LB-100AN/LB-110AN
Kii Cloud User's Manual

White Paper: TD2003LB_01

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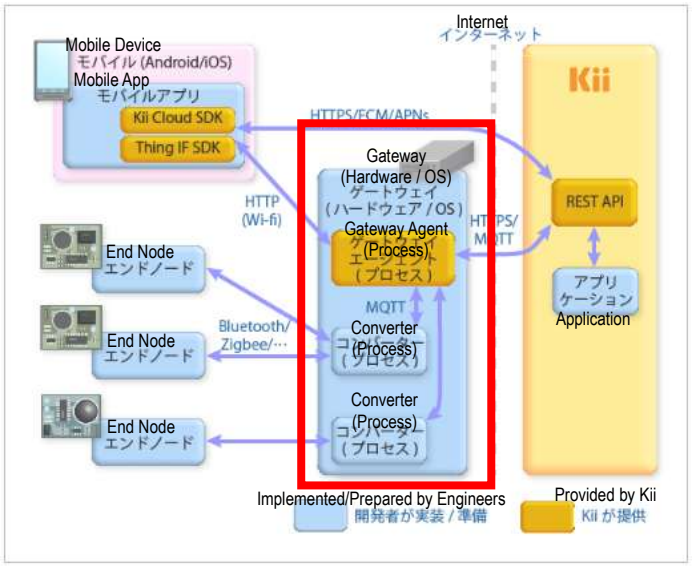
1. Overview

LB-100AN and LB-110AN offer various functions and services with software on Linux. This document describes how to use LB-100AN and LB-110AN as a cloud gateway for IoT sensors and how to implement the gateway functions with Kii Cloud, a cloud service provided by Kii, as well as how to connect to the cloud service to upload data. (The following chapters give instructions of LB-100AN. The same procedures can be applied to LB-110AN.)

1.1. What Is Cloud Gateway

Cloud gateways are a function that collects information of non-Internet devices such as sensors, and connects to a cloud service via Internet to exchange the information. Kii Cloud provides the function as a service named Gateway Agent.

The following image shows a system architecture to use the gateway service. LB-100AN operates as a gateway in the red frame.



1.2. Terms and Definitions

Term	Definition
Gateway agent	A service to communicate to Kii Cloud. It operates as a process on LB-100AN.
End node	A device that accesses a cloud service via Gateway agent.
Converter	An intermediate process that exchanges data between the gateway and end nodes.

2. Implementation of Gateway Agent

This chapter shows how to implement Gateway agent and a related sample program into LB-100AN.

2.1. Preparation of Development Environment

Use the development environment provided by LB-100AN's SDK. See the development manual in the SDK for how to prepare the development environment and how to build the source code for LB-100AN.

2.2. Software Detail

LB-100AN will obtain the following items after you complete the procedure in this document.

Item	Description
Kii Cloud software	Software that communicates to the cloud (provided by Kii). ・Gateway agent ・Command line gateway manager
Converter	A sample program of MQTT Publisher, which uploads the information of end nodes to Gateway agent.
Shell scripts	The startup script and a sample script that analyzes PDU obtained with BLE.
TLS certificate	A certificate that will be needed for TLS communication with the cloud.
Bluetooth software	A group of software that will be needed when LB-100AN handles BLE sensors' scan data with a USB Bluetooth dongle. ・L2CAP, BNEP, RFCOMM support ・HCI USB Driver ・BlueZ (Bluetooth protocol stack) ・BLE scan sample program

2.3. Implementation Steps

In order to add Kii Cloud gateway functions to LB-100AN, add relevant modules, rebuild and update the firmware of LB-100AN.

Here are the update steps.

1. Copy the patch file to the development environment.
   The patch file is **Source/patches/ kii_cloud_patches.tar.gz** in SDK. Copy the file to any directory of the development environment.

2. Unzip the patch file.
   Unzip the copied **kii_cloud_patches.tar.gz** in the development environment.

3. Apply the patch file.
   Execute **patch_apply.sh** under the unzipped **kii_cloud_patches** directory. At the same time, specify the path to LB-100AN's source code.

```
$ cd kii_cloud_patches
$ ./patch_apply.sh ../lb-100an <- Specify the path to LB-100AN source code.
```

4. Update the setting file.
   Update the connection settings for Kii Cloud. For more details, see Chapter 4: Gateway Agent Settings.

