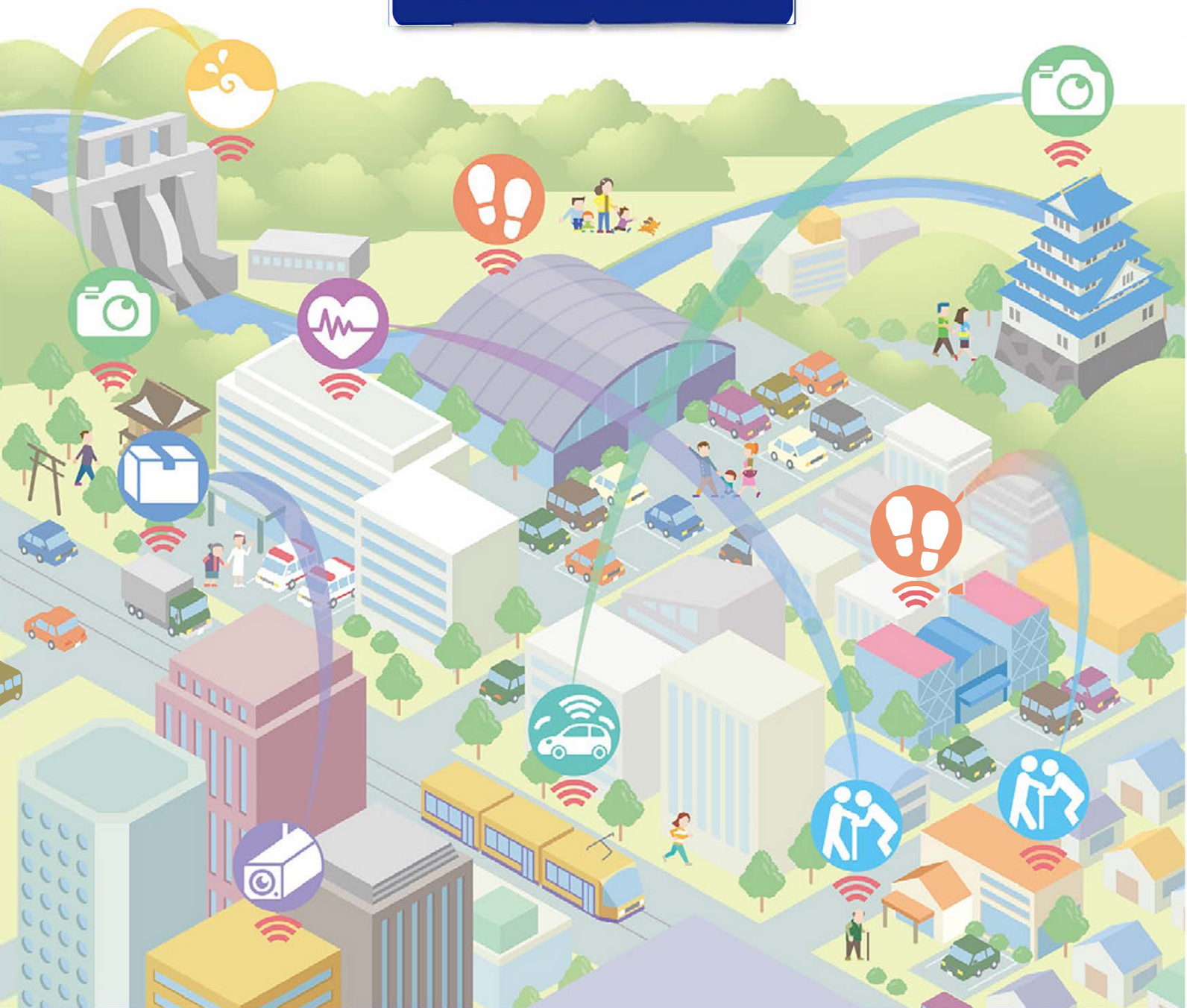**Smart City for Your Community**

How to Use
Smart City
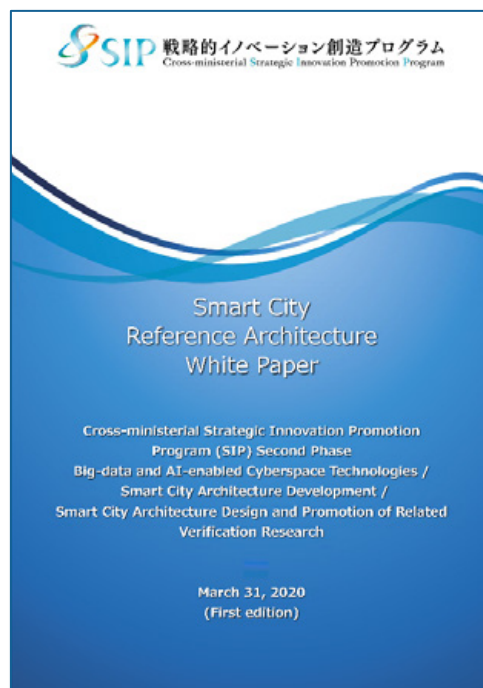# Reference Architecture

Installation Guidebook

Introduction

The positioning of this guidebook

There are various Smart City initiatives in progress across the country, and it has become indispensable to utilize digital technology in resolving regional issues.

