AppZone m2mb Sample Apps

80000NT11840A Rev. 1 - 2021-01-29

TELIT
TECHNICAL
DOCUMENTATION

1 AppZone m2mb Sample Apps

Package Version: **1.1.12-CxL**

Minimum Firmware Version: **25.21.000.3**

1.1 Features

This package goal is to provide sample source code for common activities kick-start.

2 Quick start

2.1 Deployment Instructions

To manually deploy the Sample application on the devices perform the following steps:

1. Have **25.21.000.3** FW version flashed (`AT#SWPKGV` will give you the FW version)
2. Copy m2mapz.bin to /data/azc/mod/

   `AT#M2MWRITE="/data/azc/mod/m2mapz.bin",<size>,1`

   where <size> is in bytes
3. Configure the module to run the downloaded binary as default app: `AT#M2MRUN=2,m2mapz.bin`
4. Restart the module and if no AT commands are sent within **10** seconds, start the app: `AT+M2M=4,10`

2.2 References

More info on

- Getting started with ME910C1 (doc ID 80529NT11661A)
- How to run applications with AppZone

2.3 Known Issues

None

2.4 Contact Information, Support

For general contact, technical support services, technical questions and report documentation errors contact Telit Technical Support at: TS-EMEA@telit.com.

For detailed information about where you can buy the Telit modules or for recommendations on accessories and components visit:

http://www.telit.com

Our aim is to make this guide as helpful as possible. Keep us informed of your comments and suggestions for improvements.

Telit appreciates feedback from the users of our information.

2.5 Troubleshooting

- Application does not work/start:
  - Delete application binary and retry

    ```
    AT#M2MDEL="/data/azc/mod/m2mapz.bin"
    ```

  - Delete everything, reflash and retry

    ```
    AT#M2MDEL="/data/azc/mod/m2mapz.bin"
    AT#M2MDEL="/data/azc/mod/appcfg.ini"
    ```

- Application project does not compile
  - Right click on project name
  - Select Properties
  - Select AppZone tab
  - Select the right plugin (firmware) version
  - Press “Restore Defaults”, then “Apply”, then “OK”
  - Build project again
- Application project shows missing symbols on IDE
  - Right click on project name
  - Select Index
  - Select Rebuild. This will regenerate the symbols index.

2.6 Making source code changes

2.6.1 Folder structure

The applications code follow the structure below:

- `hdr`: header files used by the application
  - `app_cfg.h`: the main configuration file for the application
- `src`: source code specific to the application
- `azx`: helpful utilities used by the application (for GPIOs, LOGGING etc)
  - `hdr`: generic utilities' header files
  - `src`: generic utilities' source files
- `Makefile.in`: customization of the Make process

2.7 Import a Sample App into an IDE project

Consider that the app HelloWorld that prints on Main UART is a good starting point. To import it in a project, please follow the steps below:

On IDE, create a new project: "File"-> "New" -> "Telit Project"

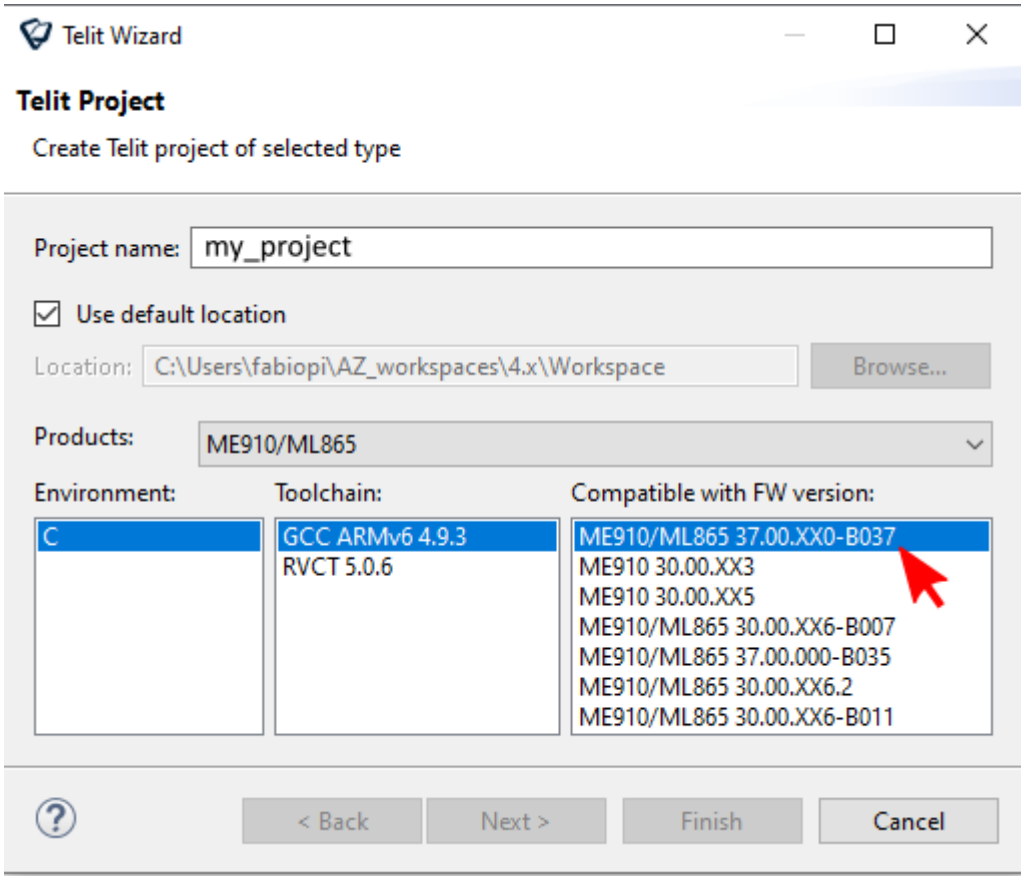

Figure 1

Select the preferred firmware version (e.g. 30.00.xx7) and create an empty project.

in the samples package, go in the HelloWorld folder (e.g. `AppZoneSampleApps-MAIN_UART\HelloWorld`), copy all the files and folders in it (as `src`, `hdr`, `azx`) and paste them in the root of the newly created IDE project. You are now ready tyo build and try the sample app on your device.

