野村総合研究所

Possible Use Cases for the 2nd Generation WoT Standards

19 September 2019

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Otemachi Financial City Grand Cube,
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Outline

- Objective of this presentation
  - Proposing possible use cases for the 2nd generation Web of Things (WoT) standards

- Background
  - The W3C WoT WG is finalizing the first phase of its standardization activity. And now development of new use cases for the 2nd generation standardization work is required.
  - Given the situation, one of the Japanese Web communities (including W3C member companies) tried to generate possible use cases to support the WG's activity and promote WoT.

- Action Description
  - An ideathon event was organized to clarify possible use cases and understand the requirements for 2nd generation WoT standards to help the WoT WG accelerate the standardization work.
  - Many possible use cases were extracted based on the results from the ideathon, and the relationship between those use cases and the basic technical requirements, which are included in the WoT WG draft Charter, was examined.
  - Nomura Research Institute (NRI) is now presenting this report to the WoT WG as the organizer of the ideathon.

Introduction to the Ideathon

Item	Overview
Theme	~From Smart Home to Smart City~ Let‘s think about a great future together with manufacture company and Web engineers!
Date	August 23-24th, 2019
Participant	22 participants (11 college students, 11 younger employees from IoT related companies)
Overview	Exchanging ideas on new lifestyles created when a society with a system highly integrating cyber and physical space is realized.

[Ideathon Photo]

Results of the Ideason（1/3）

#	Idea	Overview	Device	Data
1	**Sharing lives with remote family**	Sharing space gives users an interval to share their life even if they are away. For example, users can eat the same dishes with smart recipes or enjoy the same content simultaneously with smart TV	• Canera • Smart TV • Smart cooker • AR	• Cooking database • Content that family members can enjoy
2	**Providing lifestyles to improve productivity**	It provides a schedule that allows people to spend their daily lives efficiently and without external stress. It does not mean that one appointment can be handled efficiently and comfortably, but the entire daily schedule is optimized	• In-house IoT appliances • Office-based IoT equipment (air conditioning, CO2 sensors, etc.) • Smart watch	• Traffic data • Public facility information • Environment data such as snow removal
3	**Proposal of the best house**	Before users buy a house, they can avoid the problems that occur after they start living in the house by experiencing life in advance in the VR experience-type housing exhibition hall. It also provides total value that takes into account the lifestyle and surrounding environment after 30 years	• VR-Experienced facilities • 360 Degree camera • Audio collection sensor • Body sensor	• Local government data (precipitation, city planning, etc.) • Company's image of new products and other data
4	**Providing immersive space beyond space and time**	For people who cannot freely move away (e.g. seniors, hospitals, etc.), and people who can not meet, by inspiring five senses, the person who can not actually go to the place or can not meet realistically reproduce the person	• IoT home appliances (lights, fans, allomas, etc.) • AI speakers • Full-screen display	• Environmental data such as climate and terrain • Facebook, the LINE, and other personal data
5	**Pool check (personalization of integer environment improvement)**	In order to improve the intestinal environment, the intestinal environment is visualized, and the components necessary for improving the intestinal environment are determined and provided from the user's physical information and open data	• Miniature devices that allow people to see the intra-intelligent environment	• Physical data • Weather and environmental data such as infections and pollen
6	**Lifestyle support for critical moment in life**	In order to avoid failure at important moments in life such as encounters with fate, proposals and childbirth, we will support users to think about the best plan according to their hobbies and circumstances	• Wearable device • Smart phone	• Environmental data (maps, restaurants, etc.) • Personal data such as SNS