For that reason, the Cabinet Office has compiled the Smart City Reference Architecture for those involved in Smart City initiatives in each region.

This booklet is an installation guidebook for those who intend to utilize the Smart City Reference Architecture.

Target audience
　Those organizations which intend to play a responsible role in Smart City initiatives.
　*As it is mainly targeted at those in municipalities, when the regional development organization in the region is playing the primary role, like in the case of area management, please interpret the contents accordingly.

Contents

1 Do you have a problem like this?
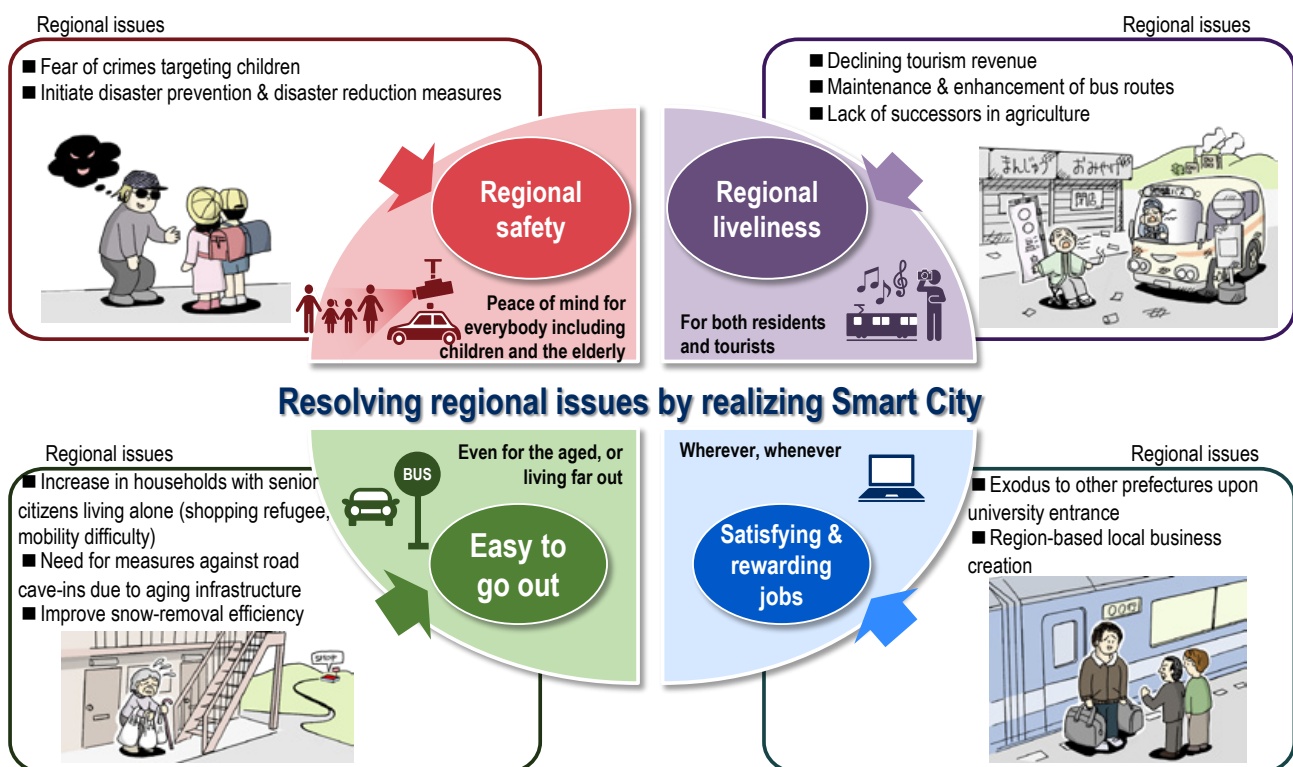## - Smart City makes progress in resolving community issues -

There are many ways to resolve regional issues.

It varies, for example, like enhancing nursery schools to increase the number of people in parenting generation, and providing subsidies for the nursing care of the elderly. However, given the situations, perhaps the manpower and financial resources may be limited.

In each region of Japan, structural social issues such as the declining birthrate and aging population, the decline in productivity, and the exhausted local economies, combined with the over-concentration in Tokyo and the delay in digitalization, are becoming apparent.

In order to improve productivity, and sustain and enhance the vitality of the region, one of the effective means is the **Smart City transformation of the region** utilizing digital technology.

Why not aim for the digitalized and sustainable regional management by realizing Smart City?