Contents

3 Applications

3.1 MISC

Applications that provide usage examples for various functionalities, without prints

3.1.1 GPIO toggle example

Sample application showcasing GPIO usage with M2MB API

Features

- How to open a gpio in output mode and change its status

3.2 MAIN UART

Applications that provide usage examples for various functionalities, log output on MAIN UART

3.2.1 ATI (AT Instance)

Sample application showing how to use AT Instance functionality (sending AT commands from code). The example supports both sync and async (using a callback) modes. Debug prints on **MAIN UART**

Features

- How to open an AT interface from the application
- How to send AT commands and receive responses on the AT interface

Application workflow, sync mode

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Init AT0 (first AT instance)
- Send AT+CGMR command
- Print response.
- Release AT0

`at_sync.c`

- Init ati functionality and take AT0
- Send AT+CGMR command, then read response after 2 seconds, then return it
- Deinit ati, releasing AT0

```
Starting AT demo app. This is v1.0.7 built on Apr  1 2020 15:12:58.
[DEBUG] 17.15  at_sync.c:53 - at_cmd_sync_init{M2M_DamsStart}$ m2mb_ati_init() on instance 0
Sending command AT+CGMR in sync mode
[DEBUG] 17.16  at_sync.c:79 - send_sync_at_command{M2M_DamsStart}$ Sending AT Command: AT+CGMR
Command response: <AT+CGMR
M0B.950004-B008

OK
>

[DEBUG] 19.21  at_sync.c:61 - at_cmd_sync_deinit{M2M_DamsStart}$ m2mb_ati_deinit() on instance 0
Application end
```

Figure 2

Application workflow, async mode

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Init AT0 (first AT instance)
- Send AT+CGMR command
- Print response.
- Release AT0

at_async.c

- Init ati functionality and take AT0, register AT events callback
- Send AT+CGMR command, wait for response semaphore (released in callback), then read it and return it
- Deinit ati, releasing AT0

```
Starting AT demo app. This is v1.0.7 built on Apr  1 2020 15:07:45.
[DEBUG] 17.13  at_async.c:116 - at_cmd_async_init{M2M_DamsStart}$ m2mb_ati_init() on instance 0
Sending command AT+CGMR in async mode
[DEBUG] 17.15  at_async.c:153 - send_async_at_command{M2M_DamsStart}$ Sending AT Command: AT+CGMR
[DEBUG] 17.15  at_async.c:169 - send_async_at_command{M2M_DamsStart}$ waiting command response...
[DEBUG] 17.17  at_async.c:88 - at_cmd_async_callback{pubTspt_0}$ Callback - available bytes: 25
[DEBUG] 17.18  at_async.c:181 - send_async_at_command{M2M_DamsStart}$ Receive response...
Command response: <AT+CGMR
M0B.950004-B008

OK
>

[DEBUG] 17.19  at_async.c:136 - at_cmd_async_deinit{M2M_DamsStart}$ m2mb_ati_deinit() on instance 0
Application end
```

Figure 3

3.2.2 AT Tunnel

Sample application showcasing how to perform an AT tunnel from Main UART to an AT instance. Debug prints on **USB1**.

Features

- How to open an AT interface from the application
- How to receive data from main UART and tunnel it to the AT interface, then report back to UART the AT response

Application workflow

`M2MB_main.c`

- Open USB1 for debug
- Initialize UART with callback function to manage input data
- Initialize AT system to manage AT commands from UART
- wait 5 minutes then deinit AT system

Main UART:

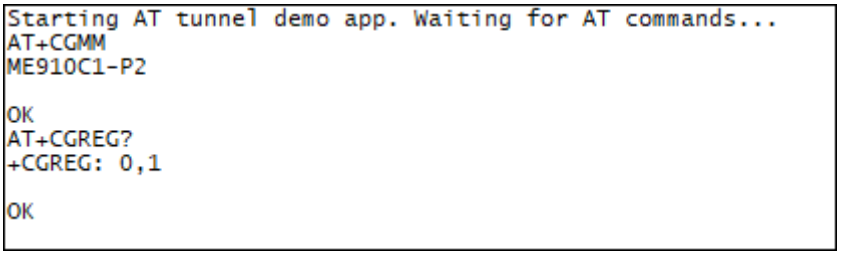

Figure 4

USB1 debug log:

```
Starting AT tunnel demo app. This is v1.0.7 built on Apr  7 2020 08:21:41.
Uart opened, setting callback for data..
[DEBUG] 17.21  M2MB_main.c:183 - at_cmd_async_init{M2M_DamsStart}$ m2mb_ati_init() on instance 0
[DEBUG] 20.43  M2MB_main.c:144 - UART_Cb{pubTspt_0}$ Received 8 bytes
[DEBUG] 20.43  M2MB_main.c:84 - msgUARTTask{uart_task}$ Received data on uart, read it and send on ATI
UART IN: <AT+CGMM
>. Sending to ATI...
[DEBUG] 20.43  M2MB_main.c:171 - at_cmd_async_callback{pubTspt_0}$ Callback - available bytes: 8
[DEBUG] 20.43  M2MB_main.c:107 - msgUARTTask{uart_task}$ Received data on ATI, read it and send on UART
[DEBUG] 20.43  M2MB_main.c:116 - msgUARTTask{uart_task}$ Received: <AT+CGMM
>
[DEBUG] 20.43  M2MB_main.c:171 - at_cmd_async_callback{pubTspt_0}$ Callback - available bytes: 20
[DEBUG] 20.43  M2MB_main.c:107 - msgUARTTask{uart_task}$ Received data on ATI, read it and send on UART
[DEBUG] 20.43  M2MB_main.c:116 - msgUARTTask{uart_task}$ Received: <
ME910C1-P2

OK
>
[DEBUG] 32.82  M2MB_main.c:144 - UART_Cb{pubTspt_0}$ Received 10 bytes
[DEBUG] 32.82  M2MB_main.c:84 - msgUARTTask{uart_task}$ Received data on uart, read it and send on ATI
UART IN: <AT+CGREG?
>. Sending to ATI...
[DEBUG] 32.82  M2MB_main.c:171 - at_cmd_async_callback{pubTspt_0}$ Callback - available bytes: 10
[DEBUG] 32.82  M2MB_main.c:107 - msgUARTTask{uart_task}$ Received data on ATI, read it and send on UART
[DEBUG] 32.82  M2MB_main.c:116 - msgUARTTask{uart_task}$ Received: <AT+CGREG?
>
[DEBUG] 32.83  M2MB_main.c:171 - at_cmd_async_callback{pubTspt_0}$ Callback - available bytes: 21
[DEBUG] 32.83  M2MB_main.c:107 - msgUARTTask{uart_task}$ Received data on ATI, read it and send on UART
[DEBUG] 32.83  M2MB_main.c:116 - msgUARTTask{uart_task}$ Received: <
+CGREG: 0,1

OK
>
```

