Position paper for W3C workshop on Web of Things

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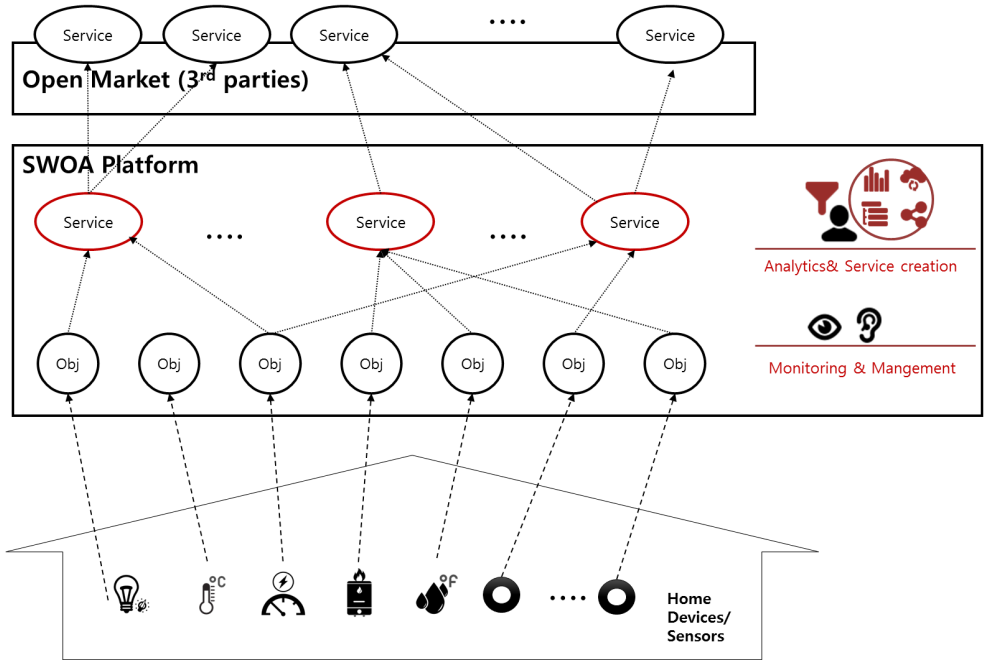
1. Introduction

As Internet of Things (IoT) is expected to bring about great impact on our lives and paradigm shift in marketplace extensively, ETRI has been paying a huge attention on IoT by initiating several projects with the government and associated companies.

'Smart home Web of Objects Architecture (SWOA)' is one of those projects ongoing at ETRI. SWOA is aiming at web based open platform that provides followings: (1) Virtualizes home devices/sensors as objects to make their resource accessible online. (2) Gathers data from the devices/sensors, and analyze customer's behavior and their resources, and then provide context-aware service that understands what users needed at given situations. (3) Ultimately provides these features via web (in standard way) so that other internet services can make use of the features extensively. The very abstract of the project is shown below figure.



We have found some issues through the research and development, and we would like to share those as open questions.

2. Challenges and point of view

A. Traffic saving and Group communication

In near future, a large number of device/sensor nodes are expected to be installed at home, office buildings or factory. There is a concern that how to deal with massive traffic coming into system or how to save/cut down the traffic from device/sensors.

Along with this concern, for certain types of services that need synchronized actions of various nodes accurately, which is likely to happen quite often in IoT service scenario, a fine way of group communication seems necessary. There is a draft document for group communication using CoAP, but other ways for group communication or multicast have to be also proposed for non-constrained nodes in which CoAP cannot be implemented or not wanted such as commercial accessary devices on the market. Even if a service provider decides to rule out synchronous use of IoT nodes, the system still needs a way of control of enormous nodes guaranteeing less failure& traffic.

B. Distributed computing

Today, it seems that most of systems or services make use of Cloud somehow or the other. There is no doubt that Cloud will play a magnificent role in spreading IoT on so many levels, but we have to give a thought about whether it is right that most of the significant works are delegated to Cloud. For a system connected with a huge number of nodes, couples of issues can be raised if the system relies on Cloud comprehensively. Traffic waste, responsiveness, latency, cost of using Cloud and security are such potential problems. We see growing demand on offloading Cloud’s work or distributed processing for IoT solutions aggregating a big number of devices/sensors to be more traffic saving, responsive, and secure. Offloading Cloud’s work or distributed processing in the proximity have been tried out such as utilizing Cloudlet (<The Case for VM-Based Cloudlets in Mobile Computing>, 2009, Satyanarayanan), home server, personal mobile phone/tablet and home wireless router. We believe there will be a more balanced architecture between Cloud and local computing for IoT usecases.

C. Dynamic service creation & discovery. Fault management.

The possible service scenarios are numerous when the primitive capabilities of devices/sensors are combined and limitless considering there are a large number of existing web services things/IoT services can get linked with. One of the ultimate goals of IoT is to provide context-aware and in prompt services. We seek for intelligent but still responsive methods for the IoT services to become completely automated and seamless. (The ultimate form of user-interface become realized when there is no user interface.) Thus, big data analysis, artificial intelligence, and semantics are absolutely of concern to most of the relevant parties including ETRI.

We particularly found that the faults occurring from system’s misunderstanding of conflicting device features should be prudently studied. When the system fails to recognize or understand deep relations among devices and sensors, a lots of (semantic) errors will rise. For instance, the system can’t decrease heat effectively by air conditioning if it fails to recognize the door opening in summer conflicts with air conditioning and affect the room temperature as result. These faults grow into more challenging as the number of entities (devices,sensors,people,places, and etc.) and their features that system has to take into account proliferates.

3. Conclusion

We are excited with the opportunity opened up by W3C. We believe that the proposals and challenges to be discussed in W3C workshop will be highly valuable for us to build our service architecture, and we hope the challenges we found and views on those issues to be helpful. It’s only the beginning of the discussion, and our findings are abstract for now. Since we think more and more issues will rise near future, we look forward to playing resourceful role in the midst of paradigm shift that IoT are going to bring about.