Regional issues
- Fear of crimes targeting children
- Initiate disaster prevention & disaster reduction measures

Regional safety

Peace of mind for everybody including children and the elderly

Regional issues
- Declining tourism revenue
- Maintenance & enhancement of bus routes
- Lack of successors in agriculture

Regional liveliness

For both residents and tourists

Resolving regional issues by realizing Smart City

Regional issues
- Increase in households with senior citizens living alone (shopping refugee, mobility difficulty)
- Need for measures against road cave-ins due to aging infrastructure
- Improve snow-removal efficiency

Even for the aged, or living far out

BUS

Easy to go out

Wherever, whenever

Satisfying & rewarding jobs

Regional issues
- Exodus to other prefectures upon university entrance
- Region-based local business creation

The power of digital is the key for regional development

Smart City of the future is expected to resolve regional issues by the digitalization of the region and cross-sectional data federation , and to promote economic cycles by creating new values.

With the declining birthrate and aging population, a major theme is how to resolve complex and intertwined regional issues with limited manpower and financial resources. Rather than trying to resolve issues in each separate field, such as disaster prevention and transportation, as has been the case so far, it becomes possible to work on resolving various regional issues and creating new values and services by federating information on the region and people through **cross-sectional data federation** overcoming the boundaries of government organizations and companies.

With the understanding of the actual status of the region, which has not been visualized until now, by way of collecting regional data using IoT, making the data held by the government open, and so on, there is a need for the reform of the resident-centered social system itself and the creation of new society and business models.

Benefits of data federation

Service federation

By federating data of individual services for citizens, it can be expected to lead to the development of a one-stop service for citizens, for example.

Cross domain federation

By linking and analyzing the data of other cities, it becomes possible, for example, to understand the characteristics of one's own community and lead to the creation of unique local businesses. Also, even in the case living place and working place are different and traveling back and forth on a daily basis, one can still benefit from wide-area services.

Inter-domain federation

By enabling data utilization across different domains, it becomes possible, for example, to advance disaster prevention measures by the combination of government hazard maps, road traffic records in private sectors, satellite images, meteorological data, and so on.

2 Smart City has already begun
- How are the neighboring regions doing? -

Efforts to resolve regional issues through Smart City have already begun in Japan. Presented here are six examples from the domestic & overseas investigation and verification projects in the SIP Architecture Construction Project*.

How was Smart City realized with what trigger, by what kind of people and organizations with what division of roles?

Resident consensus

Citizen safety-care

(Kakogawa-city)

Implementation and operation of information infrastructure, etc. for citizen safety-care

・Implementation of safety-care cameras and next generation safety-care services (public-private collaborative project)
・In safety-care services, common sensors which can detect notification tags (BLE tags) from multiple operators are developed. In addition to fixed common sensors, Kakogawa-apps and mobile IoT devices for postal service vehicles are developed as well.

Decline in the number of known criminal offenders (per 1,000 people)

1.1335 (May 2017)

The 4th worst in Hyogo Prefecture

0.5683 (Nov. 2019)

Less than the average of Hyogo Prefecture

Cross domain federation

Wide-area disaster prevention
- developing robust region -
(Takamatsu-city and neighboring municipalities)

Construction of a mechanism for quick information sharing in the event of a wide-area disaster

・Assisting decision-making of the quick and optimal countermeasures, by fusing the information on road traffic, weather, river water levels, tide levels, and other relevant disaster prevention information into a single picture.
・Development of the collaborative usage model for IoT platform with the neighboring municipalities.

**Inter-domain federation**

Developing healthy region
(Sapporo-city)

Providing Kenko (Health and Well-being) Point Service

・Introduction of Kenko Point System, a program which gives incentives to participants according to their actions and achievements (walking, improving health condition, participating in courses, visiting specific areas, etc.).
・Construction of the data federation infrastructure and the operational organization for public-private sector collaboration.

Due to introduction of "**Kenko Point**" Increase of participants in "**1800 steps/day**" even in the winter time [1]

Anticipated medical expenses reduction effect of about **40,000 yen/person-year** [2]
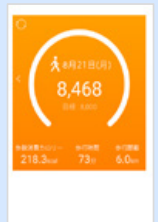
*1 Figure obtained in the verification tests conducted in Sapporo-city as Smart City Verification Research Project of Ministry of Land, Infrastructure, Transport and Tourism, FY2018
*2 Calculated assuming medical expenses reduction effect by walking to be "0.061 yen/step/day

Region with the leading-edge services promoted by City OS & users' viewpoint (Aizu-Wakamatsu-city)

Improving the rate of citizens' communication via "Aizu-Wakamatsu Plus", the regional portal for the citizens

・Displaying personalized information (optimized for each individual) on the portal in accordance with the attributes and tastes of each user.

・Various services are displayed in the form of gadgets on the portal. User convenience is maximized by enabling their usages upon registration of one regional ID and password.

Regional development utilizing sensor network (Toyama-city)

Publicly recruited project to provide the free-of-charge usage of Toyama-city sensor network

・Verification trial environment for the development of IoT sensors, etc. and verification of new functions is provided to private companies and higher academic institutions.

・23 projects (36 parties) participated in FY2019. Verification trials were conducted by a wide variety of private businesses in the field of IT, welfare, agriculture, etc.

