Getting Started with HTTP Connectivity on the FSP DA16XXX HTTP On-chip Client

This document demonstrates a quick HTTP server connectivity solution using the FSP DA16XXX HTTP On-chip Client driver with an EK-RA6M4 evaluation kit. The application example provided in the package uses a custom Flask server to send temperature data and control the user LED on the EK-RA6M4 remotely. The detailed steps in this document show the complete setup to run and test the application.

Target Devices

- RA6M4 MCU Group

Required Resources

To build and run the HTTP application example, the following resources are required.

Development tools and software:

- Flexible Software Package (FSP) v5.3.0 (GitHub – renesas/fsp: Flexible Software Package (FSP) for Renesas RA MCU Family)
- SEGGER J-Link RTT Viewer (see segger.com)
- e² studio version 2024-04 (Platform Installer)

Hardware:

- EK-RA6M4 Evaluation Kit for the RA6M4 MCU Group
- Windows PC with any browser
- Micro-USB cable
- DA16200 or DA16600 Wi-Fi module

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1. Setting Up the EK-RA6M4 kit

This section of the document covers the steps to set up the EK-RA6M4 kit and connect the hardware to the PC.

1.1 Steps

- Attach the US159-DA16200MEVZ/US159-DA16600EVZ Wi-Fi Pmod module to PMOD2 (J25, upper right) on the EK-RA6M4. Ensure the DA16xxx module and components are facing up.
- Connect the EK-RA6M4 dev kit to the PC using a USB Micro-B cable connected to DEBUG (J10) on the board (right side of the board above the Ethernet jack).
- When completed, the LEDs should be illuminated as in Figure 1, and the board should appear as follows:
  - LED4 (middle of board) – Illuminating white
  - LED5 (right side, near USB debug port) – Illuminating yellow

