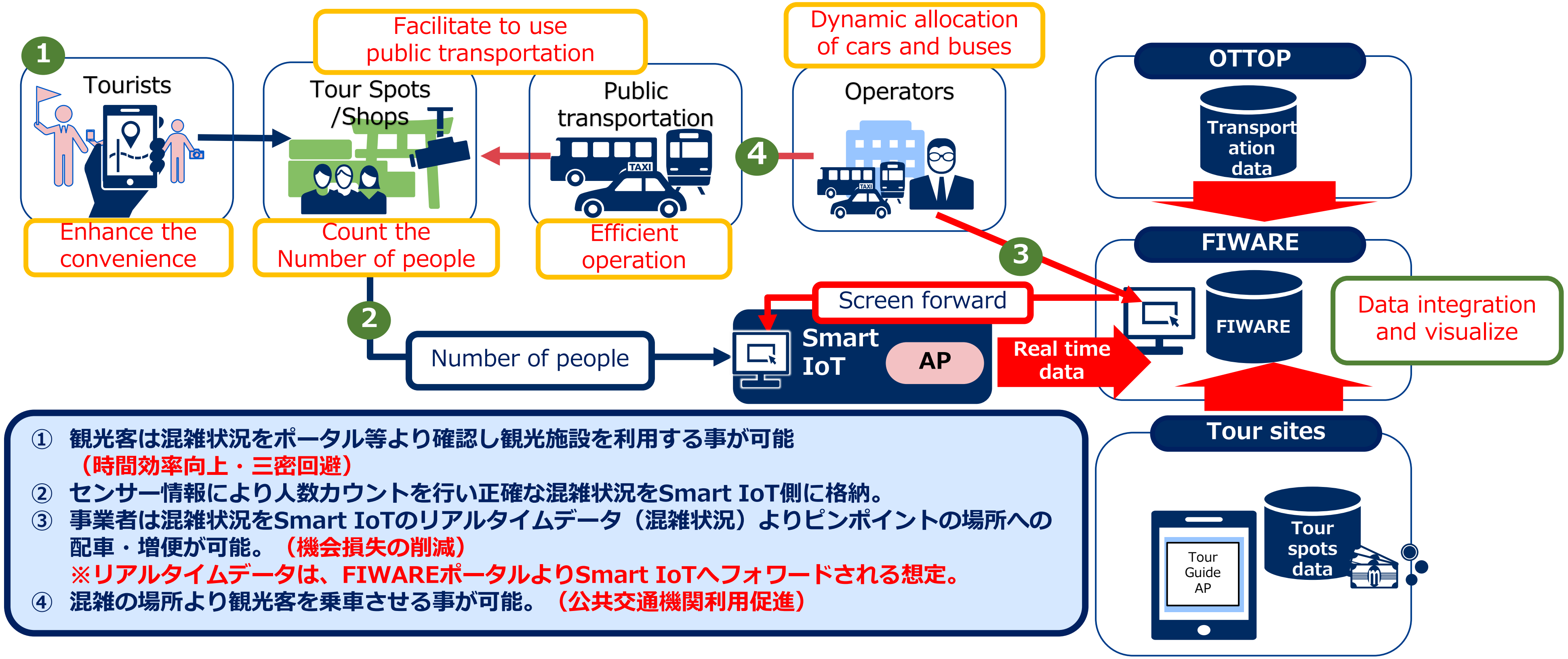
Case 1 : Count the Number of People (Real Time)

- Count the number of people at tour spots/shops by sensors and send data to the Smart IoT system, thus tourists can see the congestion status in real time
- Public transportation operators can facilitate the usage of public transportation and can avoid opportunity loss by dynamic allocation of cars and busses according to the congestion status