International business center by way of digital & contents (Takeshiba Area)

Synergy effect between the liveliness creation of the area and the PR promotion of leading-edge technologies

・Robot demonstrations at Takeshiba Summer Festival
Number of visitors: about 5,000 people (Aug. 2019)
* 3 days total

・Lighting-up of the former Shiba Imperial Garden incorporating leading-edge technologies
Number of visitors: about 4,100 people (Nov. 2019) * 4 days total
(Number of visitors more than doubled from normal)

memo

3 You can do it in your community, too
- What is Smart City architecture? -

When you talk of utilizing Smart City to resolve regional issues, perhaps some concerns like the followings may come to your mind first.

Common concerns for Smart City among region and municipality employees

1. Where do we start with Smart City?

- The approaches to Smart City are so broad, we do not know where to start.

- As it has never been done before, we cannot even imagine what to decide and how to proceed.

- As it requires collaboration between organizations and departments beyond what has been done before, we need guidance on how to proceed better.

2. What services and systems fit best for our region?

- Although we are aware of the example cases of studies and verification trials in various cities, we do not know on what basis we should implement services and systems.

- We do not know what has to be decided to construct systems.

- We would like to reduce the implementation cost as much as possible.

Smart City Reference Architecture can assist you take the first step from those concerns.

What is Smart City Reference Architecture?

The term "architecture" has originally been used in the field of building construction to describe a blueprint showing the structure and relationships of things.

By referring to the Smart City version of this blueprint as a "reference", it is possible to design a blueprint of Smart City (Smart City Architecture) reflecting the characteristics of each region planning to promote Smart City.

In Society 5.0, the following model is defined as the architecture to be referenced to realize super smart society.
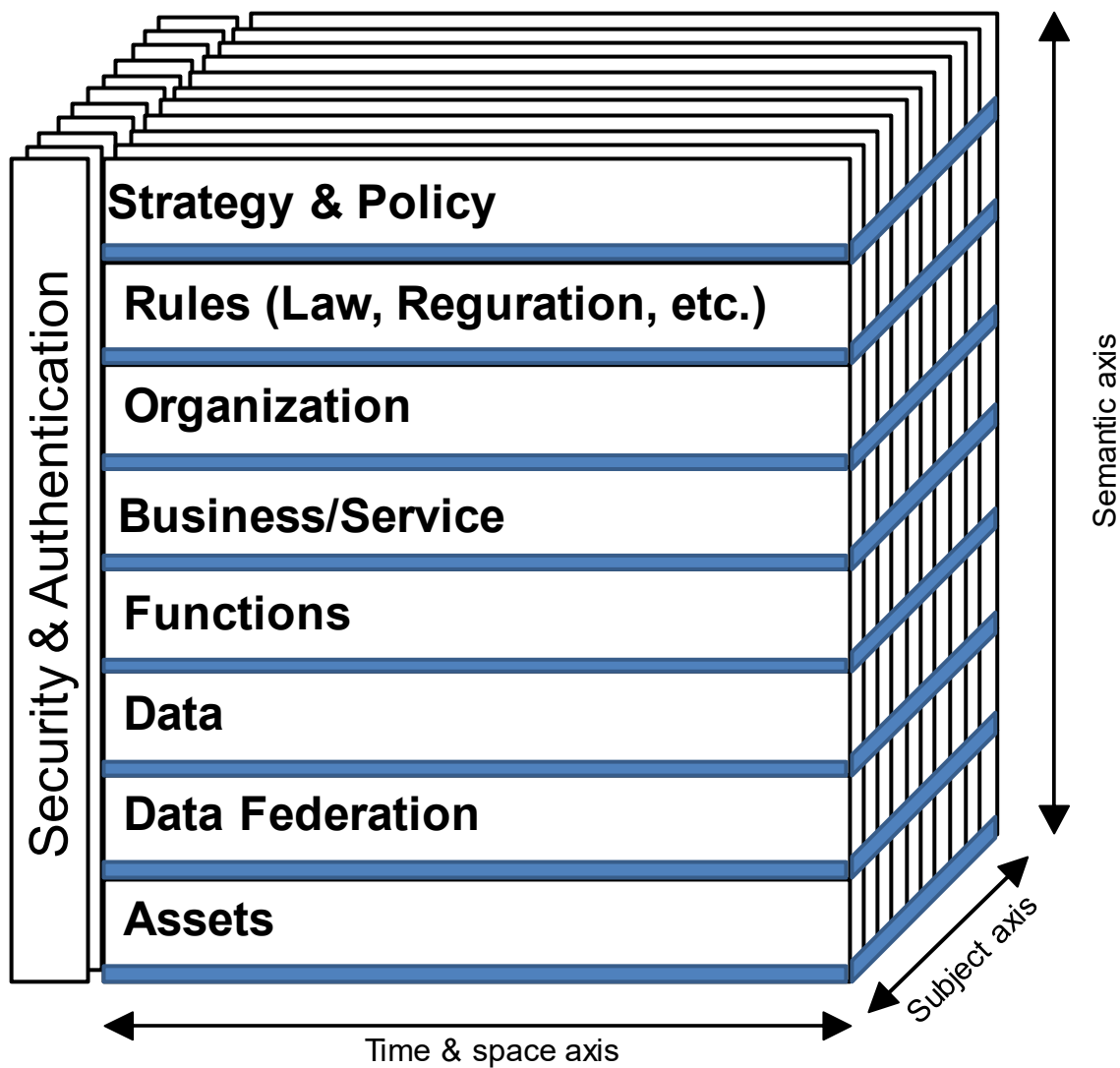
Society5.0 reference architecture (source: Cabinet Office)

Why is Smart City Reference Architecture necessary?