5. Rebuild LB-100AN.
   Update the Linux Kernel settings and rebuild Kernel and the application of LB-100AN.

```
$ make clean
$ make linux-configure
$ make
$ make archive
$ make hex
```

6. Update the firmware of LB-100AN.
   Update LB-100AN with the created firmware. For how to update the firmware, see the development manual.

3. Kii Cloud Registration

3.1. Account Registration

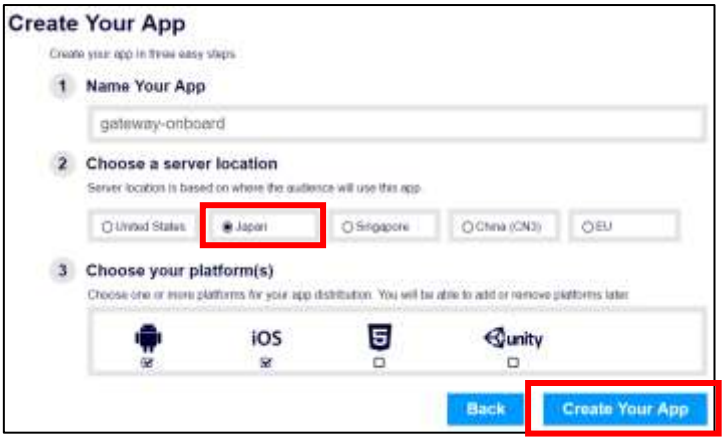
Create an account for Kii Cloud. (It is free to create an account.) Go to Kii Cloud's portal site (https://developer.kii.com/?locale=jp) and sign up for the service.

* The free service is for trial use. If you offer the service to your end users, the fee will be charged.

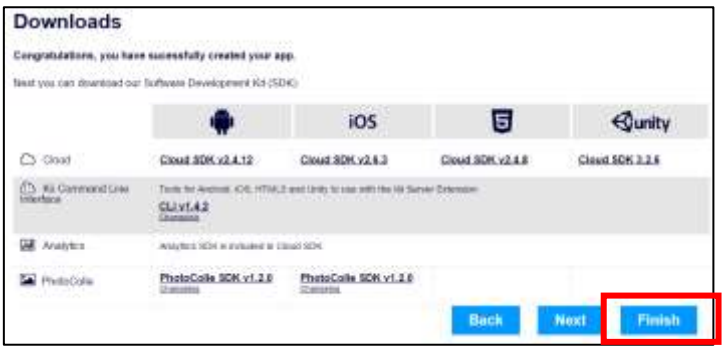
3.2. Creating an Application

Create an application domain to manage data on Kii Cloud. When you sign up for the service, the web page will request you to add an application after you log in. Follow the instruction to create the application. (The web page will show a list of applications from your second login onwards. You can click "Create App" in the page to create an application anytime.) The following page appears. Name your application to create. (Click items highlighted in red.)

Note: Choose Japan for the server location.



The SDK download page shows up as follows. Click Finish (highlighted in red).



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3.3. User Registration for Kii Cloud App

Choose the application from the list to go to the application-setting page. The following page appears.

The left of the window shows the menu. Click "Users" – "User Console" to add users who access the application.

Add the following user as an example.

User name	Password
lb-gateway	lb-gateway

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3.4. Information Registration for End Nodes and Cloud

Register end nodes' information to control over Kii Cloud. This chapter explains how to register a sensor module as an end node for temperature data to get the status over Kii Cloud.

Go to the "Things" menu from the page-left menu. (Click the icon below in red.)

Go to "Thing-IF". (Click the tab in red.)

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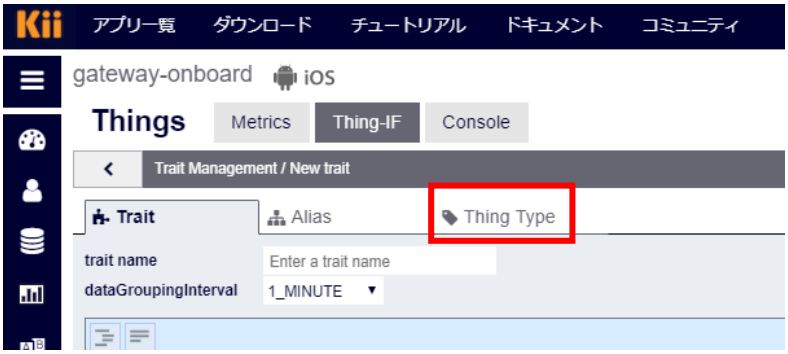
Go to "Traits" under Thing-IF. (Click the button in red.)