Results of the Ideason（2/3）

#	Idea	Overview	Used device	Use data
7	**Security robots to help people in trouble**	Smart agents (security robots) help people in trouble in the city. They communicate to people in trouble (e.g. lost child, people at the time of disaster, etc) with appropriate voice tone and phrases to make them feel alright	• Smart agent • Cameras and various sensors for detecting trouble situations	• Information on the appearance and feeling of all objects • DB to manage troubleshooting situations and solutions • Personal data such as preferences
8	**Lifestyle support through clones with other people's experience and knowledge**	A clone with the experience and knowledge of another person will act on behalf of the work and provide a new experience. Using clones not only complement each other's experiences and skills, but can also be optimized for the times and individuals.	• 3D printers • AI robots • VR equipment	• Accumulated experience information • Family registers and other personal data • Vital data • Public information such as the social environment
9	**Providing non-residential life with smart camping car**	A camping car provides a life in a camping car with a function of living and social procedures. It is a service that allows users to relocate to their preferred location according to the situation while eliminating travel costs and tax payment procedures, and solves social problems such as regional disparities.	• Automated camping car • Wearable device	• Traffic data • Tax, Education/Health Information • Personal data such as vital and location data
10	**Mental scoring and proposal of preventive measure**	It visualizes mental status from health data and surrounding environment, and propose preventive measures. By using elements such as the surrounding environment and DNA as explanatory variables, perform highly accurate predictions and optimize the environment with IoT home appliances etc.	• Smartwatch • Smart Speakers • In-house IoT appliances	• Personal data such as consultation records, vitals, DNA data, and life patterns • Environmental data such as weather

Results of the Ideason（3/3）

#	Idea	Overview	Used device	Use data
11	**Natural lecture of behavior and appearance**	It notifies and improve the appearance and behavior problems that are difficult to point out and difficult to recognize by themselves. For example, by improving the appearance, speech, posture, body odor, etc. then users are expected to be able to believe themselves and control the image	• Street live camera • IoT appliances (smart speakers, electric toothbrushes, smart cheers/desks, etc.) • Wearable device	• Action data of people around you, as well as audio data of conversations observed by the camera • Odor index
12	**Learning of know-how that is difficult to verbalize**	By observing and sharing the motion itself, it provides accurate advice for getting some tricks that are difficult to verbalize. Efficiently learn languages such as cooking and pronunciation and practice instruments	• Wearable devices with sensors (gyro sensors, accelerometers, musical potential sensors, microphones, etc.)	• Data on know-how and skills

WoT WG Charter Topics

#	Topics	概要
1	Architectural Requirements, Use Cases, and Vocabulary	• Understand and state requirements for new use cases, architectural patterns, and concepts
2	Link Relation Types	• Definition of specific link relation types for specific relationships
3	Interoperability Profiles	• Support plug-and-play interoperabilty via a profile mechanism and define profiles for specific application domains and use cases
4	Templates	• Define how Thing Descriptions can defined in a modular way
5	Complex Interactions	• Document how complex interactions can be supported via hypermedia controls
6	Discovery	• Define how Things are discovered in both local and global contexts and Thing Descriptions are distributed
7	Privacy Risk Mitigation and Identity Management	• Mitigate privacy risks by defining how identity is managed and updated
8	Security Schemes	• Vocabulary for new security schemes supporting targetted protocols and use cases
9	TD Vocabulary	• Extensions to TD vocabulary definitions
10	Protocol Vocabulary	• Extensions to protocol vocabulary definitions and protocol bindings
11	Observe Defaults	• For protocols such as HTTP where multiple ways to implement "observe" is possible, define a default
12	Implementation View Spec	• More fully define details of implementations

Source: http://w3c.github.io/wot/charters/wot-wg-charter-draft-2019.html

Example of possible use cases for WoT ①（1/2）

■ Title

- Poop checker

■ Abstract

- Service that improves a intraintestinal environment of user with appropriate yogurt:
  1. Analyze user's intraintestinal environment (based on the poop)
  2. Identify appropriate ingredient based on the results of #1 above and additional personal information (e.g. age, height, weight, clinical record) and other open data (e.g. history of disease such as infections and allergy)
  3. Generate yogurt based on the results of #2 above and distribute it to the user

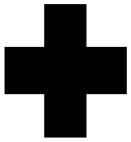
Input

- Use following information


Personal data


Weather


Biometric


Disease

Device

- Use following devices


Intraintestinal environment checking device


Yogurt generating machine

Output

- Generate yogurt containing appropriate components automatically according to the intraintestinal environment of user


(Analyzing)


(Generating)

Outcome

- We can easily manage the health of individuals with yogurt based on biometric data
- We can predict the health condition of the user with the information of poop