Figure 5

3.2.3 AWS demo

Sample application showcasing AWS Iot Core MQTT communication. Debug prints on **MAIN UART**

Features

- How to check module registration and enable PDP context
- How to load certificates into device SSL session storage
- How to configure MQTT client parameters
- How to connect to AWS server with SSL and exchange data over a topic

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage MQTT client and start it

`aws_demo.c`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Init MQTT client
- Configure it with all parameters (Client ID, PDP context ID, keepalive timeout…)
- Initialize the TLS parameters (TLS1.2) andh auth mode (server+client auth in the example)
- Create SSL context
- Read certificates files and store them
- Connect MQTT client to broker
- Subscribe to topic
- Publish 10 messages with increasing counter
- Print received message in mqtt_topc_cb function
- Disconnect MQTT client and deinit it
- Disable PDP context

3.2.4 How to get started with AWS IoT

- Go to AWS console and create an account if one is not available yet.
- Go to **IoT Core** section
- Go to **Secure** > **Policies** section
- Create a new policy, which describes what the device will be allowed to do (e.g. subscribe, publish)
- Give it a name, then configure it using the configuration below (it is possible to copy/paste by clicking on **Add statements** section, then **Advanced mode**) :

```
{
  "Version": "2012-10-17",
  "Statement": [
  {
"Action": [
  "iot:Publish",
  "iot:Subscribe",
  "iot:Connect",
  "iot:Receive"
],
"Effect": "Allow",
"Resource": [
  "*"
]
  }
  ]
}
```

- Click on create to complete the policy creation.
- Go to **Manage** section
- Press **Create**, then **Create a single thing**
- Give the new thing a name, then click on Next
- Select **One-click certificate creation (recommended)** by clicking on **Create certificate**
- Once presented with the **Certificate created** page, download all certificates and keys
- Click on the **Activate** button to enable the certificate authentication of the newly created device
- Click on **Attach a policy** and select the policy created in a previous step

For further information, please refer to the full AWS IoT documentation

3.2.5 Application setup

- Set **CLIENTCERTFILE** and **CLIENTKEYFILE** defines in **aws_demo.c file** in order to match the certificate and key created in the previous section.
- Set **AWS_BROKER_ADDRESS** to the correct AWS URL. It can be retrieved from AWS IoT **Manage** > **Things** > **Interact** in the HTTPS **Rest API Endpoint** URL.
- Set **CLIENT_ID** to the desired Client ID for your AWS device
- (Optional) if required, change **CACERTFILE** to match the one to be used.

3.2.6 Device setup

The application requires the certificates (provided in sample app **certs** subfolder) to be stored in **/data/azc/mod/ssl_certs/** folder. It can be created with

```
AT#M2MMKDIR=/data/azc/mod/ssl_certs
```

Certificates can then be loaded with

```
AT#M2MWRITE="/data/azc/mod/ssl_certs/preload_CACert_01.crt",1468
AT#M2MWRITE="/data/azc/mod/ssl_certs/Amazon-IoT.crt",1646
```

providing the file content in RAW mode (for example using the “Transfer Data” button in Telit AT Controller)

For client certificates, the commands will be

```
AT#M2MWRITE="/data/azc/mod/ssl_certs/xxxxx.crt",yyyy
AT#M2MWRITE="/data/azc/mod/ssl_certs/xxxxx.key",zzzz
```