Select "Thing Type" under Trait menu to register the Type of the end node. (Click the tab in red.)



Enter a Type name and click "+Add" on the right to add a "thing Type" (highlighted in red). In this example, enter "SENSOR" and click "+Add".

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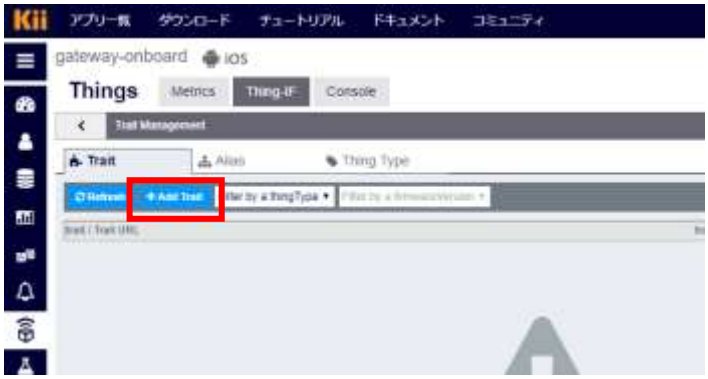
Specify the version of added "thing Type". Select the "thing Type" to go to the input page for firmware version. Enter the version and click "+Add" on the right to add the firmware version. Select "SENSOR", in this example, under Type name, and enter "1.0.0" as the firmware version. Click "+Add".

Next, set Trait for the end node. Select "+Add Trait" under Trait menu (highlighted in red).



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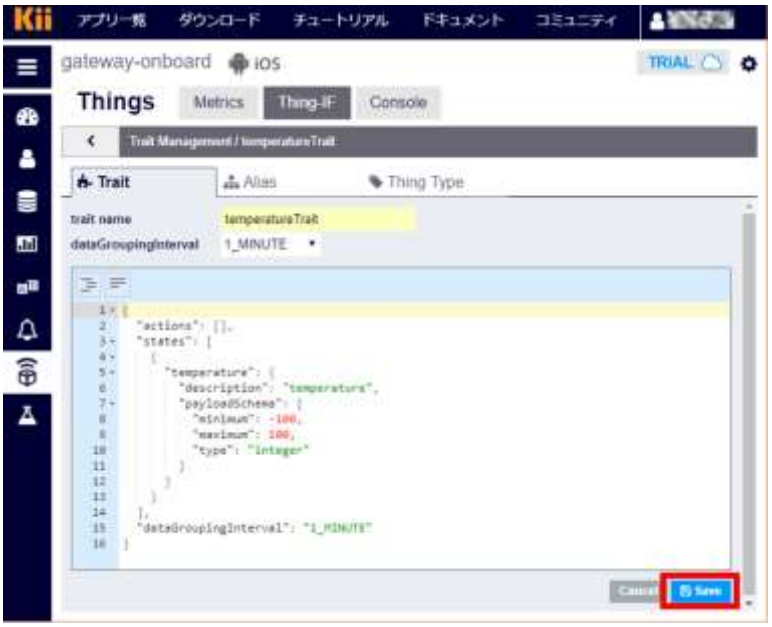
Specify a Trait, write the definition, and click "Save" at the bottom right of the page. In this example, enter "temperatureTrait" as the trait name to register an item that handles the temperature information in the range of +/- 100 degrees C. Create parameters as shown below. (Click Save after you edit it.)