Example of possible use cases for WoT ①（2/2）

■ Target Users

- People having problems with stomach (e.g. constipation, diarrhea)

■ **Motivation**

- Currently, people who have problems with stomach need to go to doctors and/or take medicine when they feel pain
- However, it is not easy for some people (e.g. elder people, people who are busy) to visit doctor often
- With this service people could acknowledge their intraintestinal environment and could plan when to visit doctor. It leads to improve their quality of life

■ Expected Devices

- Yogurt generator
- Delivery locker (at home)
- Toilet with sensors
- Micro sensor device (taken by mouth)
- Smart speaker

■ Expected Data

- Weather/meteorological phenomena
- Infection data
- Allergy data
- Personal data (e.g. age, height, weight)

■ **Requirements (related to the new WG Charter Topics)**

- Interoperability Profile
- Complex Interactions
- Discovery
- Privacy Risk Mitigation and Identity Management
- Security Schemes

Example of possible use cases for WoT ②（1/2）

■ Title

- Providing non-residential life with smart camping car

■ Abstract

- Service that provides life in a camping car equipped with the functions of residential and social procedures
  - User could leave the existing "residential" model and live with a mobile camping car
  - A Camping car extracts needs from user‘s personal information such as vital data, location data, and My Number, and so on. Then it automatically moves to suit the purpose of user, such as visiting medical care, going to school, commuting, etc....

Input

- Use following information

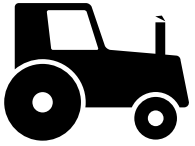
Personal data

Location

Biometric

Device

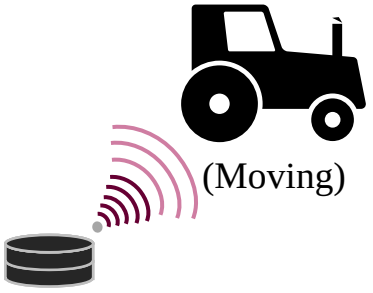
- Use following device



A camping car

Output

- Automatically move according to the purpose of user



(Moving)

Outcome

- We can reduce the number of hazardous driving with automated drive
- We can utilize personal data to predict dangerous actions.
- We can collect taxes according to the location
- We can reduce the number of commute rush

Example of possible use cases for WoT ② （2/2）

■ Target Users

- People who doesn‘t want to settle in one place

■ **Motivation**

- We can reduce the cost of moving when a person intend to do something. For example, a camping car can automatically head to the hospital when it is hard for user to move due to sickness or injury
- Users could take online courses in a camping car. In addition, they could attend multiple schools with a camping car. It makes educational facilities more specialized
- Users could move across different regions and it could solve the problem of local underpopularization and population concentration. It also supports local government collecting taxes based on the location data of a camping car

■ Expected Devices

- Camping car with automatic drive function
- Wearable device

■ Expected Data

- Transportation data
- Public data such as tax, education/medical information
- Personal data such as vital (physical condition/emotion), location data and my number (The Social Security and Tax Number System)

■ **Requirements (related to the new WG Charter Topics)**

- Interoperability Profile
- Complex Interactions
- Discovery
- Privacy Risk Mitigation and Identity Management
- Security Schemes
- Protocol Vocabulary

Example of possible use cases for WoT ③（1/2）

■ Title

● Security robots to help people in trouble

■ Abstract

● Smart agents (security robots) help people in trouble in the city. They communicate to people in trouble (e.g. lost child, people at the time of disaster, etc.) with appropriate voice tone and phrases to make them feel alright

Input

- Use following information

Personal data

Crime rate

Biometric

Emergency

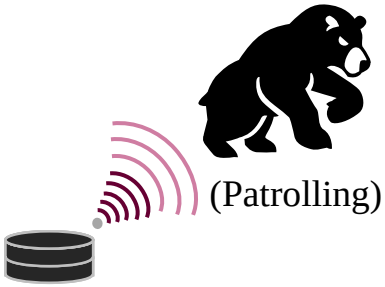
Device

- Use following device

Smart agents
(Security robot)

Output

- Take appropriate action according to the situation



(Patrolling)