PLEASE NOTE: always verify the file sizes to be used in the commands above as they might change

```
Starting AWS IoT Core MQTT demo app. This is v1.1.5 built on Apr 30 2021 09:05:17.
[DEBUG] 15.51  aws_demo:607 - AWS_Task{MQTT_TASK}$ Init MQTT client for AWS
[DEBUG] 15.52  aws_demo:265 - PrepareSSLEnvironment{MQTT_TASK}$ m2mb_ssl_config SNI succeeded
[DEBUG] 15.52  aws_demo:271 - PrepareSSLEnvironment{MQTT_TASK}$ Root CA cert file /mod/ssl_certs/preload_CACert_01.crt
[DEBUG] 15.52  aws_demo:297 - PrepareSSLEnvironment{MQTT_TASK}$ Buffer successfully received from file. 1468 bytes were loaded.
[DEBUG] 15.52  aws_demo:308 - PrepareSSLEnvironment{MQTT_TASK}$ Cross Signed CA cert file /mod/ssl_certs/Amazon-IoT.crt
[DEBUG] 15.52  aws_demo:334 - PrepareSSLEnvironment{MQTT_TASK}$ Buffer successfully received from file. 1646 bytes were loaded.
[DEBUG] 15.52  aws_demo:360 - PrepareSSLEnvironment{MQTT_TASK}$ Client certificate file /mod/ssl_certs/ab71          -certificate.pem.crt
[DEBUG] 15.52  aws_demo:384 - PrepareSSLEnvironment{MQTT_TASK}$ Buffer successfully received from file. 1224 bytes were loaded.
[DEBUG] 15.52  aws_demo:396 - PrepareSSLEnvironment{MQTT_TASK}$ Client Key file /mod/ssl_certs/ab71          -private.pem.key
[DEBUG] 15.52  aws_demo:422 - PrepareSSLEnvironment{MQTT_TASK}$ Buffer successfully received from file. 1679 bytes were loaded.

SSL environment preparation completed
[DEBUG] 15.52  aws_demo:726 - AWS_Task{MQTT_TASK}$ Waiting for registration...
[DEBUG] 15.52  aws_demo:514 - NetCallback{pubTspt_0}$ Module is registered
[DEBUG] 15.52  aws_demo:738 - AWS_Task{MQTT_TASK}$ PDP context initialization
[DEBUG] 17.55  aws_demo:753 - AWS_Task{MQTT_TASK}$ Activate PDP with APN web.omnitel.it on CID 1....
[DEBUG] 18.37  aws_demo:557 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 18.37  aws_demo:561 - PdpCallback{pubTspt_0}$ IP address: 109.114.102.21

Connecting to Server <angy83rl5oizs-ats.iot.eu-west-2.amazonaws.com>:8883...
Done.
[DEBUG] 27.87  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 2, "data": {"RSSI": -72, "tm":"2021-04-30,09:05:50"} }> to topic
device/35308109          /updates
[DEBUG] 27.87  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 30.94  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 3, "data": {"RSSI": -72, "tm":"2021-04-30,09:05:53"} }> to topic
device/353081090         /updates
[DEBUG] 30.94  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 33.99  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 4, "data": {"RSSI": -72, "tm":"2021-04-30,09:05:56"} }> to topic
device/35308109          /updates
[DEBUG] 34.00  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 37.00  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 5, "data": {"RSSI": -72, "tm":"2021-04-30,09:05:59"} }> to topic
device/35308109          /updates
[DEBUG] 37.00  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 40.03  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 6, "data": {"RSSI": -72, "tm":"2021-04-30,09:06:02"} }> to topic
device/35308109          /updates
[DEBUG] 40.03  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 43.05  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 7, "data": {"RSSI": -72, "tm":"2021-04-30,09:06:05"} }> to topic
device/353081            /updates
[DEBUG] 43.05  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 46.13  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 8, "data": {"RSSI": -72, "tm":"2021-04-30,09:06:08"} }> to topic
device/3530810           /updates
[DEBUG] 46.13  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 49.15  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 9, "data": {"RSSI": -72, "tm":"2021-04-30,09:06:11"} }> to topic
device/3530810           /updates
[DEBUG] 49.15  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 52.19  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 10, "data": {"RSSI": -72, "tm":"2021-04-30,09:06:14"} }> to topic
device/3530810           /updates
[DEBUG] 52.19  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 55.22  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 11, "data": {"RSSI": -72, "tm":"2021-04-30,09:06:17"} }> to topic
device/3530810           /updates
[DEBUG] 55.22  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.

Disconnecting from MQTT broker..
[DEBUG] 58.27  aws_demo:878 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 58.27  aws_demo:908 - AWS_Task{MQTT_TASK}$ application exit
[DEBUG] 58.27  aws_demo:918 - AWS_Task{MQTT_TASK}$ m2mb_pdp_deactivate returned success
[DEBUG] 58.27  aws_demo:924 - AWS_Task{MQTT_TASK}$ Application complete.
```

Figure 6

Data received from a subscriber:

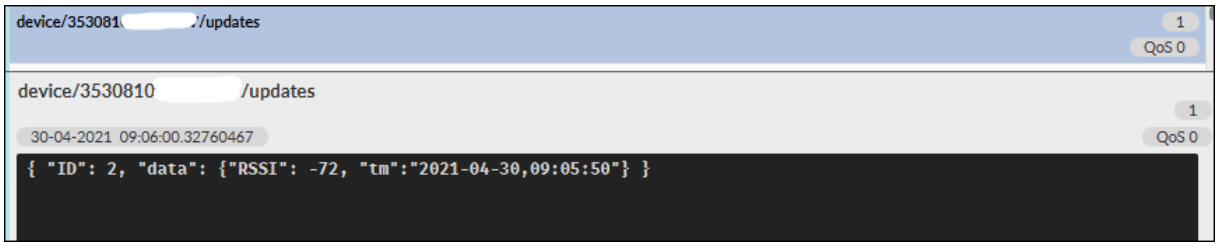

Figure 7

3.2.7 App Manager

Sample application showing how to manage AppZone apps from m2mb code. Debug prints on **MAIN UART**

Features

- How to get how many configured apps are available
- How to get the handle to manage the running app (change start delay, enable/disable)
- How to create the handle for a new binary app, enable it and set its parameters
- How to start the new app without rebooting the device, then stop it after a while.

3.2.7.1 Prerequisites

This app will try to manage another app called “second.bin”, which already exists in the module filesystem and can be anything (e.g. another sample app as GPIO toggle). the app must be built using the flag ROM_START=

in the Makefile to set a different starting address than the main app (by default, 0x40000000). For example, 0x41000000.