1.2 Connection

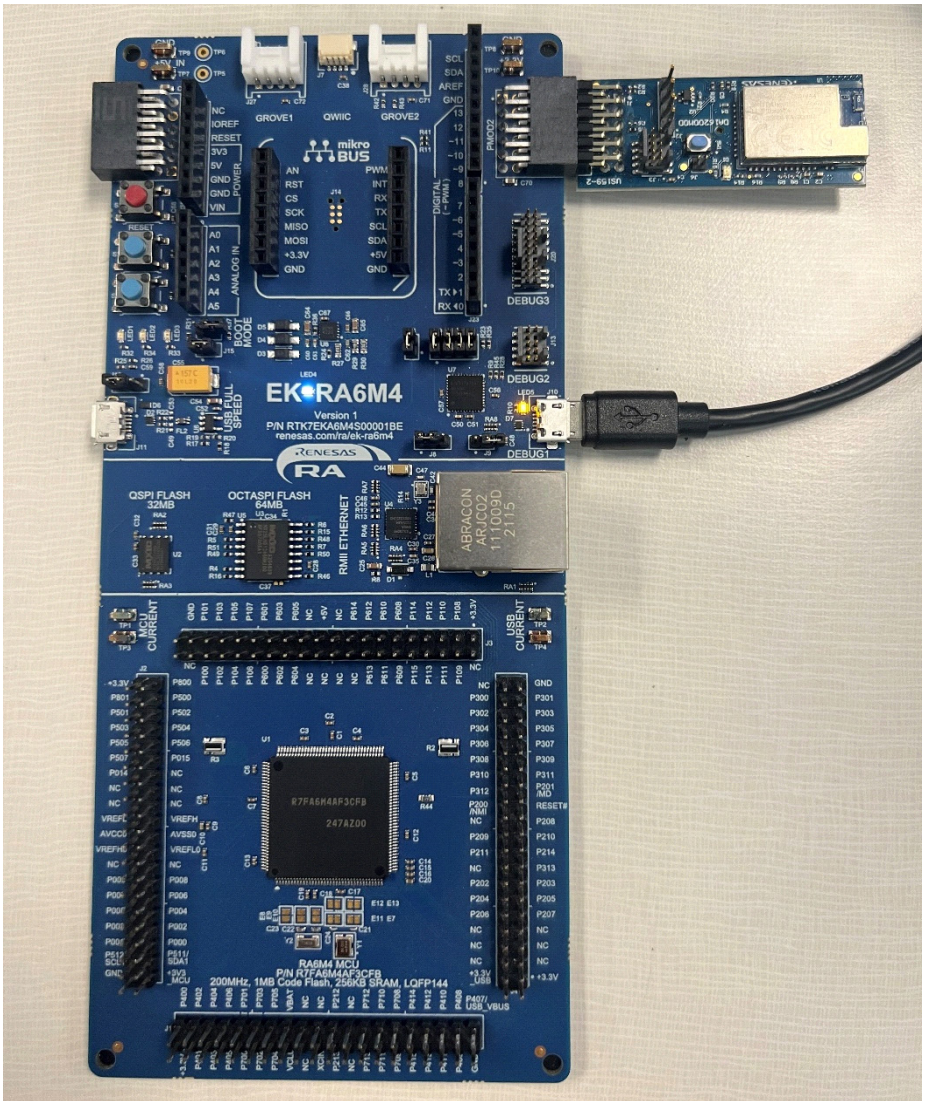

Figure 1. EK-RA6M4 Connections

2. Application Overview

This section discusses the application overview, detailing the architecture and overall functionality of the HTTP server connectivity with a Flask server.

2.1 Overview

This application demonstrates the use of the Renesas FSP DA16XXX Wi-Fi APIs and Wi-Fi module to establish quick connectivity to a custom Flask-based HTTP service. This document provide an example that demonstrates API calls to an HTTP server. It provides periodic publication of temperature from the MCU to the server. The server also allows for sending a toggle button control (LED ON/OFF) from the server, showing two-way control.