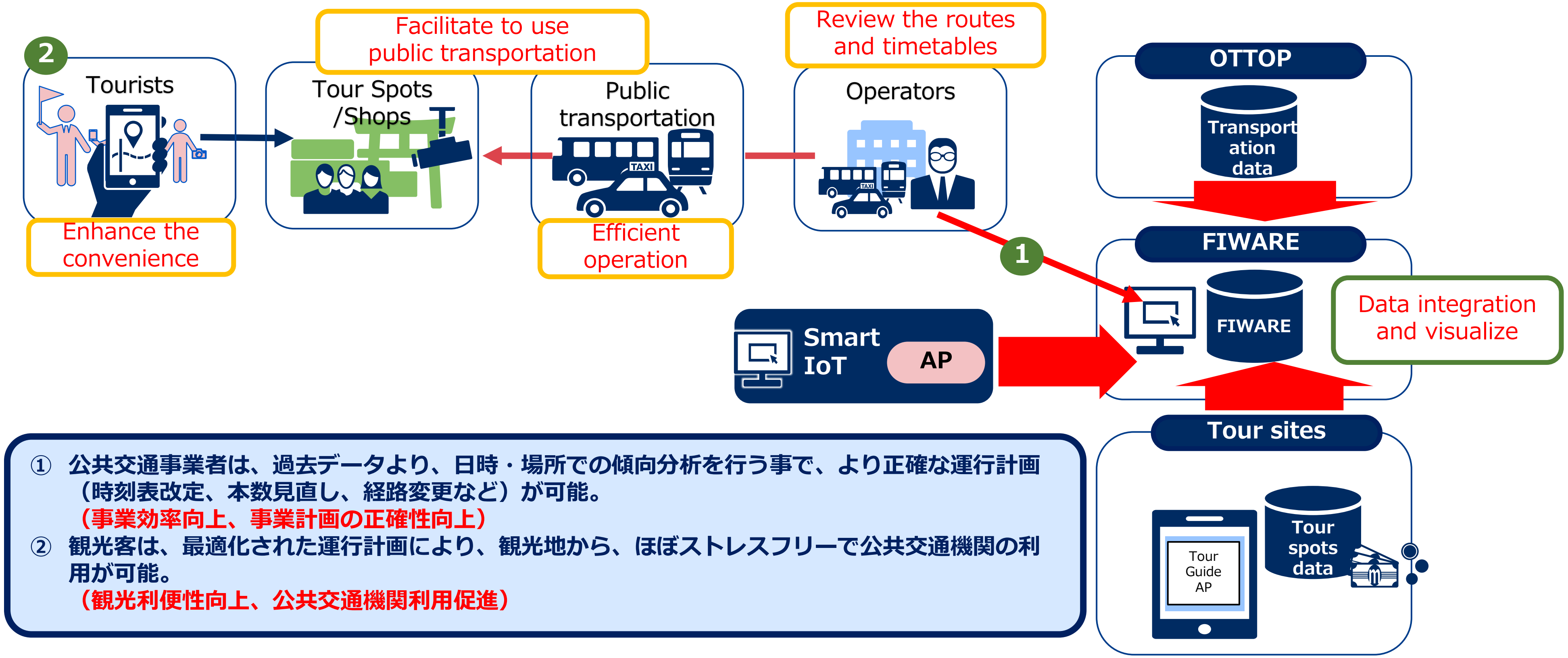


1
Tourists
Enhance the convenience
Facilitate to use public transportation
Tour Spots /Shops
Count the Number of people
Public transportation
TAXI
Efficient operation
4
Dynamic allocation of cars and buses
Operators
OTTOP
Transportation data
FIWARE
FIWARE
Data integration and visualize
3
Screen forward
2
Number of people
Smart IoT
AP
Real time data
Tour sites
Tour Guide AP
Tour spots data

① 観光客は混雑状況をポータル等より確認し観光施設を利用する事が可能
（時間効率向上・三密回避）
② センサー情報により人数カウントを行い正確な混雑状況をSmart IoT側に格納。
③ 事業者は混雑状況をSmart IoTのリアルタイムデータ（混雑状況）よりピンポイントの場所への配車・増便が可能。（機会損失の削減）
※リアルタイムデータは、FIWAREポータルよりSmart IoTへフォワードされる想定。
④ 混雑の場所より観光客を乗車させる事が可能。（公共交通機関利用促進）

Case 2：Accumulated Data Utilization

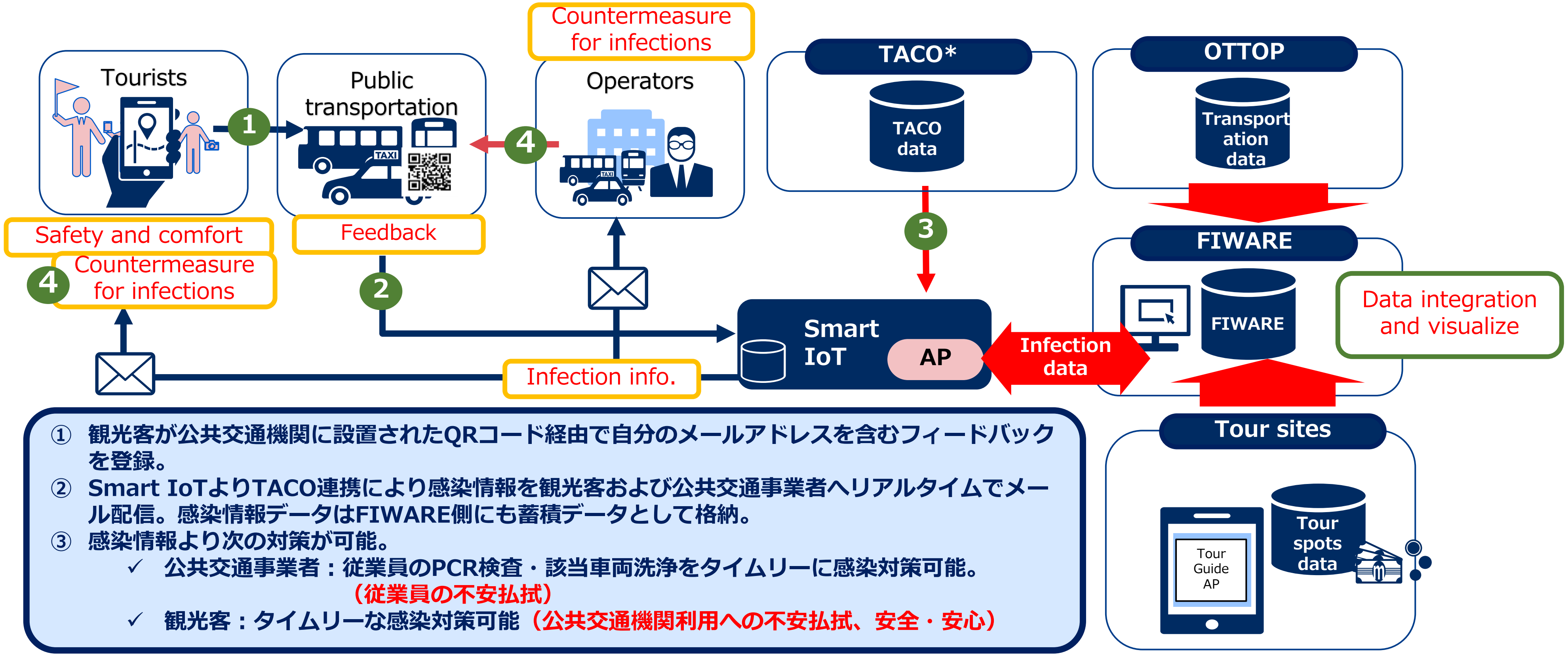
- Public transportation operators can create more efficient and suitable routes and timetables by analyzing the accumulated data such as number of people at each place, date and time


