Telecommunication
Development Sector
Study Groups

Second meeting of ITU-D Study Group 2
Geneva, 25 - 29 March 2019

Document 2/208-E
12 March 2019
English only

DELAYED CONTRIBUTION

Question 1/2: **Creating smart cities and society: Employing information and communication technologies for sustainable social and economic development**

SOURCE: NEC Corporation (Japan)

TITLE: Sustainable smart society with information communication infrastructure and data utilization software

Reference to Document: SG2RGQ/28

Action required: Participants are invited to consider this document.

Keywords: *IoT sensors, smart city and society, CATV, SDN, data utilization*

Abstract:

This contribution introduces the case study of Shiojiri City, Nagano prefecture Japan, where they have been trying to build the infrastructure of a sustainable smart city. The environmental data collection done by Shiojiri City was already introduced in Document SG2RGQ/28. This time, a wide set of data, including environmental data is used to underpin services such as disaster prevention, crime prevention, tourism, and agricultural support. This information is shared with the community via the city's information communication infrastructure (CATV). Shiojiri City has conducted a feasibility study of the infrastructure for a sustainable smart city and this contribution shares the outcome of that study.

Name/Organization/Entity: Mr Ataru Kobayashi, NEC Corporation, Japan
Phone number: +81 337 988 639
E-mail: a-kobayashi@df.jp.nec.com

1. Introduction

This contribution introduces some of the challenges experienced in Shiojiri City (Japan) when working towards achievement of sustainable smart society.

The use case of automatic collection of environmental data with IoT sensors in Shiojiri City was presented to the ITU-D Study Group 2 Rapporteur Group Meeting (October, 2018) in Document SG2RGQ/28 ("Proposal for the sustainable smart society"). This use case emphasized the importance of the effective use of data for social life.

For further details on the background of Shiojiri City, please refer to Document SG2RGQ/28.

2. Background

Rural cities in Japan have several common issues including aging demographics, population decline, aging infrastructure, climate change, abnormal weather and natural disasters such as, earthquakes, floods, and landslides. To solve these issues, this contribution shares the experiences of using Software Defined Networks (SDN) and a data utilization software (FIWARE) in Shiojiri City to tackle some of these issues.

SDN is a new concept for dynamically controlling a network and its architecture with software. In current networks, when delivering data to a destination, each node individually applies the network rules and judges the route for sending data packets. This can lead data to take quite complicated routes through the network. For this reason, it has been difficult to optimize the path of data in response to the real time situation of a network (e.g. data congestion or network maintenance situation). Also, when building or modifying a network, it is necessary to set up a large number of nodes, which takes a lot of time and resources. SDN separates network control from data transfer processing and dynamically controls devices that only perform data transfer processing with software. The main advantage of this, is that it is a much more flexible, efficient and safe approach, meaning that it is possible to change a network bandwidth in real time.

FIWARE, developed and first implemented in Europe, is a data utilization software for linking data divided across different sensors and different fields. It is centred on "context information management" functions to realize a data-centric society. Also, it is an open architecture, it can maximize the benefits of Open Source Software (OSS) without depending on a single ICT vendor.

3. Advancement of cable television network applying SDN technology

3.1. Important role of cable television network in the rural area

Cable television (CATV) in Japan has 30.22 million household subscribers nationwide, and the household penetration rate reaches 52.6%. CATV's popularity is partly because of the difficulty of broadcasting in Japan with its mountainous geographical features. In addition to broadcast television programs, CATV operators in Japan also provide a wide range of network services including Internet access, fixed and mobile telephone services. As the network and media providers to many parts of Japan, CATV operators play an important role as providers of information services for local and regional residents and communities.

3.2. Challenges faced by cable television operators in rural areas

CATV operators in Japan are often operated by small businesses, and they are required to realize sophisticated services while reducing the maintenance and operation costs. When introducing additional ICT services, it is often necessary to build infrastructure dedicated to each service. Management of this diverse service infrastructure is also costly.

3.3. SDN solution for decreasing management cost of CATV network

In order to solve the above issues of CATV networks, a feasibility study applying SDN was conducted in Shiojiri City.

An SDN device[1] was implemented and a conventional large-capacity video service[2] was accommodated, as well as other services such as Web access for CATV subscribers, applications, movie streaming, crime prevention for regions, tourism, and agricultural support, etc.