Smart City Reference Architecture systematically organizes the components to be considered in utilizing Smart City to resolve regional issues. Therefore, it enables efficient construction of Smart City in each region based on the standardized methods and rules (reference architecture).

The effects of utilizing
Smart City Reference Architecture

✓ **Understand the procedures to start Smart City**

✓ Implement systems to realize sustainable community development **without omitting what has to be done**

✓ **Prevent it becoming a stand-alone effort** by conducting it under common policies and language. It therefore becomes easier to enable the repurposing of outcomes and the interoperability between cities and between domains

This chapter describes why it is important to utilize Smart City Reference Architecture, and the following chapter 4 describes the details on how to use it and its procedures.

Four concepts of Smart City Reference Architecture

Smart City Reference Architecture is constructed based on the following four concepts.

1. User-oriented principle

All participants in Smart City project are always aware of the users of Smart City services in their efforts to work on Smart City

2. Role of city management

To maintain sustained management of Smart City, functions to manage the whole region are needed

3. Role of City OS

Through provision of Smart City services via City OS, data and services are federated efficiently without restrictions
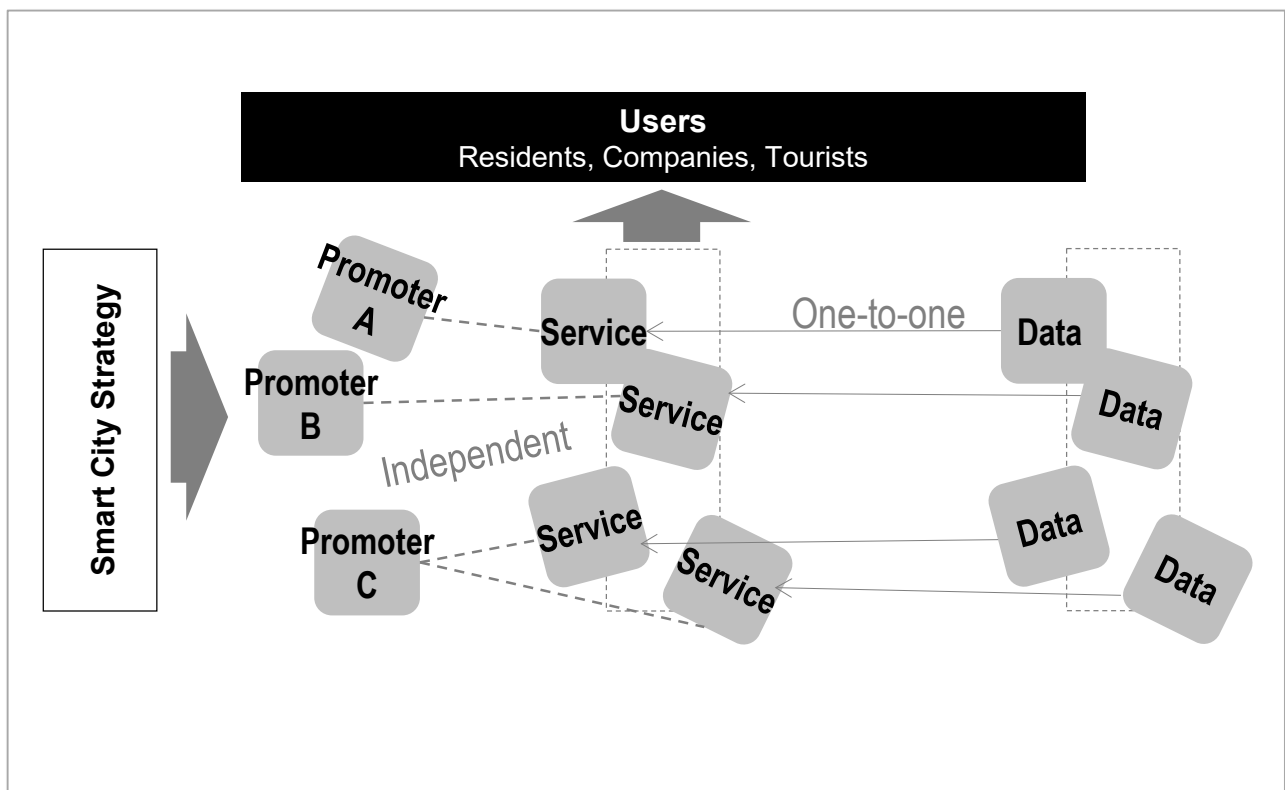
4. Importance of interoperability

