Research of Management and Operation System for low-cost IoT devies

1710214　Yamamoto Yohei

In recent years, IoT is becoming mainstream of internetworking as development of various protocols which suit for low-cost devices. In recent IoT network, lots of sensor or home appliance, such as temperature, humidity sensor, smart lamp, IoT-enabled Air-Conditioner, connect to network. To connect conventional items that is not intended to network, network module is widely used. Network module is small electrical circuit including physical port like RJ45 and CPU needed to conduct network protocol procedures.

As number of these items get far enormous compared to conventional one, demand to reduce cost of IoT device is increasing. To reduce cost of those items, capacity of IoT device tend to be low compared to conventional items. Because of low capacity of IoT devices, it often has small CPU capacity and restricted communication protocol. In recent IoT network, area network protocol is commonly used because of its low cost and its aptitude for low-influent small-frame length communication.

Those IoT area network protocol often have no Management and operation system. Because of that, most IoT are network is lack of stability and maintainability and reliability.

In this paper, we try to introduce low-cost Management and Operation system to IoT area network. We choose HTIP as Management and Operation system to be implemented.

HTIP is stands for Home-network Topology Identification Protocol, which aim to earn topology information of home network. This protocol has 3 types of HTIP node. HTIP-End Device, HTIP-NW device and HTIP-Manager. HTIP -End Device is correspond to normal user equipment in network, for example, PC, smartphone, smart lamp and IoT-enabled Air-Conditioners. In those HTIP-End devices, program called Agent is running as task. Agent program collect HTIP-end device specific data such as, class of HTIP-end device, name of device and so on. HTIP-NW device is basically layer 2 switches, but it can transfer HTIP frame. HTIP Manager’s work is to visualize network topology using information transferred from HTIP-end devices and HTIP-NW devices.

Adapting HTIP as Management and Operation system of IoT area networks is difficult because of those technical problems.

First problem is IoT area network is based on non-Ethernet non-IP network. HTIP is intended for ordinary Ethernet・IP network.

Second problem is that HTIP enabled network device is hard to obtain. HTIP is under-developing protocol and HTIP enabled device is planned to release in few years. But HTIP is still no popular among HTIP devices.

To solve first problem, we try to define HTIP protocol dedicated for Non-Ethernet Non-IP Area network. In this paper, we arrange the architectures of possible connection between different network protocol. Based on this we defined 2 types of data transmission method, native-frame method and pseudo-serial communication method.

Native-frame method uses frame format which is defined in area network protocol. In data transition, HTIP data is carried as payload of those protocol defined frame. We enact payload format of native-frame method based on PRISM project proposed specification and add some improvement by adding missing but necessary HTIP device data. Frame index is also added for future extension.

To solve second problem, we propose ease method to make ordinary management function enable network device, such as layer 2 switch and modem, HTIP enable by connecting external HTIP agent. This external HTIP agent obtain device data via serial or Ethernet connection and generate and broadcast HTIP frame instead of attached network devices. In this paper, we proposed the attachment case of external HTIP agent in various topology and network devices.

In conclusion, the present study has demonstrated that HTIP is applicable for Management and Operation system of IoT area network. Study also shows the technical method and part of system is implemented as experimental device. For future, full stack implementation of non-Ethernet non-IP HTIP for evaluation and measure behavior of network depends on varying of parameter.