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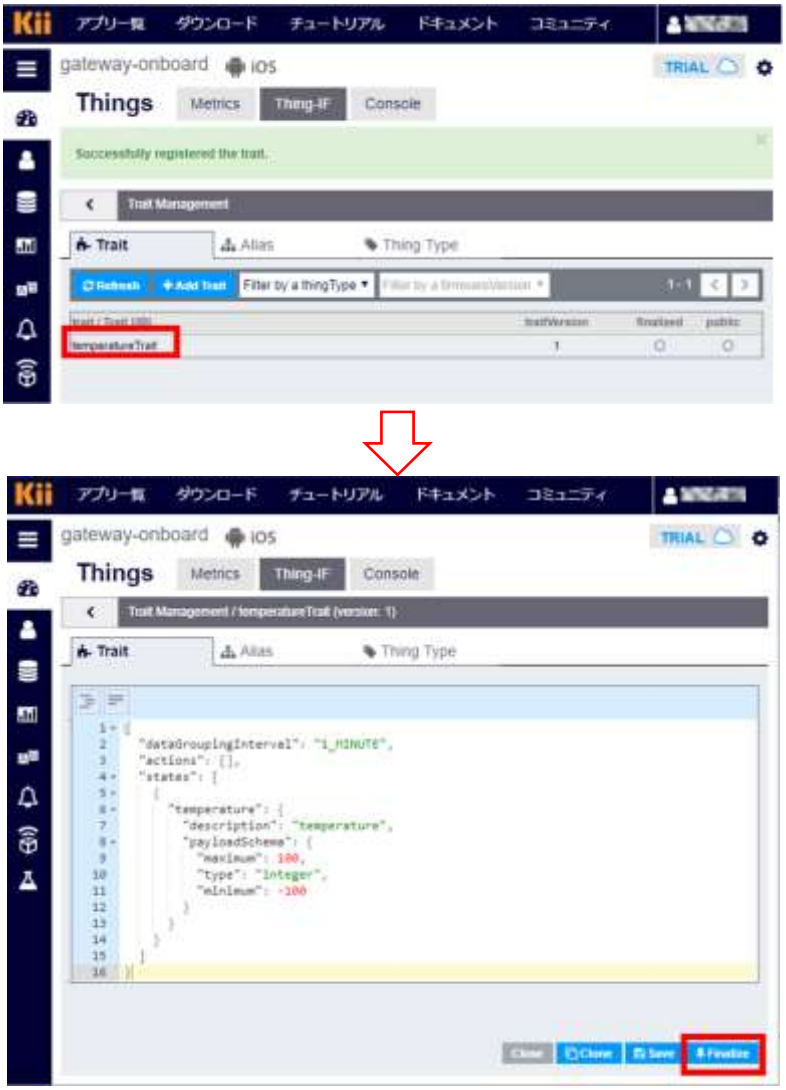
Select the registered Trait to finalize. (Select buttons in red as follows.)



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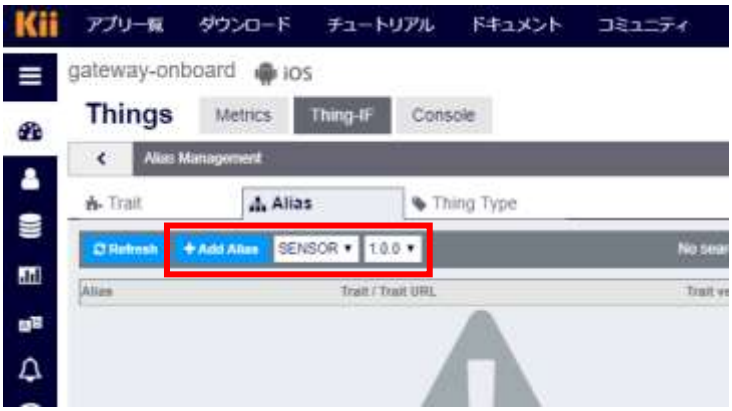
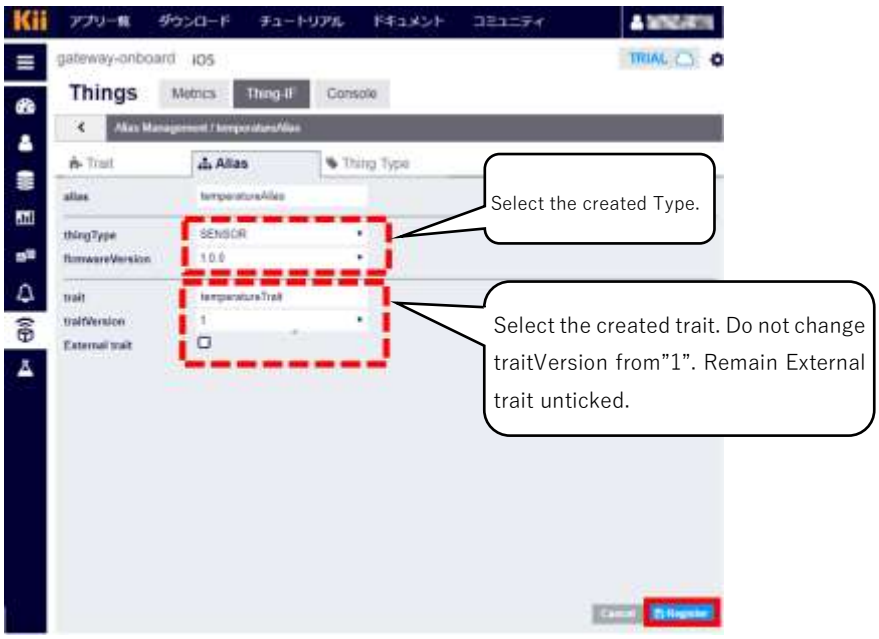
Register an alias of Trait as the final step. Select the Type of end node and the firmware version under Alias menu, and click "+Add Alias". (Select items in red.)