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- get a non existing app handle and verify it is NULL
- get the current app handle, then get the start delay **set in the INI file (so persistent)**
- change the current app delay value **in the INI file**
- verify that the change has been stored
- get current app state
- create an handle for a second application binary.
- add it to the INI file
- set its execution flag to 0
- get the delay time and the state from INI file for the new app
- get the current set address for the new app
- set the app delay **in RAM, INI will not be affected**.
- start the new app without reboot, using the right set delay
- wait some time, then get the app state and the used RAM amount
- wait 10 seconds, then stop the second app.
- set its execution flag to 1 so it will run at next boot.

```
Starting App Manager demo app. This is v1.0.14-C1 built on Sep 24 2020 12:33:25.
There are 2 configured apps.
Not existing app handle test (should be 0): 0x0
Manager app handle: 0x809e20e0
Manager app delay from nv memory: 5 seconds

Changing Manager app delay time (on non volatile configuration) to 5 seconds..
Manager app delay from nv memory is now 5 seconds
Manager app state is M2MB_APPMNG_STATE_RUN

Trying to get Second app handle...
Second app handle is valid
2nd app delay from nv memory is 1
2nd app current state is M2MB_APPMNG_STATE_READY
Second app current address is 0x41000000
Setting volatile Second app delay (not stored in nvm) to 0 seconds...
Starting Second app on the fly (without reboot)...
Waiting 2 seconds...
2nd app current state is M2MB_APPMNG_STATE_RUN
Second app is running!
Second App is using 475136 bytes of RAM
Stopping Second app now...
wait 10 seconds...
2nd app current state is M2MB_APPMNG_STATE_STOP
Set permanent run permission for Second app.
Done. Second App will also run from next boot-up
```

Figure 8

3.2.8 App update OTA via FTP

Sample application showcasing Application OTA over FTP with AZX FTP. Debug prints on **MAIN UART**

Features

- How to check module registration and activate PDP context
- How to connect to a FTP server
- How to download an application binary and update the local version

The app uses a predefined set of parameters. To load custom parameters, upload the `ota_config.txt` file (provided in project's `/src` folder) in module's `/data/azc/mod` folder, for example with

```
AT#M2MWRITE="/data/azc/mod/ota_config.txt",<filesize>
```

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage app OTA and start it

`ftp_utils.c`

- Set parameters to default
- Try to load parameters from `ota_config.txt` file
- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Initialize FTP client
- Connect to FTP server and log in
- Get new App binary file size on remote server
- Download the file in `/data/azc/mod` folder, with the provided name
- Close FTP connection
- Disable PDP context
- Update applications configuration in **app_utils.c**

`app_utils.c`

- Set new application as default

- Delete old app binary
- Restart module

```
Starting FTP APP OTA demo app. This is v1.0.7 built on Apr  7 2020 17:04:05.
[DEBUG] 21.23  ftp_utils.c:447 - msgFTPTask{FTPOTA_TASK}$ INIT
[DEBUG] 21.25  ftp_utils.c:152 - readConfigFromFile{FTPOTA_TASK}$ Reading parameters from file
[DEBUG] 21.26  ftp_utils.c:154 - readConfigFromFile{FTPOTA_TASK}$ Opening /mod/ota_config.txt in read mode..
Set APN to: <<web.omnitel.it>>
Set FTP URL to: <<ftp.telit.com>>
Set FTP PORT to: 21
Set FTP USER to: <<[illegible]>>
Set FTP PASS to: <<[illegible]>>
Set FTP FILE URI to: <</samples/APP_OTA/helloworld.bin>>
Set LOCAL FINAL APP NAME to: <<helloworld.bin>>
Set LOCAL ORIGINAL APP NAME to: <<m2mapz.bin>>
[DEBUG] 23.53  ftp_utils.c:464 - msgFTPTask{FTPOTA_TASK}$ m2mb_os_ev_init success
[DEBUG] 23.54  ftp_utils.c:470 - msgFTPTask{FTPOTA_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 23.55  ftp_utils.c:478 - msgFTPTask{FTPOTA_TASK}$ Waiting for registration...
[DEBUG] 23.56  ftp_utils.c:371 - NetCallback{pubTspt_0}$ Module is registered to network
[DEBUG] 23.56  ftp_utils.c:491 - msgFTPTask{FTPOTA_TASK}$ Pdp context activation
[DEBUG] 23.57  ftp_utils.c:495 - msgFTPTask{FTPOTA_TASK}$ m2mb_pdp_init returned M2MB_RESULT_SUCCESS
[DEBUG] 25.61  ftp_utils.c:504 - msgFTPTask{FTPOTA_TASK}$ Activate PDP with APN web.omnitel.it on cid 3....
[DEBUG] 26.30  ftp_utils.c:398 - PdpCallback{pubTspt_0}$ Context active
[DEBUG] 26.30  ftp_utils.c:401 - PdpCallback{pubTspt_0}$ IP address: 176.246.110.148
Start ftp client...
[DEBUG] 27.36  ftp_utils.c:533 - msgFTPTask{FTPOTA_TASK}$ Connected.
[DEBUG] 28.87  ftp_utils.c:546 - msgFTPTask{FTPOTA_TASK}$ FTP login successful.
Get remote file /samples/APP_OTA/helloworld.bin size
[DEBUG] 29.31  ftp_utils.c:568 - msgFTPTask{FTPOTA_TASK}$ Done. File size: 116224.
Starting download of remote file /samples/APP_OTA/helloworld.bin into local /mod/helloworld.bin
/samples/APP_OTA/helloworld.bin  4.68% 5440
/samples/APP_OTA/helloworld.bin  9.36% 10880
/samples/APP_OTA/helloworld.bin 14.04% 16320
/samples/APP_OTA/helloworld.bin 18.72% 21760
/samples/APP_OTA/helloworld.bin 23.40% 27200
/samples/APP_OTA/helloworld.bin 28.08% 32640
/samples/APP_OTA/helloworld.bin 32.76% 38080
/samples/APP_OTA/helloworld.bin 37.44% 43520
/samples/APP_OTA/helloworld.bin 42.13% 48960
/samples/APP_OTA/helloworld.bin 46.81% 54400
/samples/APP_OTA/helloworld.bin 51.49% 59840
/samples/APP_OTA/helloworld.bin 56.17% 65280
/samples/APP_OTA/helloworld.bin 60.85% 70720
/samples/APP_OTA/helloworld.bin 65.53% 76160
/samples/APP_OTA/helloworld.bin 70.21% 81600
/samples/APP_OTA/helloworld.bin 74.89% 87040
/samples/APP_OTA/helloworld.bin 79.57% 92480
/samples/APP_OTA/helloworld.bin 84.25% 97920
/samples/APP_OTA/helloworld.bin 88.93% 103360
/samples/APP_OTA/helloworld.bin 93.61% 108800
/samples/APP_OTA/helloworld.bin 97.42% 113220
[DEBUG] 43.54  ftp_utils.c:608 - msgFTPTask{FTPOTA_TASK}$ download successful.
FTP quit...
[DEBUG] 43.77  ftp_utils.c:632 - msgFTPTask{FTPOTA_TASK}$ Deactivating PDP
[DEBUG] 43.77  ftp_utils.c:642 - msgFTPTask{FTPOTA_TASK}$ m2mb_pdp_deactivate returned success
[DEBUG] 44.20  ftp_utils.c:407 - PdpCallback{pubTspt_0}$ Context deactive
[DEBUG] 45.44  app_utils.c:76 - update_app{FTPOTA_TASK}$ Application successfully configured.
[DEBUG] 45.45  app_utils.c:82 - update_app{FTPOTA_TASK}$ Deleting old application /mod/m2mapz.bin
€ÿStarting. This is v1.0.7 built on Apr  7 2020 17:02:52. LEVEL: 2

 Start Hello world Application  [ version: 2.000000 ]

 Hello world 2.0 [ 000001 ]
 Hello world 2.0 [ 000002 ]
 Hello world 2.0 [ 000003 ]
```