3.4. Lessons learnt from applying SDN technology to a CATV network

The feasibility study proved the possibility of providing services closely tied to local residents and communities by introducing SDN technology and how this makes it easier to sustain important information communication infrastructure for rural areas.

Specifically, first of all, by making the service visible, providers can better understand service utilization by users, and provide more appropriate content provision and service quality.

Secondly, on network quality control, SDN network slicing[3] technology secures real-time traffic volume control and service quality according to communication characteristics, communication priorities and service requirements. SDN technology allows this to be done with a common network infrastructure, resulting in reduced infrastructure and operating costs.

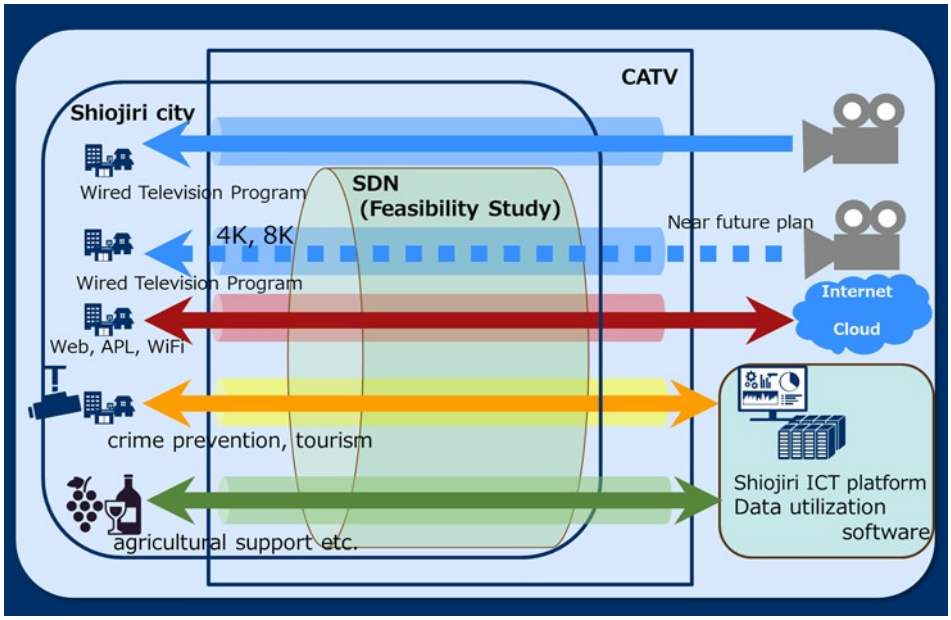

Figure 1: Feasibility study of CATV information communication infrastructure with SDN

4. Data utilization software

4.1. Challenges in utilizing collected data

As IoT has become more widespread, various environmental data can be collected, but it is necessary to prepare a database of each sensor type and further intelligence is necessary to combine the various data collected so that it can be applied to the local society.

4.2. Software solution for utilizing collected data

In order to solve the above issue, Shiojiri City introduced the infrastructure software. NEC Corporation has participated in the feasibility study in Shiojiri City and

1 _____ SDN device was jointly developed by NEC Networks & System Integration Corporation, the National Institute of Information and Communications Technology, and Professor Akihiro Nakao from the University of Tokyo

2_____ Feasibility study of conventional large-capacity video service with SDN is currently ongoing.

3_____ Network slicing is a technology to manage physical equipment (physical resources) such as servers and routers as virtually divisible resources (virtual servers, virtual links, virtual network functions, etc.) and to configure virtual networks (slices) combining these virtual resources on shared physical equipment.

incorporated environmental data into this infrastructure software.

4.3. Problems being solved

In Shiojiri City, accumulated data collected from across multiple domains (e.g. disaster prevention, tourism, transportation, energy, and environment, etc.) from across the city, was used to solve issues, such as revitalizing the community and improving safety. The data utilization software was also used to share, analyse, process and visualize the data.

As a concrete example, Shiojiri City is surrounded by many mountainous and forested areas. Many tourists visit the city including climbers and trekking enthusiasts. However, it is a place where the weather can change very rapidly. Dangerous places are identified from databases of environmental sensor information (e.g. temperature, humidity, wind speed, wind direction, rainfall) in the mountainous area and other data of terrain and position information of known hazards. By providing the information in real time to local tourists, it can be useful for reducing accidents and incidents.