Facilitate to use public transportation
Review the routes and timetables
2
Tourists
Tour Spots /Shops
Public transportation
TAXI
Operators
TAXI
OTTOP
Transportation data
Enhance the convenience
Efficient operation
1
FIWARE
FIWARE
Data integration and visualize
Smart IoT
AP
Tour sites
Tour Guide AP
Tour spots data

① 公共交通事業者は、過去データより、日時・場所での傾向分析を行う事で、より正確な運行計画（時刻表改定、本数見直し、経路変更など）が可能。
（事業効率向上、事業計画の正確性向上）
② 観光客は、最適化された運行計画により、観光地から、ほぼストレスフリーで公共交通機関の利用が可能。
（観光利便性向上、公共交通機関利用促進）

Case 3 : Utilize QR Code (Countermeasure for COVID-19)

- By scanning the QR code in public transportation and registering a feedback to the Smart IoT system, tourists can get infection information by email if the infection happens near the QR code
- Public transportation operators can also get the infection information including date, time and which cars, then the operators can take actions for the infection


Countermeasure for infections
Tourists
1
Public transportation
TAXI
4
Operators
TACO*
TACO data
OTTOP
Transportation data
Safety and comfort
Feedback
3
FIWARE
4
Countermeasure for infections
2
Smart IoT
AP
Infection data
FIWARE
Data integration and visualize
Infection info.
Tour sites
Tour Guide AP
Tour spots data

① 観光客が公共交通機関に設置されたQRコード経由で自分のメールアドレスを含むフィードバックを登録。
② Smart IoTよりTACO連携により感染情報を観光客および公共交通事業者へリアルタイムでメール配信。感染情報データはFIWARE側にも蓄積データとして格納。
③ 感染情報より次の対策が可能。
  - ✓ 公共交通事業者：従業員のPCR検査・該当車両洗浄をタイムリーに感染対策可能。（従業員の不安払拭）
  - ✓ 観光客：タイムリーな感染対策可能（公共交通機関利用への不安払拭、安全・安心）

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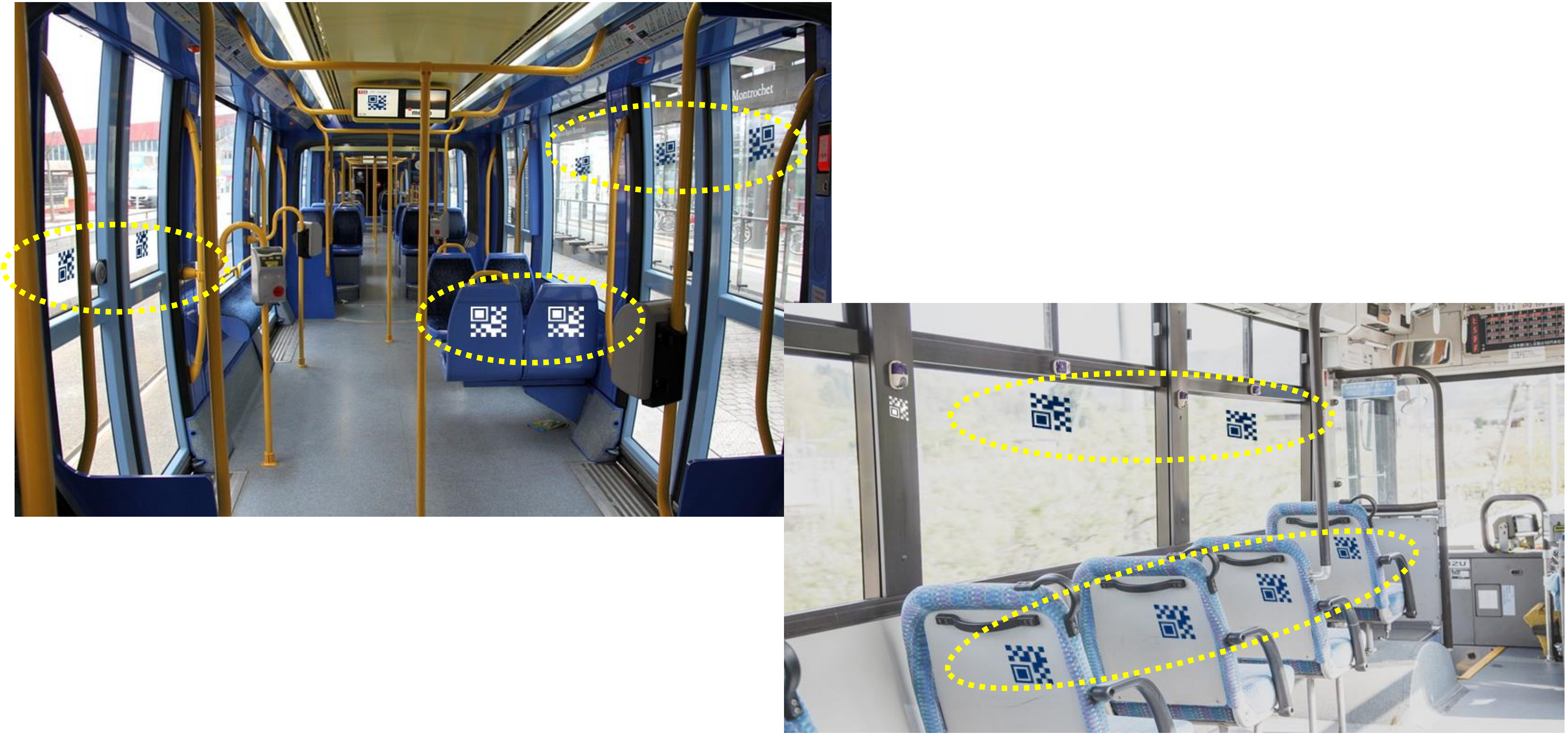
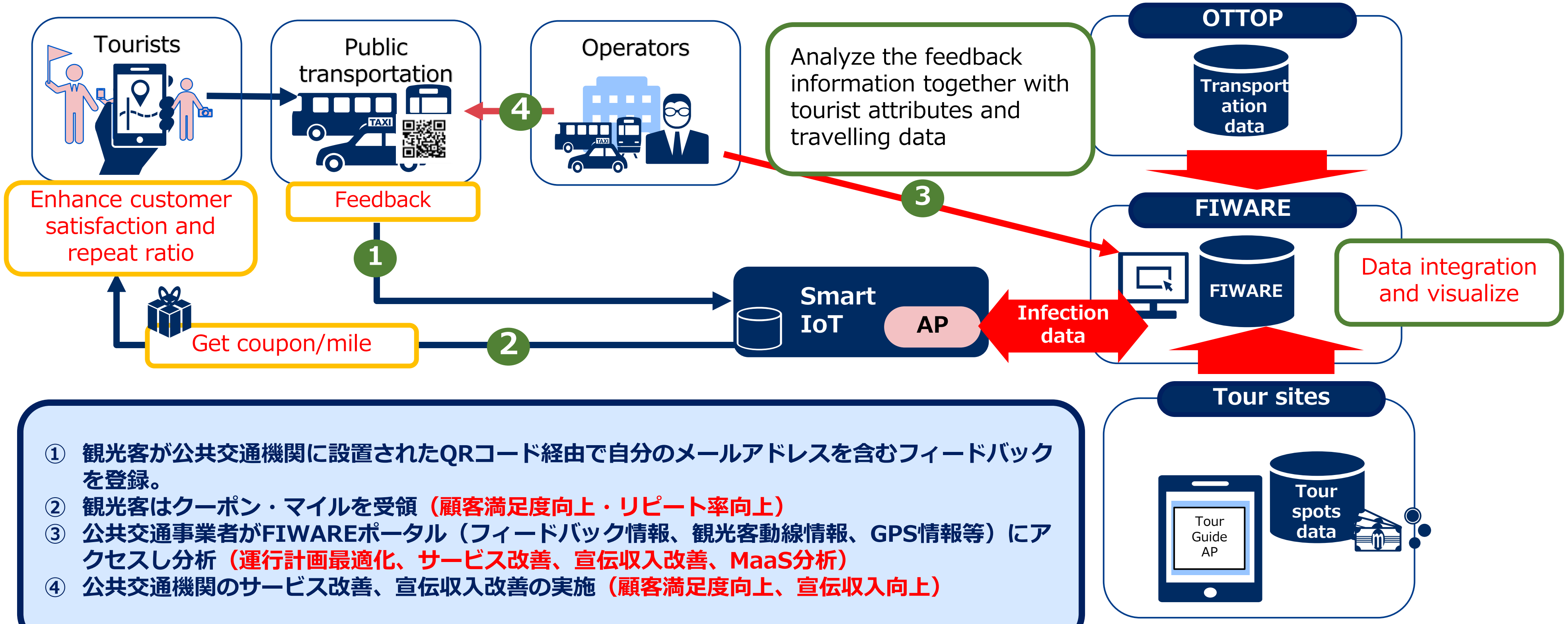
* TACO (Traveler's Access Center Okinawa) has been established in Naha Airport to support travelers for preventing infectious diseases