To promote efficient Japan-wide Smart City transformation, the efficiency in interoperability with other regions and systems is needed
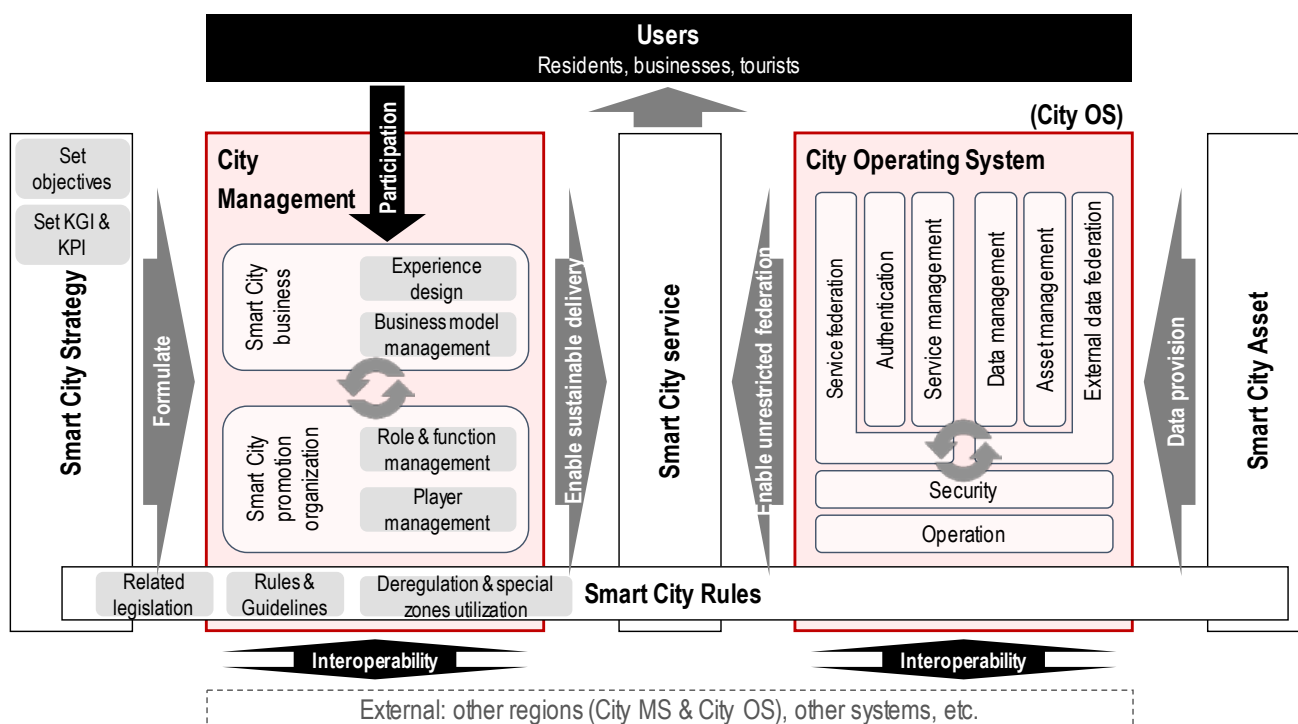
Looking back at the domestic Smart City initiatives to date, the following issues have arisen.

Before : Current status and issues

- Duplication of services within the single region and unclear points of contact and persons in charge make it difficult to enable cross domain federation, etc.
- The system is such that there is one-to-one relationship between Smart City service and data.
- Each system is closed to itself making it difficult to enable service federation within the region.
- It has to be developed from scratch in each region resulting in high costs of implementation.
  It is individually optimized for each region making it difficult to enable horizontal development.

By utilizing Smart City Reference Architecture, you can resolve these issues.