As another example, traditional city hall had issued warnings based on the forecasts issued by the Meteorological Agency. By adding the information on the amount of water in the soil measured by moisture content sensors in the soil at hazardous areas, it is now possible to issue alerts and warnings with a much higher level of accuracy.

More feasibility studies are planned for both of the cases above in the near future.

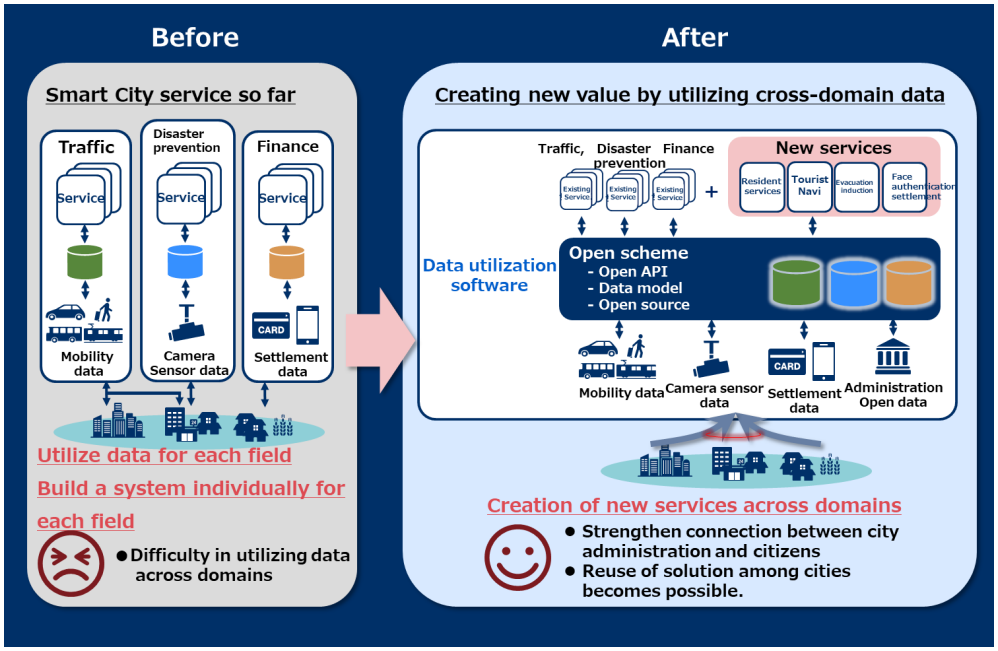

Figure 2: Feasibility study of data utilization software

5. Use case of SDN and data utilization software combination

In the feasibility study in Shiojiri City, combination of information communication infrastructure using SDN and the data utilization software produced concrete results.

This use case shows how frost predictions are shared with the fruit orchard. Temperature and humidity data collected by IoT sensors, along with geographical and position data are shared across domains using the data utilization software. By processing this data, the dew point of each area can be calculated. As a result, the likelihood of frost occurring in the next two hours is predicted for each area. This frost occurrence forecast is provided to producers such as orchards via the information communication base of the CATV network using SDN. In this way producers can receive real-time forecasts of the probability of a frost and can take measures to minimize frost damage. Frost that occurs during the period of March to May has a major influence on the growth of fruit trees and will damage the harvest of the orchard. Efficiently minimizing frost damage to fruit trees is a major benefit for producers.

6. Conclusion

The use cases presented here illustrate that using SDN (that does not separate radio broadcasting and wired communication and adopts bidirectional communication) is one of the options that developing countries have when planning and deploying communication infrastructure.

When building new environmental sensor networks for smart society, rather than separately collecting and managing databases divided into categories as in the past, it is possible to use the data utilization software to manage this. Therefore, the costs of data management can be reduced.

Shiojiri City is a good example of how SDN and data utilization software can solve problems in local residents and communities. The environmental data (already introduced in Document SG2RGQ/28) is shared, analysed, and processed by data utilization software to make value-added information for local residents. It is also an example of using that information to deliver services such as disaster prevention, crime prevention, tourism, agricultural support, etc. towards the local community via information communication infrastructure (SDN).

It is proposed that these use cases be included in the Final Report of Question 1/2.

This contribution was gratefully supported by Mr Haruo Kaneko from Shiojiri City Hall (Japan); (hk@shiojiri.com).