QR Code Implementation Image for Feedback


Montrochet

Case 4 : Utilize QR Code (Coupon/Mile Distribution)

- By scanning the QR code in public transportation and registering a feedback to the Smart IoT system, tourists can get coupons/miles to discount the public transportation and tour spots/shops
- Public transportation operators can improve routes and timetables and enhance services based on the feedback information

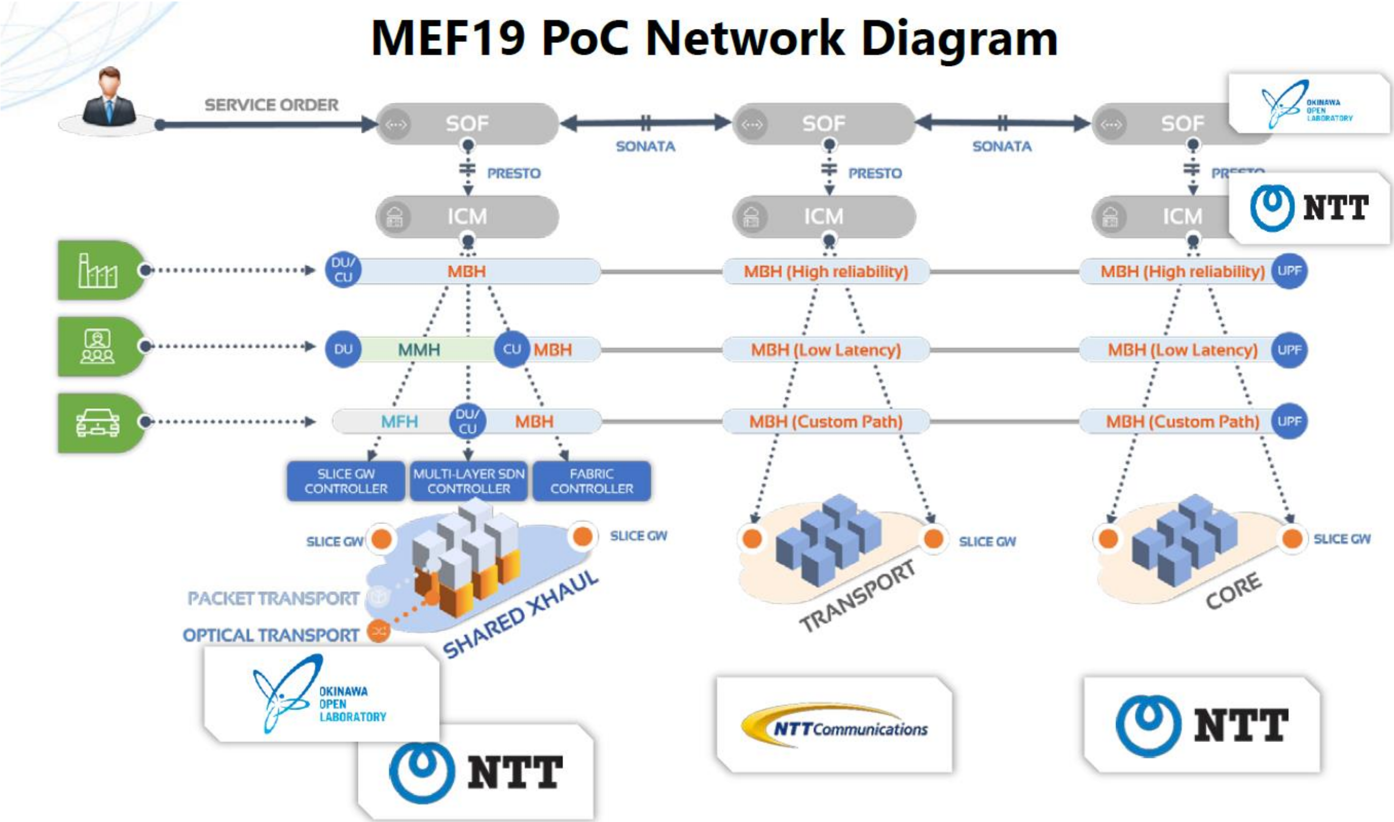

Tourists
Public transportation
TAXI
Operators
Analyze the feedback information together with tourist attributes and travelling data
OTTOP
Transportation data
Enhance customer satisfaction and repeat ratio
Feedback
④
③
①
FIWARE
FIWARE
Data integration and visualize
Smart IoT
AP
Infection data
Get coupon/mile
②
Tour sites
Tour Guide AP
Tour spots data

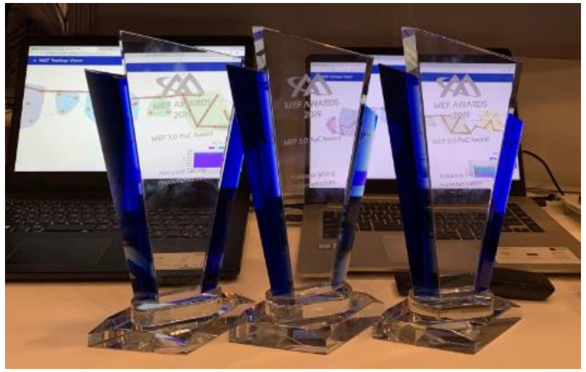
① 観光客が公共交通機関に設置されたQRコード経由で自分のメールアドレスを含むフィードバックを登録。
② 観光客はクーポン・マイルを受領（顧客満足度向上・リピート率向上）
③ 公共交通事業者がFIWAREポータル（フィードバック情報、観光客動線情報、GPS情報等）にアクセスし分析（運行計画最適化、サービス改善、宣伝収入改善、MaaS分析）
④ 公共交通機関のサービス改善、宣伝収入改善の実施（顧客満足度向上、宣伝収入向上）