2.2 Architecture

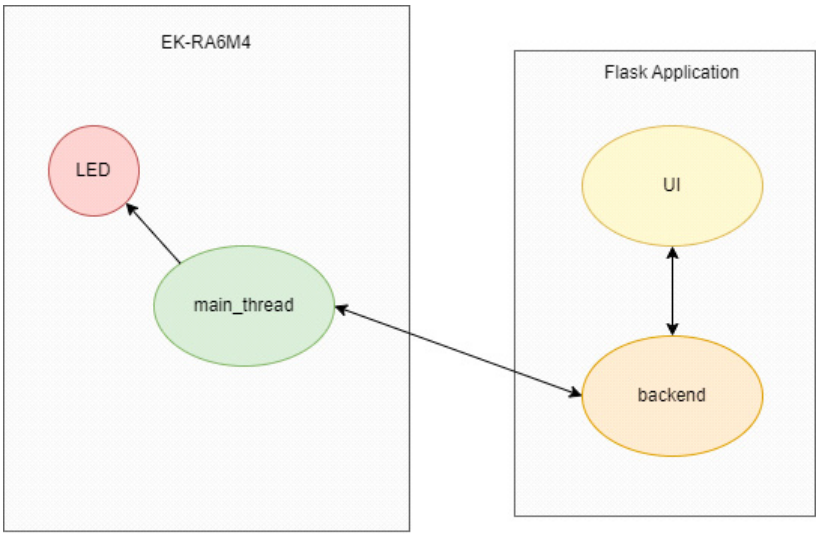

Figure 2. Architecture Diagram

2.3 Functional Flowchart

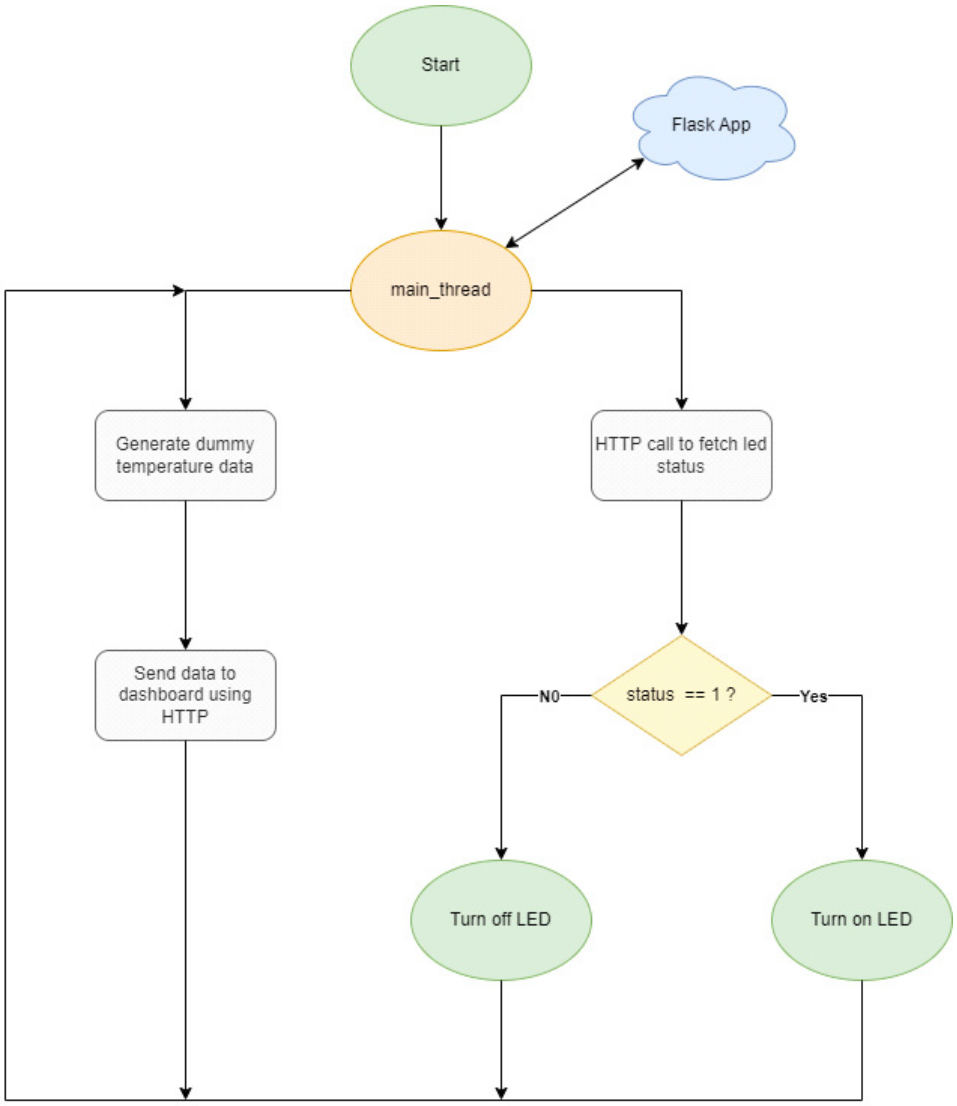

Figure 3. Functional Flow Diagram

3. Setting Up Flask Application

This section covers setting up the Python-based Flask application, including instructions on starting the server and setting up the libraries.

3.1 Installing Python

Install the latest Python distribution from the Python Releases for Windows | Python.org website, and add Python to the environment variables while installing.

Note: Skip this step if Python is installed already. Check if the installation is correct by running **python --version** in the command prompt. After running the command, the Python version installed on the computer is displayed.

3.2 Installing Required Libraries

Run **pip install flask** from the command prompt to install the Flask library. After running the command, the Flask application is completely set up.

3.3 Running the Flask Application

Open the command prompt and navigate to the Renesas Dashboard folder downloaded from the provided zip file. Run **python app.py** to start the application. Next, the Flask app is up and running on the local server. The server is being periodically polled and the logs are displayed on the terminal screen indicating that the server is ready to consume the data.

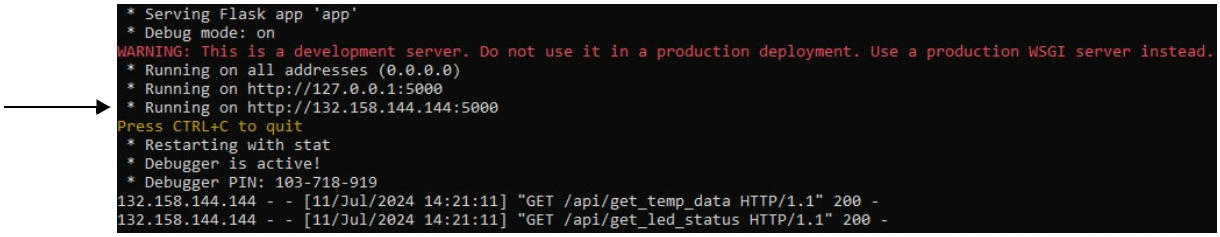

Figure 4. Flask Application's Terminal Logs

Copy the address, paste it into a browser, and press enter. The dashboard is displayed serving the temperature and LED details.