After : Design Smart City based on Smart City Reference Architecture

* For the detailed descriptions of architecture, please refer to "Section 2.2" of the White Paper.
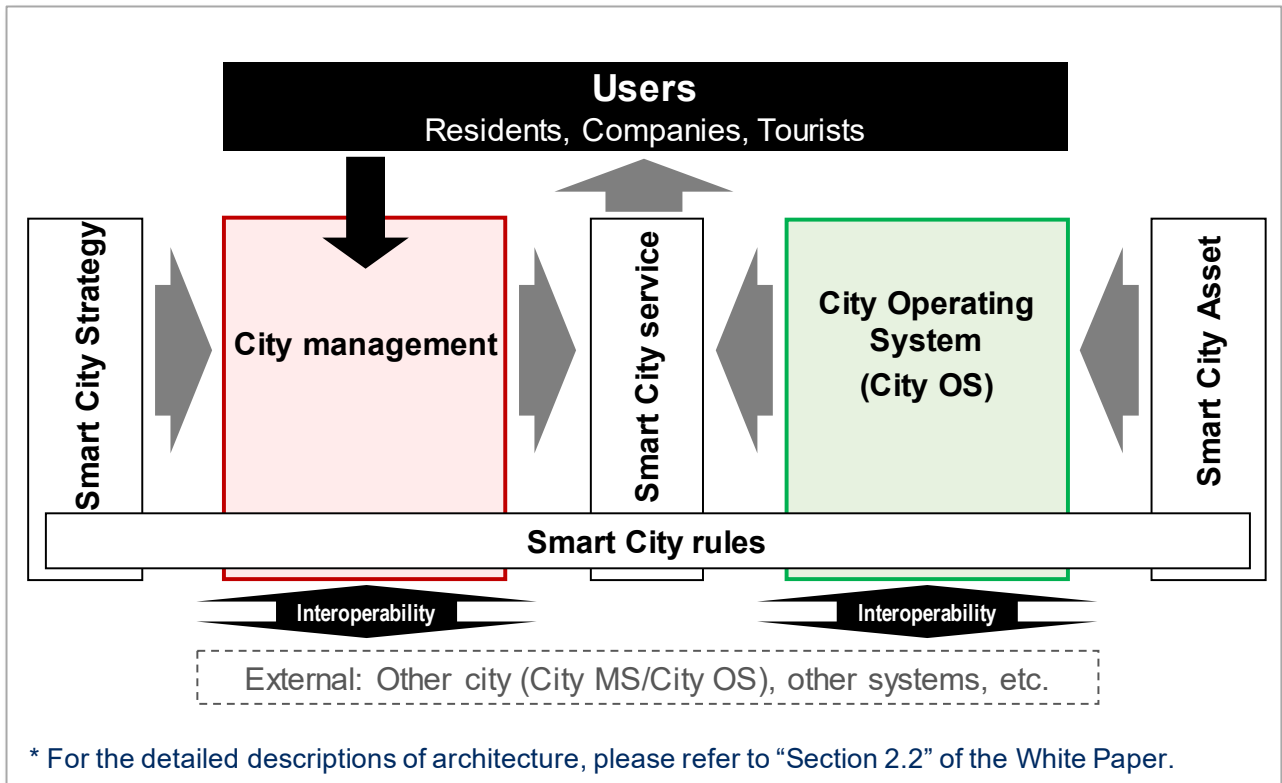
By city management

- The primary promoter and the business model of the whole region become clear and the initiatives become unified and sustainable.

By City Operating System (City OS)

- Smart City services and data form N-to-N relationships for mutual utilizations
- Creation of new value via service federation
- Service providers can focus on the service development thanks to accelerated development and reduced cost due to horizonal development from other regions
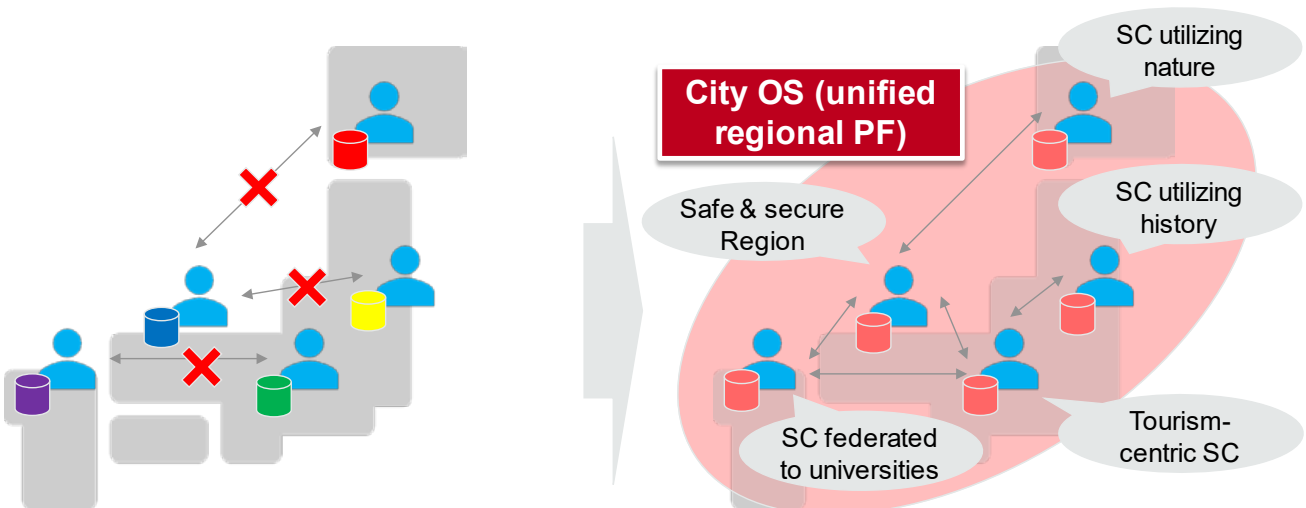
● What is city management ? What is the benefit ?

City management is a framework to design business models by organizing primary promoters and stakeholders involved in the Smart City project in the region. It enables sustainable regional development.