4 End to End
Network Slice Evaluation

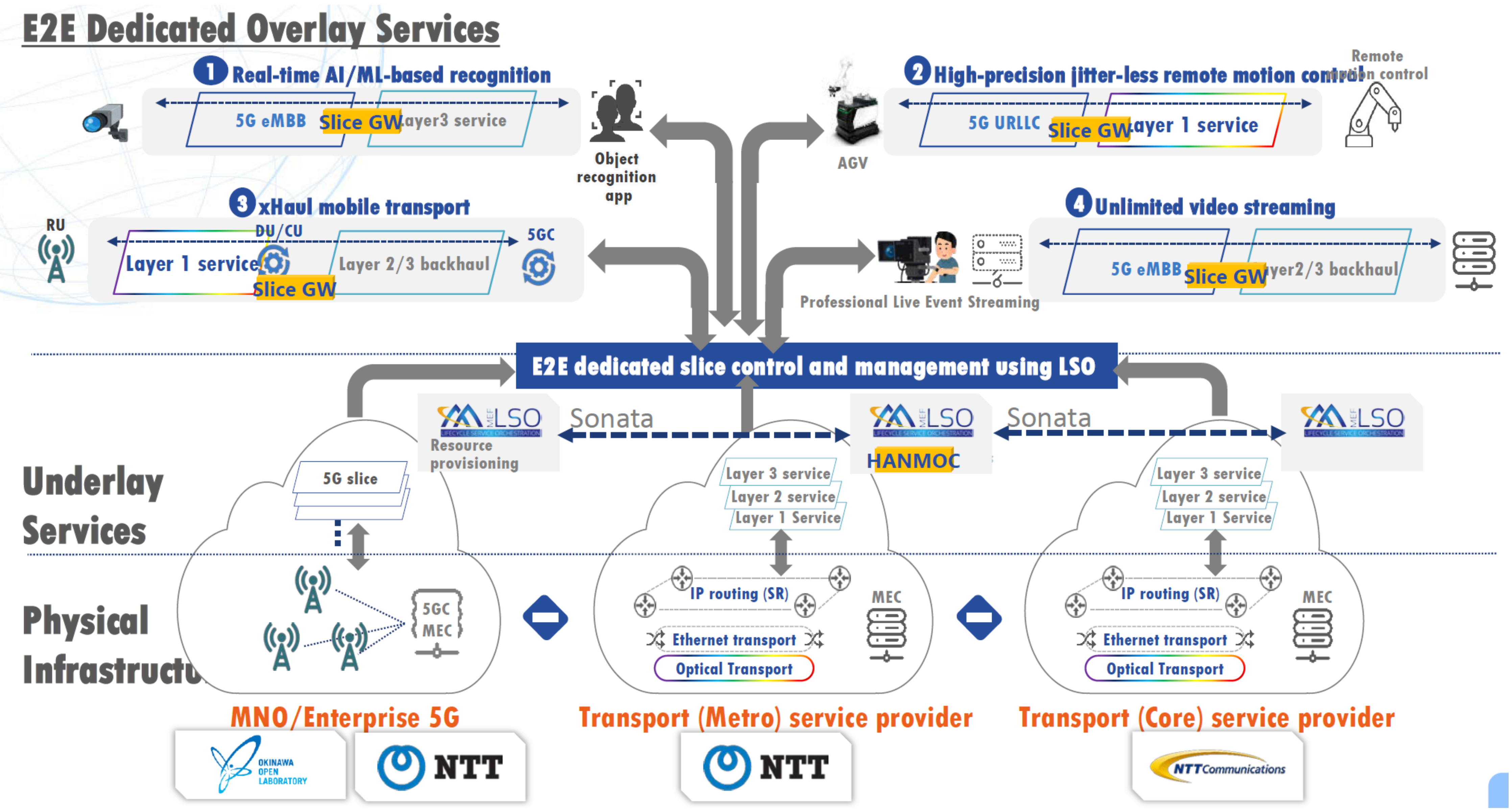
MEF 3.0 PoC in 2019

- Exhibited PoC “5G xHaul Sharing as Slices with LSO Orchestration” in MEF19
- Demonstrated network slicing and multi orchestrator/controller integration on multi operator inter-connection environment
- Won “Network Slicing Implementation Award 2019”


MEF19 PoC Network Diagram
SERVICE ORDER
SOF
SONATA
SOF
SONATA
SOF
OKINAWA OPEN LABORATORY
PRESTO
PRESTO
PRESTO
NTT
ICM
ICM
ICM
DU/CU
MBH
MBH (High reliability)
MBH (High reliability)
UPF
DU
MMH
CU
MBH
MBH (Low Latency)
MBH (Low Latency)
UPF
MFH
DU/CU
MBH
MBH (Custom Path)
MBH (Custom Path)
UPF
SLICE GW CONTROLLER
MULTI-LAYER SDN CONTROLLER
FABRIC CONTROLLER
SLICE GW
SLICE GW
SLICE GW
SLICE GW
PACKET TRANSPORT
OPTICAL TRANSPORT
SHARED XHAUL
TRANSPORT
CORE
OKINAWA OPEN LABORATORY
NTT
NTT Communications
NTT



MEF PoC 2020


E2E Dedicated Overlay Services
1 Real-time AI/ML-based recognition
5G eMBB
Slice GW
Layer3 service
Object recognition app
2 High-precision jitter-less remote motion control
Remote motion control
5G URLLC
Slice GW
Layer 1 service
AGV
3 xHaul mobile transport
RU
DU/CU
5GC
Layer 1 service
Slice GW
Layer 2/3 backhaul
4 Unlimited video streaming
5G eMBB
Slice GW
Layer2/3 backhaul
Professional Live Event Streaming
E2E dedicated slice control and management using LSO
MEF LSO
Resource provisioning
Sonata
MEF LSO
HANMOC
Sonata
MEF LSO
Underlay Services
Physical Infrastructu
5G slice
5GC MEC
Layer 3 service
Layer 2 service
Layer 1 Service
IP routing (SR)
Ethernet transport
Optical Transport
MEC
Layer 3 service
Layer 2 service
Layer 1 Service
IP routing (SR)
Ethernet transport
Optical Transport
MEC
MNO/Enterprise 5G
Transport (Metro) service provider
Transport (Core) service provider
OKINAWA OPEN LABORATORY
NTT
NTT
NTT Communications