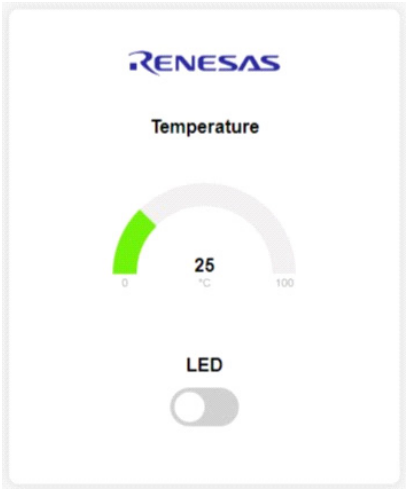

Figure 5. Flask Application Dashboard

4. Setting Up the FSP Project

This section details the process for setting up the FSP Project, including importing the RA project and configuring user files.

4.1 Import RA Project

For how to import FSP projects, refer to the *Official Renesas RA Family Beginner's Guide* (PDF)and import the project from the provided zip file into e^2 studio.

4.2 Configure the User File

Modify the **user.h** file under the **src** folder and provide the Wi-Fi Password and SSID Information. And provide the address of the local server in the base URL.

Note: Do not copy the base URL provided in Figure 6.

```
#ifndef USER_H_
#define USER_H_

#define WIFI_SSID               "WIFI_SSID"
#define WIFI_PWD                "WIFI_PWD"
#define BASE_URL                "http://132.158.144.144:5000/api"

#endif /* USER_H_ */
```

Figure 6. Reference for User File Configuration

4.3 Build The Project

Open the FSP configuration window by double-clicking the **configuration.xml** file, and click on **Generate Project Content**. Finally, click on the **Build** button.

5. Adding J-Link RTT for Monitoring

This section explains adding J-Link RTT for monitoring and configuring the J-Link RTT application.

5.1 Configure J-Link RTT Application

When the MCU connections are made, open the SEGGER RTT Application. Before configuring the J-Link, open the map file present in the Debug folder, search for the " _SEGGER_RTT " keyword in the file and note down the address. Check the reference as shown below.

Note: Do not copy this address.

```
.bss._acDownBuffer
                0x20000424       0x40 ./src/SEGGER_RTT/SEGGER_RTT.o
.bss._acUpBuffer
                0x20000464      0x800 ./src/SEGGER_RTT/SEGGER_RTT.o
.bss._SEGGER_RTT
                0x20000c64       0xa8 ./src/SEGGER_RTT/SEGGER_RTT.o
                0x20000c64 <----       _SEGGER_RTT
.bss.g_rm_mqtt_onchip_da16xxx_instance
                0x20000d0c      0x40c ./src/main_thread_entry.o
                0x20000d0c            g_rm_mqtt_onchip_da16xxx_instance
.bss.g_read_queue_queue_memory
                0x20001118       0xa0 ./ra_gen/common_data.o
                0x20001118            g_read_queue_queue_memory
.bss.g_read_queue_memory
```

Figure 7. Address for SEGGER RTT

Next, open the J-Link application and set it up as in Figure 8 by pasting the address that was copied. The remaining fields should be the same as in Figure 8.