Figure 9

3.2.9 CJSON example:

Sample application showcasing how to manage JSON objects. Debug prints on **MAIN UART**

Features

- How to read a JSON using cJSON library
- How to write a JSON
- How to manipulate JSON objects

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Parse an example string into a JSON object and print the result in a formatted string
- Print some test outcomes (e.g. non existing item correctly not found)
- Retrieve single elements from the parsed JSON object and use them to format a descriptive string
- Delete the JSON object
- Create a new JSON object appending elements to it
- Print the result JSON string from the object

```
Starting Logging demo app. This is v1.0.7 built on Apr  7 2020 08:33:03.
And here is what we got:
{
        "name":         "Atlantic Ocean",
        "format":       {
                "type":         "salt",
                "volume":       310410900,
                "depth":        -8486,
                "volume_percent":       23.300000,
                "tide":         -3.500000,
                "calm":         false,
                "life":         ["plankton", "corals", "fish", "mammals"]
        }
}
inexistent key not found
name found: Atlantic Ocean
format found (null)
Our JSON string contains info about an ocean named Atlantic Ocean,
has a volume of 310410900 km^3 of salt water with -8486 meters max depth,
represents 23.3% of total oceans volume,
has an average low tide of -3.5 meters,
hosts a huge number of living creatures such as plankton, corals, fish, mammals,
and is not always calm.

Let's build a TR50 command with a proprety.publish and an alarm.publish for MQTT (no auth).
And here is what we got:
{
        "1":    {
                "command":      "property.publish",
                "params":       {
                        "thingKey":     "mything",
                        "key":  "mykey",
                        "value":        123.144000
                }
        },
        "2":    {
                "command":      "alarm.publish",
                "params":       {
                        "thingKey":     "mything",
                        "key":  "mykey",
                        "state":        3,
                        "msg":  "Message."
                }
        }
}
END.
```

Figure 10

3.2.10 Easy AT example

Sample application showcasing Easy AT functionalities. Debug prints on **MAIN UART**

Features

- Shows how to register custom commands

3.2.11 Events

Sample application showcasing events setup and usage. Debug prints on **MAIN UART**

Features

- How to setup OS events with a custom bitmask
- How to wait for events and generate them in callback functions to synchronize blocks of code

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Create an event handler
- Create a timer to generate an event, with a 2 seconds expiration time
- Wait for a specific event bit on the event handler
- At timer expiration, set the same event bit and verify that the code flow went through after the event.

```
Starting Events demo app. This is v1.0.7 built on Apr  7 2020 08:44:29.
[DEBUG] 20.55  M2MB_main.c:171 - M2MB_main{M2M_DamsStart}$ m2mb_os_ev_init success
Set the timer attributes structure success.
Timer successfully created
[DEBUG] 20.57  M2MB_main.c:125 - setup_timer{M2M_DamsStart}$ Start the timer, success.
[DEBUG] 22.60  M2MB_main.c:60 - hwTimerCb{pubTspt_0}$ Timer Callback, generate event!
[DEBUG] 22.61  M2MB_main.c:183 - M2MB_main{M2M_DamsStart}$ event occurred!
```

Figure 11

3.2.12 Events - Barrier (multi events)

Sample application showcasing how to setup and use multiple events to create a barrier. Debug prints on **MAIN UART**

Features

- How to setup OS events to be used as a barrier
- How to wait for multiple events in the same point, and generate them in call-back functions to synchronize blocks of code

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Create an event handler
- Create a timer to generate an event, with a 3 seconds expiration time
- Create another timer to generate an event, with a 6 seconds expiration time
- Start both timers
- Wait for both event bits on the event handler (each one will be set by one of the timers)
- At first timer expiration, set the first event bit and verify that the code flow does not procede.
- At second timer expiration, set the second event bit and verify that the code flow went through after the event (implementing a barrier).

```
Starting Barrier demo app. This is v1.0.7 built on Apr  7 2020 08:48:30.
[DEBUG] 20.01  M2MB_main.c:179 - M2MB_main{M2M_DamsStart}$ m2mb_os_ev_init success
Set the timer attributes structure success.
Timer successfully created with 3000 timeout (ms)
Set the timer attributes structure success.
Timer successfully created with 6000 timeout (ms)
[DEBUG] 23.08  M2MB_main.c:66 - hwTimerCb1{pubTspt_0}$ Timer Callback, generate event 1!
[DEBUG] 26.12  M2MB_main.c:75 - hwTimerCb2{pubTspt_0}$ Timer Callback, generate event 2!
[DEBUG] 26.13  M2MB_main.c:214 - M2MB_main{M2M_DamsStart}$ BOTH events occurred!
```