Create the alias information based on the registered Type and the trait information. As an example, create "temperatureAlias" as the alias information. Select created Type and trait, and click "Register" at the right bottom. When the registration is successfully finished, Kii Cloud will be able to handle the temperature information.



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4. Gateway Agent Settings

Set up LB-100AN to connect to the application registered on Kii Cloud. First, edit the following setting file in the development environment.

apps/preinstall/etc/default/kii_gwagent.conf

Change the following red texts based on the Kii Cloud settings in Chapter 3.

```
(skip)
#####################################################################
# Configuration for /gwagent/config.yml and /gwm-cli/config.yml
#####################################################################

# Gateway vendor and Thing specific information
VENDORTHINGID=Set VendorThingID of the gateway (optional)
THINGPASSWORD=Set the password of the gateway (optional)

(skip)

# App information for gateway
APP_NAME=master
APP_SITE=jp
APP_ID=Specify App ID registered on Kii Cloud.
APP_KEY=Specify App Key registered on Kii Cloud.
APP_URL=api-jp.kii.com
APP_USER= Set the user name in Chapter 3.3.
APP_PASS= Set the password in Chapter 3.3.

(skip)
```

Those values will be the initial setting values of LB-100AN. Write the firmware and start LB-100AN, and the file will be copied to /etc/sysconfig/kii_gwagent.conf as the setting file. From now on, edit the above setting file to change LB-100AN settings.

The user's "Access Keys" page shows App ID and App Key after you register the application on Kii Cloud. Click the right-top icon of the user's page to check them.

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5. LB-100AN Operation

When LB-100AN starts after update of the firmware, LB-100AN will automatically access Kii Cloud with the startup script. When it accesses Kii Cloud, the application on Kii Cloud will show LB-100AN as a gateway agent.

When LB-100AN operates properly, it uploads the temperature information from the converter periodically (initial setting: 10-second interval).

To stop LB-100AN's operation, go through the following step.

```
# /etc/init.d/S99kii stop
```

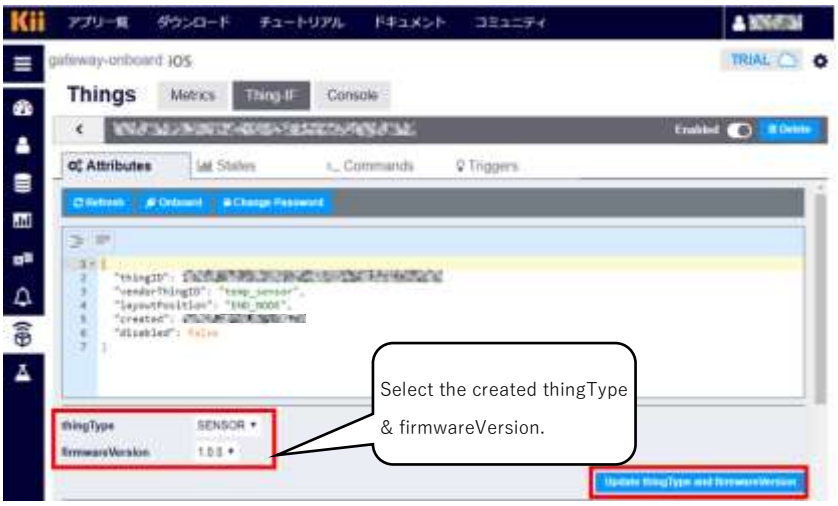
To change settings after startup, change settings of /tmp/sysconfig/kii_gwagent.conf and execute the following command to restart all the processes.

```
# /etc/init.d/S99kii restart
```

6. How to Check Uploaded Data

Go to "Thing-IF" under "Things" of Kii Cloud application, and select "temp_sensor" that is ThingID of the sensor module (end node) for temperature data.