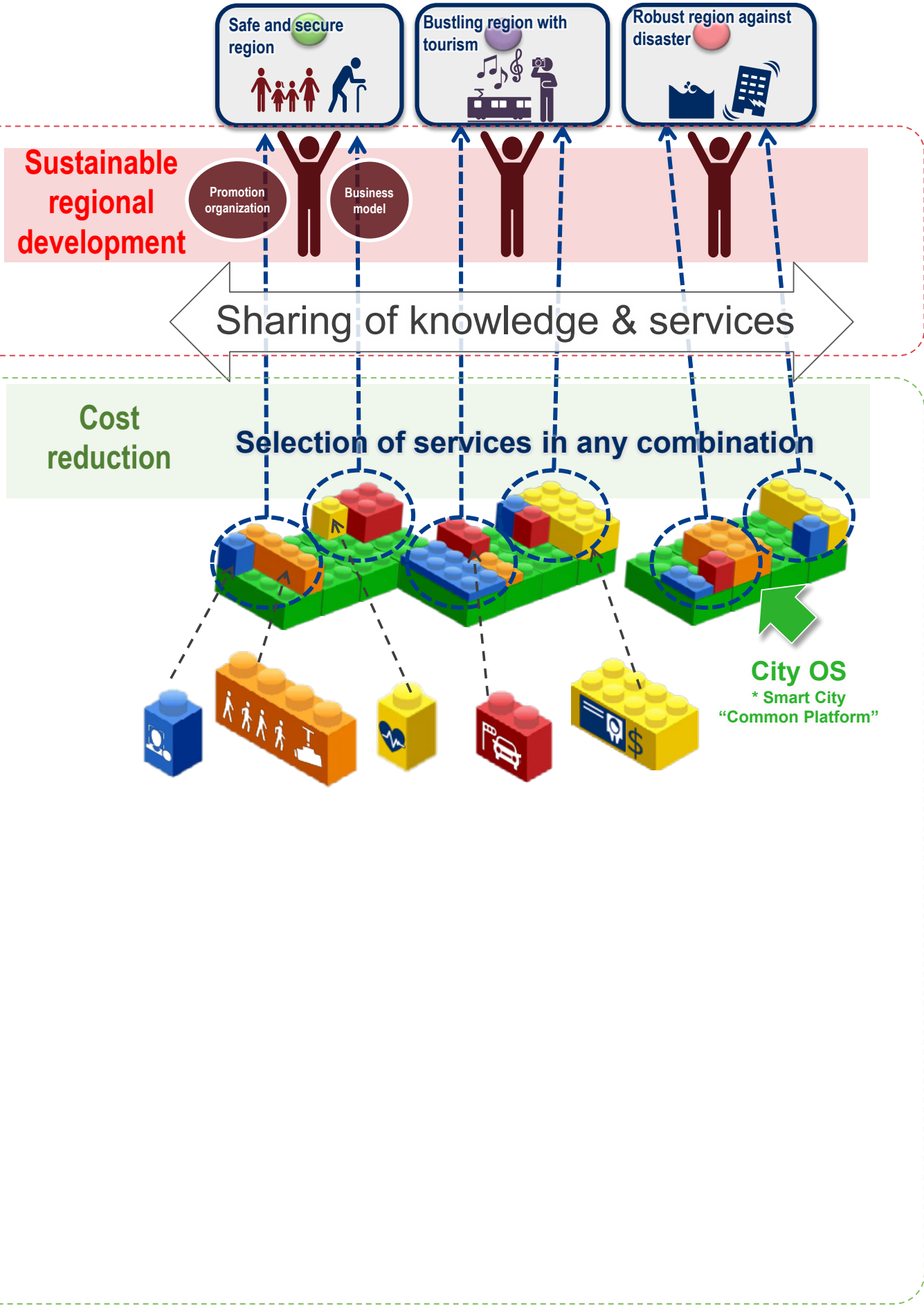## ● What is City OS ? What is the benefit ?

In order to achieve service federation and cross domain federation a systematic common platform is created. It enables utilization of any combinations of services and functions provided by various operators and other regions. This common platform is called "City OS".

By openly publishing API (Application Programming Interface), services and data which used to be federated to each other one-to-one are separated and enabled for seamless utilizations. Thanks to this, it is not necessary to develop them from scratch in each region and Smart City can be realized efficiently and at low cost.

City OS (unified regional PF)

SC utilizing nature

SC utilizing history

Safe & secure Region

SC federated to universities

Tourism-centric SC

*What it API (Application Programming Interface)?
It is a mechanism to externally call a function of a computer. It is in effect a drawer of tools and data which can be used whenever necessary, and made available for external service development by openly publishing the data and parts of functions of a particular service.

Safe and secure region

Bustling region with tourism

Robust region against disaster

Sustainable regional development

Promotion organization

Business model

Sharing of knowledge & services

Cost reduction

Selection of services in any combination

City OS
* Smart City "Common Platform"

15

Smartphone, a single device which can do anything

Before smartphone was introduced, one had to use a separate single-purpose medium depending on the use, such as a camera to take pictures, a newspaper to read news, a game machine to play games, etc.

However, with the advent of mobile phones, in particular smartphones, it has become possible to use multiple functions developed by any business operators with just one smartphone by installing an appropriate application for the purpose.

It has become not only convenient for users but also possible for any business operators and individuals to develop services and share them easily due to the lower barrier of entry to application development.

It can be said that this is due to the existence of "OS" with smartphones as the common platform.

**A single device which can do anything
Mobile phone/Smartphone changes life completely**

Camera images

Current location

Map information

Internet

Up to now, different medium had to be used for each function

memo