Figure 12

3.2.13 FOTA example

Sample application showcasing FOTA usage with M2MB API. Debug prints on **MAIN UART**

Features

- How download a delta file from a remote server
- How to apply the delta and update the module firmware

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a main task to manage connectivity.
- create a fota task to manage FOTA and start it with INIT option

`fota.c`

fotaTask()

- Initialize FOTA system then reset parameters.
- Check current FOTA state, if not in IDLE, return error.
- Send a message to mainTask so networking is initialized.
- after PdPCallback() notifies the correct context activation, configure the fota client parameters such as FTP server URL, username and password
- get delta file from server. when it is completed, FOTADownloadCallback is called.
- If delta download went fine, check it.
- If delta file is correct, apply it. Once complete, restart the module.

mainTask()

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context. Event will be received on **PdP-Callback** function
- Disable PDP context when required to stop the app

PdpCallback()

- When PDP context is enabled, send a message to fotaTask to start the download

```
Starting FOTA demo app. This is v1.1.7 built on Jun 11 2021 12:20:43.
[DEBUG] 23.60  fota:187 - fotaTask{FOTA_TASK}$ Init FOTA...

Session file not present, procede with FOTA...
[DEBUG] 23.61  fota:236 - fotaTask{FOTA_TASK}$ m2mb_fota_reset PASS
[DEBUG] 23.61  fota:260 - fotaTask{FOTA_TASK}$ m2mb_fota_state_get  M2MB_FOTA_STATE_IDLE
[DEBUG] 23.62  fota:379 - mainTask{MAIN_TASK}$ INIT
[DEBUG] 23.62  fota:392 - mainTask{MAIN_TASK}$ m2mb_os_ev_init success
[DEBUG] 23.63  fota:398 - mainTask{MAIN_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 23.63  fota:405 - mainTask{MAIN_TASK}$ Waiting for registration...
[DEBUG] 23.64  fota:131 - NetCallback{pubTspt_0}$ Module is registered to network
[DEBUG] 23.65  fota:418 - mainTask{MAIN_TASK}$ Pdp context initialization
[DEBUG] 25.70  fota:431 - mainTask{MAIN_TASK}$ Activate PDP with APN web.omnitel.it on cid 1....
[DEBUG] 35.42  fota:152 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 35.43  fota:155 - PdpCallback{pubTspt_0}$ IP address: 2.41.116.139

[DEBUG] 35.43  fota:285 - fotaTask{FOTA_TASK}$
Trying to download "samples/FOTA/37.00.003.3_to_37.00.003.1_ME310G1_NANVWWAU.bin" delta file...
[DEBUG] 35.45  fota:295 - fotaTask{FOTA_TASK}$ m2mb_fota_get_delta OK - Waiting for the completion callback
[DEBUG] 119.43  fota:96 - FOTADownloadCallBack{pubTspt_0}$ FOTA download Success - performing packet validation...
[DEBUG] 119.44  fota:301 - fotaTask{FOTA_TASK}$ Validating delta file...
[DEBUG] 156.36  fota:317 - fotaTask{FOTA_TASK}$ Packet is valid, start update...
[DEBUG] 156.40  fota:329 - fotaTask{FOTA_TASK}$ m2mb_fota_start PASS
[DEBUG] 158.36  fota:342 - fotaTask{FOTA_TASK}$
Rebooting...After reboot there will be the new FW running on module!

#OTAEV: Module Upgraded To New Fw
Starting FOTA demo app. This is v1.1.7 built on Jun 11 2021 12:20:43.
[DEBUG] 29.24  fota:187 - fotaTask{FOTA_TASK}$ Init FOTA...

Session file is already present, stop.
```

Figure 13

3.2.14 FTP

Sample application showcasing FTP client demo with AZX FTP. Debug prints on **MAIN UART**

Features

- How to check module registration and activate PDP context
- How to connect to a FTP server
- How to exchange data with the server

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage FTP client and start it

`ftp_test.c`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Init FTP client and set the debug function for it
- Connect to the server
- Perform log in
- Check remote file size and last modification time
- Download file from server to local filesystem. A data callback is set to report periodic info about the download status
- Upload the same file to the server with a different name. A data callback is set to report periodic info about the upload status
- Download another file content in a buffer instead of a file. A data callback is set to report periodic info about the download status
- Close the connection with FTP server
- Disable PDP context