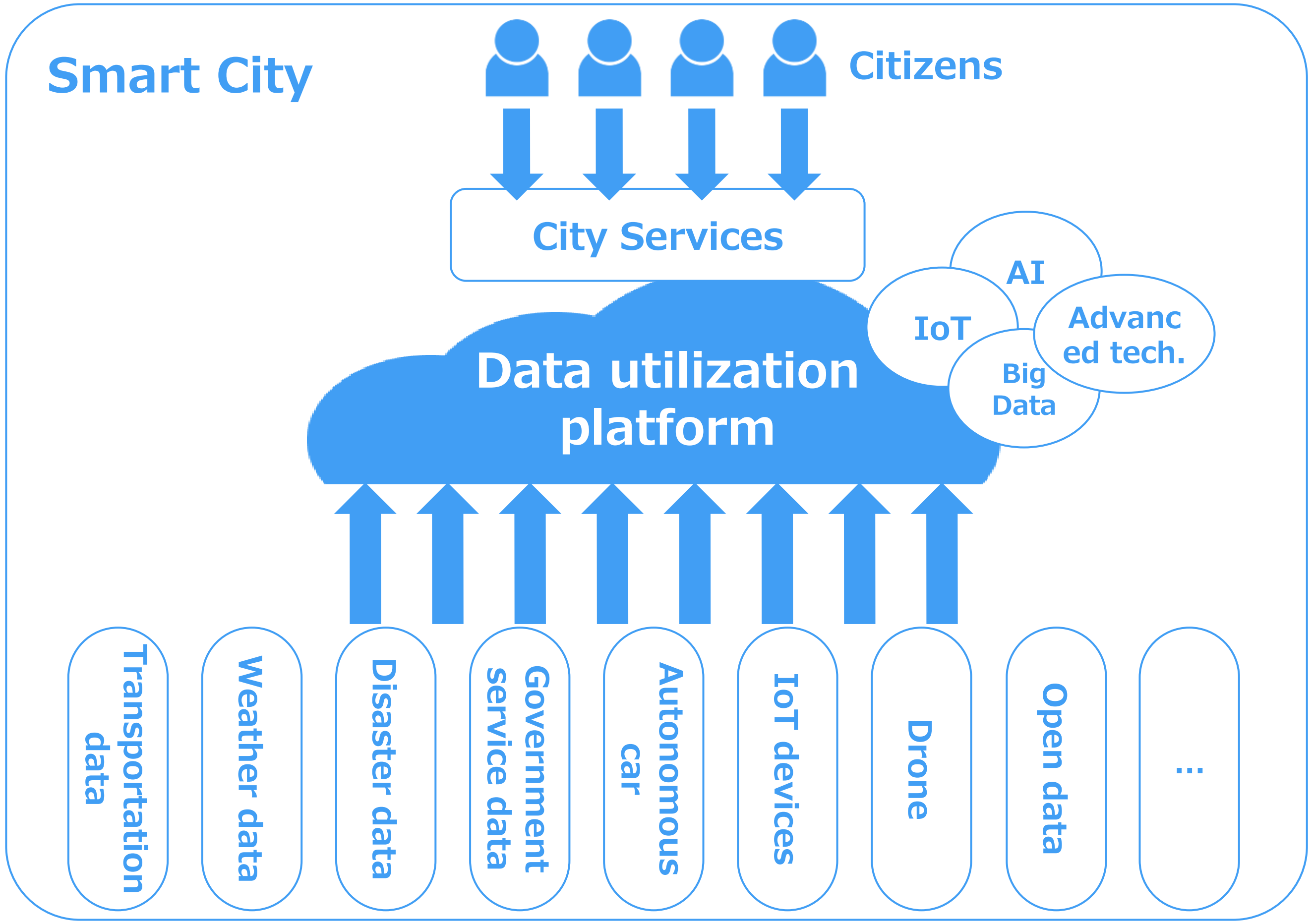
5 5G and IoT Projects Towards Next Generation Smart City

Concept of Smart City

- Utilize the advanced technologies for urban development for citizens life and government services, etc.

- Make efficient for entire city

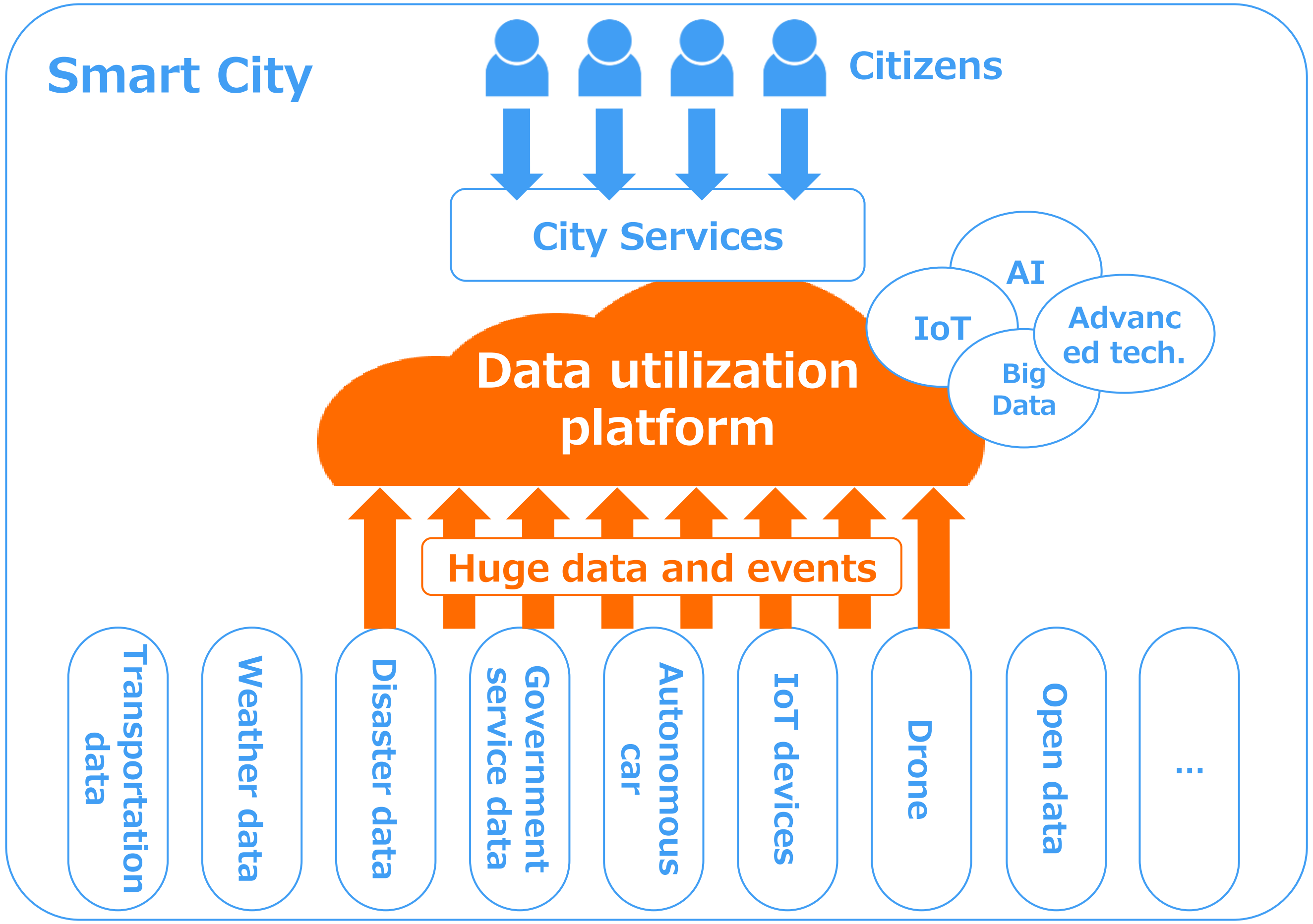
- Data exchange between various industries