Outcome

- We can rescue lost children based on location data
- We can care independent and aged people based on personal data
- We can rescue people based on disaster information
- We can increase security measure at the time of events, based on the crime rate database

Example of possible use cases for WoT ③（2/2）

■ Target Users

- People in trouble in a city (lost child, sick person, etc.), and people live alone

■ **Motivation**

- Currently, there are only limited resources, such as police and emergency personnel, could respond to people in trouble (e.g. people who get lost in a city, people at a time of disaster, etc.) and it is assumed that more manpower is needed at events such as the Tokyo Olympic
- It is necessary for us to alert / communicate to the people in trouble so that they could feel secure and solve the problem regardless of situation
- By providing the monitoring function and the security function by the smart agent, we could let our children play outside safely and improve the efficiency of emergency activities for people such as people at a time of disaster, sick people, and people live alone

■ Expected Devices

- Smart agent for all situations
- Cameras and various sensors for detecting trouble situations

■ Expected Data

- Information on the appearance and feeling of all objects
- DB to manage troubleshooting situations and solutions
- Personal data such as preferences
- Disaster information
- Crime rate DB

■ **Requirements (related to the new WG Charter Topics)**

- Link Relation Types
- Interoperability Profile
- Complex Interactions
- Discovery
- Privacy Risk Mitigation and Identity Management
- Security Schemes

Summary of the Ideathon (1/3)

- **Need for the possible future IoT services from the consumer's point of view**
  - Release from physical and temporal restrictions (virtually skip over space)
    - Example: “#1 Sharing lives with remote family”, “#3 Proposal of the best house”, “#4 Providing immersive space beyond space and time”, “#9 Providing non-residential life with smart camping car”
  - Visualization of human mind, emotion, etc. (Previously, physical information such as envirionmental information and transformation information data has been visualized)
    - Example: “#10 Mental scoring and proposal of preventive measure”, “#11 Natural lecture of behavior and appearance"
  - Support in time of emergency situations
    - Example: “#6 Lifestyle support for critical moment in life“, “#7 Security robots to help people in trouble"
  - Sharing of professional experience
    - Example: “#7 Security robots to help people in trouble“, “#8 Lifestyle support through clones with other people‘s experience and knowledge“, “#12 Learning of know-how that is difficult to verbalize"
  - Realization of personally optimized life
    - Example: “#2 Providing lifestyles to improve productivity “, “#5Pool check (personalization of integer environment improvement)“, “#9 Providing non-residential life with smart camping car"

Summary of the Ideathon (2/3)

- **Required IoT devices and data**
  - IoT devices
    - IoT appliances (smart speakers, lights, TV, etc.)
    - Wearable devices (close to smartwatches, specialized for detecting body movement)
    - Network cameras
    - Equipment that reproduces another space (VR equipment, full-screen display, etc.)
  - Data
    - Personal data such as preferences, skills, mental health status, etc.
    - Traffic data for public transportation
    - Environmental data such as climate, maps and buildings

- **Related technical topics from the draft WoT WG Charter**
  - Interoperability Profile
  - Complex Interactions
  - Discovery
  - Privacy Risk Mitigation and Identity Management
  - Security Schemes

Summary of the Ideathon (3/3)

Business domains expected to be applied to WoT

- Healthcare × Diet
  - Example: “#5Pool check (personalization of integer environment improvement)“,
- Healthcare x Smart Home
  - Example: “#10 Mental scoring and proposal of preventive measure”
- MaaS × Smart Home
  - Example: "#9 Providing non-residential life with smart camping car”
- MaaS × Burglar Prevention/Monitoring
  - Example: “#7 Security robots to help people in trouble"
- Burglar Prevention/Monitoring × Smart Home
  - Example: “#1 Sharing lives with remote family”

Key social challenges to implement the use cases

- Implementation of sensors in society to enhance open data
- Method of retrieving data associated with individuals that are not retrieved as logs (e.g. skills, mental health status, etc.)
- Data of tacit knowledge that cannot be acquired by sensors, such as local knowledge related to culture and customs (e.g. local cuisine etc.)
- Method of utilizing personal information
  - Use of personally identifiable information
  - Masking and use of data that does not identify individuals
- Standardization and method of sharing of data among local governments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