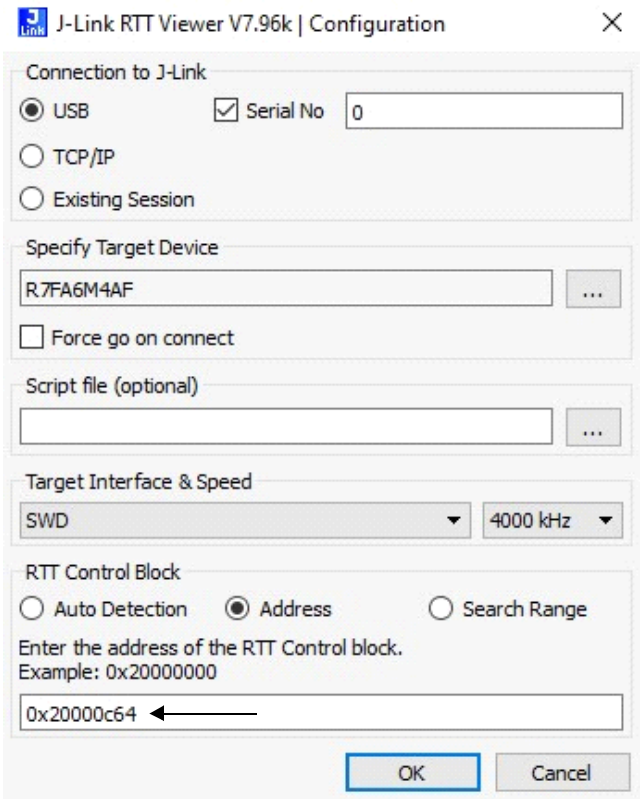

Figure 8. SEGGER RTT Configuration

6. Running the Application

This section is focused on running the application, providing step-by-step guidance on building, debugging, and testing the application. The subsections cover (1) building and debugging the application and (2) testing the application, including checking the dashboard and subscribed LEDs.

6.1 Debug the Application

The application is completely set up. Click on the **Build** button. Next, click on the **Debug** button. Finally, double-click the **Resume** button.

6.2 Testing the Application

6.2.1 Control the User LED from Dashboard

When the RTT logs display **http open success!**, Simply click on the toggle button on the dashboard to turn on/off the user LED. The temperature gauge is also periodically updated with the latest data.

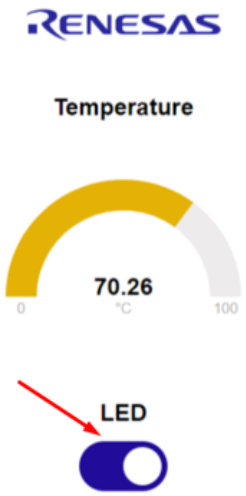

Figure 9. Application Dashboard

6.2.2 Monitoring RTT Viewer

Logs can be monitored from the SEGGER RTT Viewer, the events will be captured on the RTT viewer as shown in Figure 10.

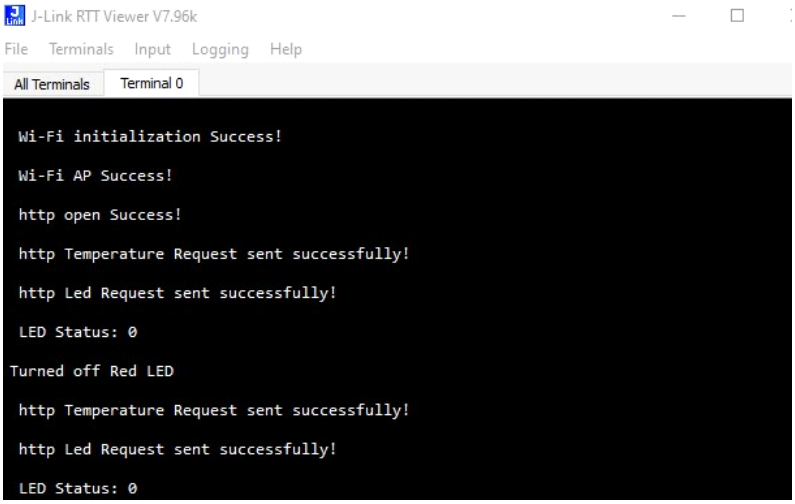

Figure 10. SEGGER RTT Logs

Website and Support

Visit the following URLs to learn about key elements of the RA family, download components and related documentation, and get support:

RA Product Information	www.renesas.com/ra
RA Product Support Forum	https://community.renesas.com/mcu-mpu/ra/
RA Flexible Software Package	www.renesas.com/FSP
Renesas Support	www.renesas.com/support

7. Revision History

Revision	Date	Description
1.00	Aug 5, 2024	Initial release

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The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)
   A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.
2. Processing at power-on
   The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.
3. Input of signal during power-off state
   Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.
4. Handling of unused pins
   Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.
5. Clock signals
   After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.
6. Voltage application waveform at input pin
   Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).
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   Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.
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