Smart City
Citizens
City Services
Data utilization platform
AI
IoT
Advanced tech.
Big Data
Transportation data
Weather data
Disaster data
Government service data
Autonomous car
IoT devices
Drone
Open data
…

Requirements in Smart City (Infrastructure)

1. Platform needs to manage various kind of data and needs to develop services

2. Network needs to handle the huge data and real time events


Smart City
Citizens
City Services
Data utilization platform
AI
IoT
Advanced tech.
Big Data
Huge data and events
Transportation data
Weather data
Disaster data
Government service data
Autonomous car
IoT devices
Drone
Open data
…

Approach to Meet the Requirements

1. Platform needs to manage various kind of data and needs to develop services

   Evaluate the integration of data utilization platform FIWARE and FaaS (Function as a Service) feature for easy service development

2. Network needs to handle the huge data and real time events

   Utilize 5G Multi Access Edge Computing (MEC)
   - Locate the computing resource physically near place to the device or base station
   - Process the data or events at the MEC for those unnecessary to send to the cloud

Approach in the IoT Project

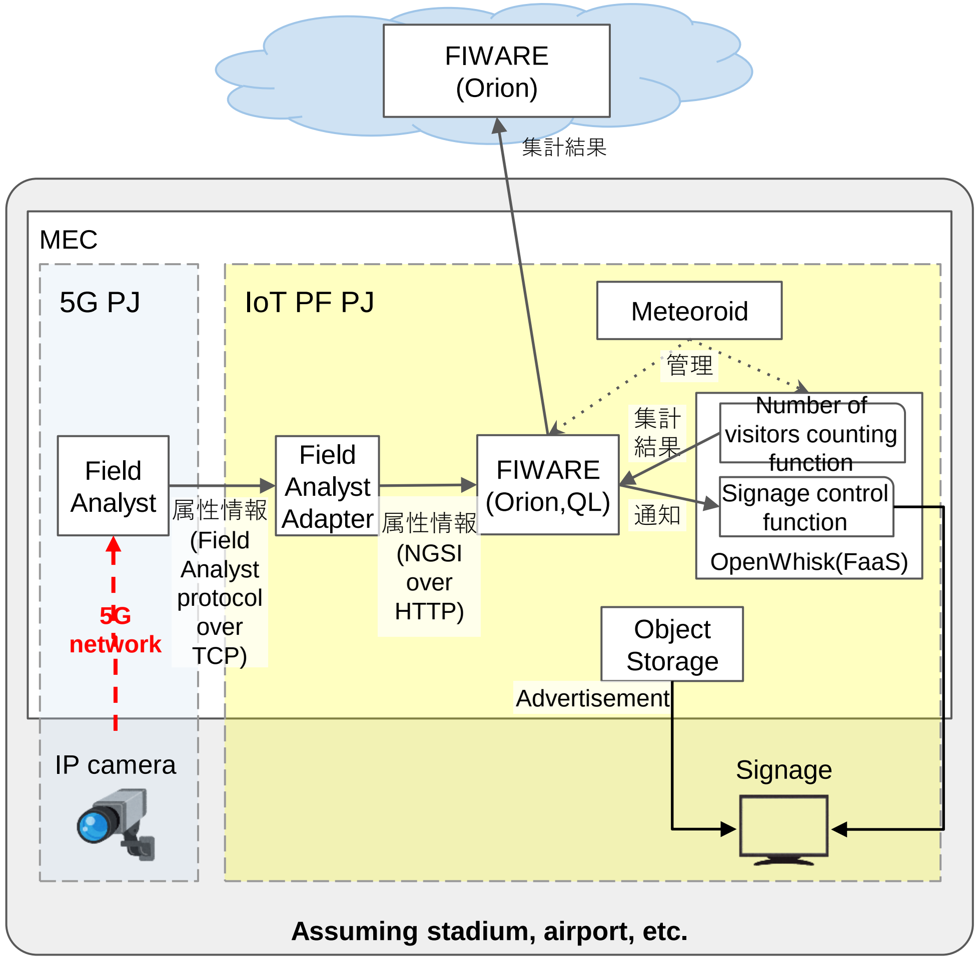
- Develop the Meteoroid to integrate the FIWARE and FaaS feature
  - Meteoroid provides the event driven application execution environment in the FIWARE eco system utilizing FaaS (Apache OpenWhisk)

- Evaluate a use case utilizing the Meteoroid integrating with 5G project network
  - Use case : Digital signage control depends on the personal attribute

Use Case Evaluation

Use case

- Assume the entrance of stadium or airport
- Display the advertisement depends on the visitor’s attribute (age)
- Collect the visitor’s attribute by Field Analyst and notify to the FIWARE in every 3 sec.
- Control the signage depends on the attribute and count the number of visitors once a day
- Collected and counted data are stored into FIWARE in the cloud
- Advertisement data are gotten from object storage



FIWARE (Orion)

集計結果

MEC

5G PJ

IoT PF PJ

Meteoroid

管理

Field Analyst

属性情報 (Field Analyst protocol over TCP)

Field Analyst Adapter

属性情報 (NGSI over HTTP)

FIWARE (Orion,QL)

集計結果

通知

Number of visitors counting function

Signage control function

OpenWhisk(FaaS)

Object Storage

Advertisement

5G network

IP camera

Signage

Assuming stadium, airport, etc.

6 Wrap up

Wrap up

- Key factors to succeed the open collaboration (from our experience)
  - Target oriented approach
  - Zero base thinking to consider the collaboration partners
  - Sufficient communications
  - Scheme, formation or system to keep sustainability

Thank you!!

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