Specify "thingType" and "firmwareVersion" under "Attributes" tab, and click "Update thingType and firmwareVersion".



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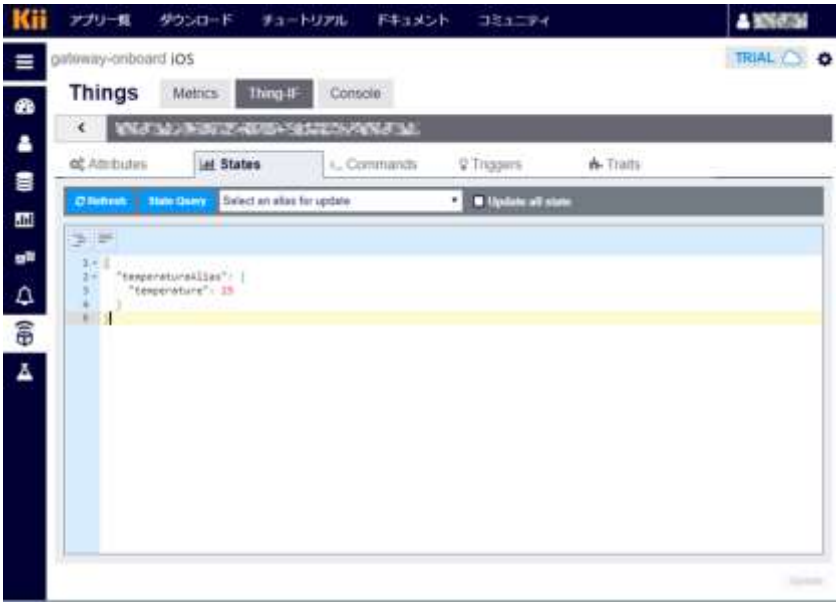
The "States" tab shows the uploaded temperature information.



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7. Others

7.1. Operation of Startup Script

The startup script, /etc/init.d/S90kii, conducts the following processes.

1) Sets the local time zone.
   The script sets the time zone to GMT+9.
2) Copies the execution file of Gateway agent.
   Since the gateway agent dynamically creates files when it is operating, the script copies the relevant files in /usr directory to /tmp directory, and runs the program in the /tmp directory.
3) Waits to collect DNS server information. *1
   The script waits for LB-100AN to register the DNS server for DNS name resolution required for time synchronization (#4) and name resolution of the cloud server.
4) Synchronizes NTP time. *1
   TLS communication requires time synchronization for two-way authentication under, so the system time will synchronize with NTP. The scripts waits for synchronization of the system time with NTP.
5) Starts Bluetooth interface (hci0).
   The script makes BLE dongle operate.
6) Starts Kii Gateway Agent.
7) Connects with Kii Cloud service/authentication.
8) Registers LB-100AN on Kii Cloud as a gateway device. *2
9) Starts BLE scan.
10) Monitors the output file of BLE scan/Starts the analysis script.
11) Starts the converter module.
12) Registers sensor devices on Kii Cloud.*2

*1: LB-100AN retries the process 30 times at one-second intervals.
*2: LB-100AN retries the process 60 times at one-second intervals.

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7.2. Setting File Content

The following table shows contents of /etc/sysconfig/kii_gwagent.conf.

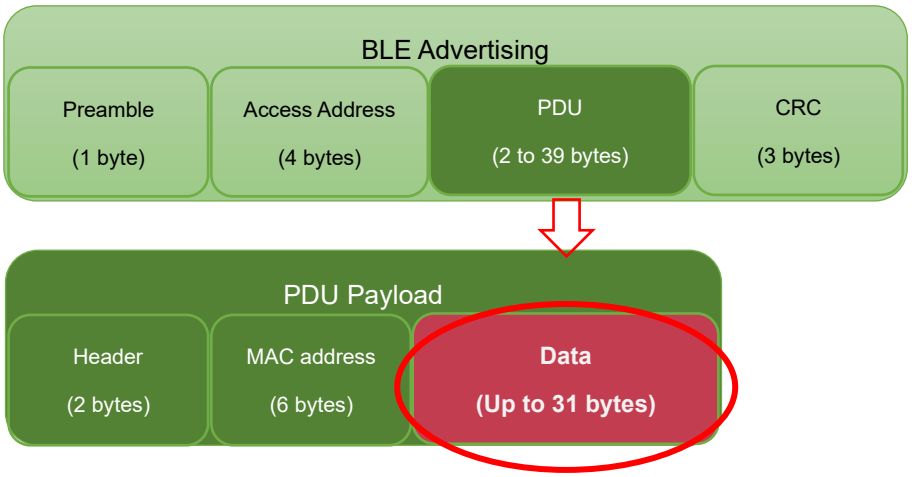
Item	Detail
Gateway Agent Settings	
VENDORTHINGID	Sets VendorThingID of the gateway.
THINGPASSWORD	Sets ThingPassword of the gateway.
THINGTYPE	Sets ThingType of the gateway.
FIRMWAREVERSION	Sets the firmware version of the gateway.
THINGPROP_VENDOR	Sets the vendor name of the gateway.
THINGPROP_LOT	Sets the lot information of the gateway.
ADMIN_USER	Sets the administrator user name of the gateway.
ADMIN_PASS	Sets the administrator password of the gateway.
APP_NAME	Sets the application name.
APP_SITE	Sets the location information of the application.
APP_ID	Sets AppID created with Kii Cloud.
APP_KEY	Sets AppKey created with Kii Cloud.
APP_URL	Sets URL for the application to connect.
APP_USER	Sets the user information registered on the application with Kii Cloud.
APP_PASS	Sets the password registered on the application with Kii Cloud.
MQTT_HOST	Sets the host information of MQTT that communicates with the converter.
MQTT_PORT	Sets the port information of MQTT that communicates with the converter.
GWA_PATH	Path to the gateway agent
GWM_PATH	Path to the command line gateway manager
GWM	File name of the command line gateway manager
Converter Settings	
CONV_ID	Unique ID of the converter
NODE_VENDOR	Sets the vendor information of end node.
NODE_LOT	Sets the lot information of end node.
NODE_FIRMVERSION	Sets the firmware version of end node.
NODE_THINGTYPE	Sets ThingType of end node.
NODE_ID	Sets ThingID of end node.
NODE_PASS	Sets ThingPassword of end node.
CONV_PATH	Path to the converter
PROP	File path to the property information of end node sent by the converter.
STATES	File path to the status information of end node sent by the converter.
INTERVAL	A time interval (second) for the converter to upload the information to the gateway.
BLE Scan Sample Program Settings	
BLE_DEVNAME	Sets the name of BLE device to collect data with BLE.
BLE_PDUFILE	Output path for PDU payload information collected with BLE

7.3. How to Get Sensor Information of End Nodes

7.3.1. BLE Scan sample tool

LB-100AN provides sample code and a script to look at the information contained in the Bluetooth Low Energy (BLE) Advertising. LB-100AN can save the information of specific BLE device in a file with the sample program when the device uses BLE Advertising.

Run the sample scan program after starting Bluetooth interface (hci0). LB-100AN will export Advertising payload data of Bluetooth device to a file as binary data.



The following steps are for the manual scan process.

```
# hciconfig hci0 up    <- Boot the Bluetooth interface (hci0).
# sxhciscan -n BLE device name to scan –o Output file name
Or
# sxhciscan –b MAC address of BLE device to scan –o Output file name
```

- When this program runs, LB-100AN will scan BLE and exports the payload data to a file as soon as it gets the Advertising of the target device. After that, LB-100AN will keep updating the output file whenever it receives Advertising of the same target device.
- When no name is specified for the output file, a file named /tmp/bleadv.pdu will be created.
- The update time interval for the file depends on the advertising transmission interval of the target BLE device.

7.4. File Analysis

The payload information obtained in Chapter 7.3 is binary data. Since the converter only handles JSON text format, LB-100AN needs to dump the binary file and export necessary values to a file in the appropriate format.

Linux's od and awk commands carry out the process.

Example: Shell script process that exports the 10th byte of payload data as the temperature information

```
temp=`od -An -tu1 File name to analyze | awk '{printf("%d", $10)}'`
cat >JSON file to export <<__EOF__
{"temperatureAlias":{"temperature":${temp}}}
__EOF__
```

The "-An" option of od command hides the address information that is displayed when the file is dumped.
The "-tu1" option presents the binary information every byte in decimal notation.

8. Reference

For more details of Kii Cloud Gateway, see the webpage below.
https://docs.kii.com/ja/functions/thingifsdk/gateway/

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