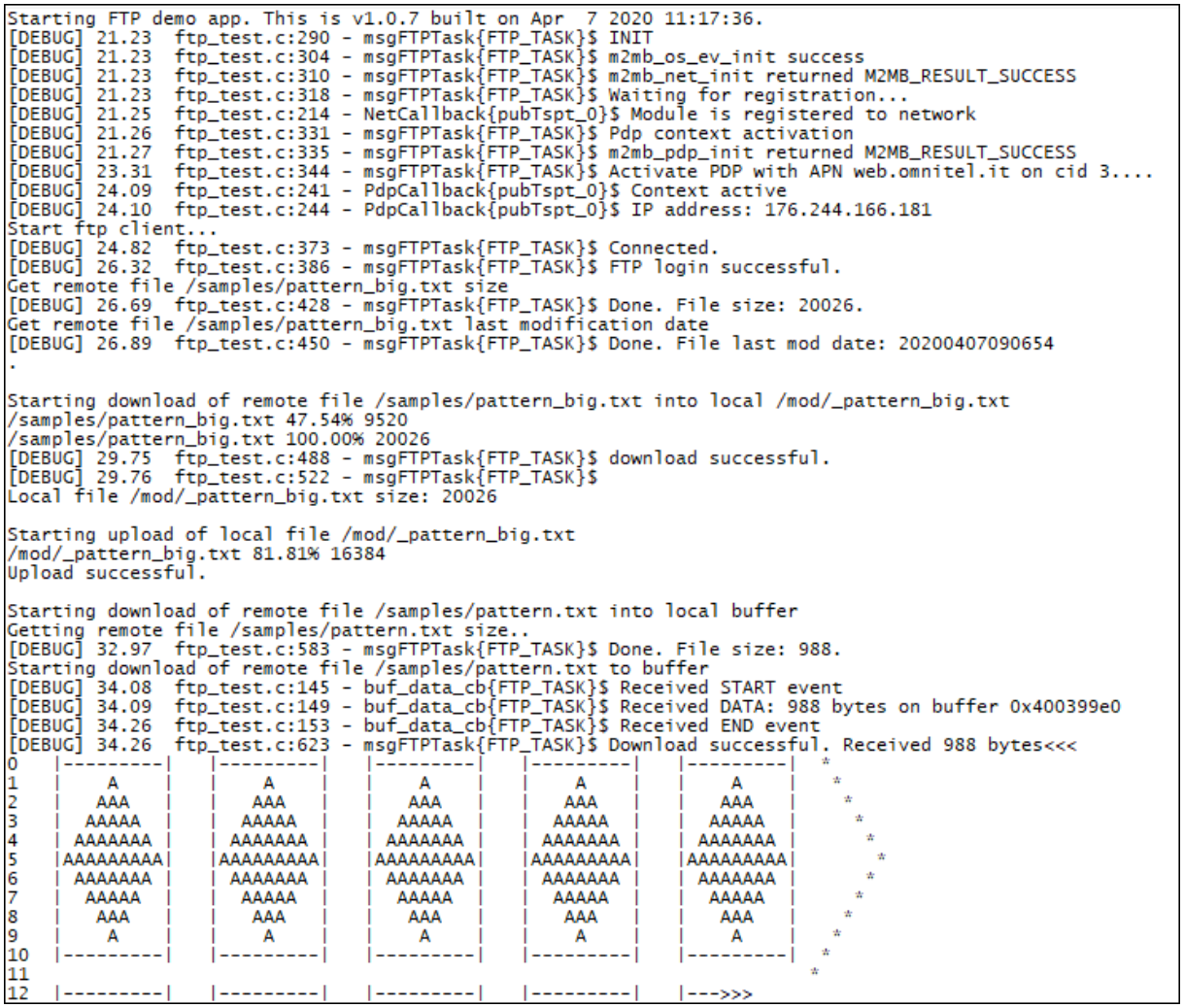
Starting FTP demo app. This is v1.0.7 built on Apr 7 2020 11:17:36.
[DEBUG] 21.23 ftp_test.c:290 - msgFTPTask{FTP_TASK}$ INIT
[DEBUG] 21.23 ftp_test.c:304 - msgFTPTask{FTP_TASK}$ m2mb_os_ev_init success
[DEBUG] 21.23 ftp_test.c:310 - msgFTPTask{FTP_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 21.23 ftp_test.c:318 - msgFTPTask{FTP_TASK}$ Waiting for registration...
[DEBUG] 21.25 ftp_test.c:214 - NetCallback{pubTspt_0}$ Module is registered to network
[DEBUG] 21.26 ftp_test.c:331 - msgFTPTask{FTP_TASK}$ Pdp context activation
[DEBUG] 21.27 ftp_test.c:335 - msgFTPTask{FTP_TASK}$ m2mb_pdp_init returned M2MB_RESULT_SUCCESS
[DEBUG] 23.31 ftp_test.c:344 - msgFTPTask{FTP_TASK}$ Activate PDP with APN web.omnitel.it on cid 3....
[DEBUG] 24.09 ftp_test.c:241 - PdpCallback{pubTspt_0}$ Context active
[DEBUG] 24.10 ftp_test.c:244 - PdpCallback{pubTspt_0}$ IP address: 176.244.166.181
Start ftp client...
[DEBUG] 24.82 ftp_test.c:373 - msgFTPTask{FTP_TASK}$ Connected.
[DEBUG] 26.32 ftp_test.c:386 - msgFTPTask{FTP_TASK}$ FTP login successful.
Get remote file /samples/pattern_big.txt size
[DEBUG] 26.69 ftp_test.c:428 - msgFTPTask{FTP_TASK}$ Done. File size: 20026.
Get remote file /samples/pattern_big.txt last modification date
[DEBUG] 26.89 ftp_test.c:450 - msgFTPTask{FTP_TASK}$ Done. File last mod date: 20200407090654
.
Starting download of remote file /samples/pattern_big.txt into local /mod/_pattern_big.txt
/samples/pattern_big.txt 47.54% 9520
/samples/pattern_big.txt 100.00% 20026
[DEBUG] 29.75 ftp_test.c:488 - msgFTPTask{FTP_TASK}$ download successful.
[DEBUG] 29.76 ftp_test.c:522 - msgFTPTask{FTP_TASK}$
Local file /mod/_pattern_big.txt size: 20026
Starting upload of local file /mod/_pattern_big.txt
/mod/_pattern_big.txt 81.81% 16384
Upload successful.
Starting download of remote file /samples/pattern.txt into local buffer
Getting remote file /samples/pattern.txt size..
[DEBUG] 32.97 ftp_test.c:583 - msgFTPTask{FTP_TASK}$ Done. File size: 988.
Starting download of remote file /samples/pattern.txt to buffer
[DEBUG] 34.08 ftp_test.c:145 - buf_data_cb{FTP_TASK}$ Received START event
[DEBUG] 34.09 ftp_test.c:149 - buf_data_cb{FTP_TASK}$ Received DATA: 988 bytes on buffer 0x400399e0
[DEBUG] 34.26 ftp_test.c:153 - buf_data_cb{FTP_TASK}$ Received END event
[DEBUG] 34.26 ftp_test.c:623 - msgFTPTask{FTP_TASK}$ Download successful. Received 988 bytes<<<
0 |---------| |---------| |---------| |---------| |---------| *
1 | A | | A | | A | | A | | A | *
2 | AAA | | AAA | | AAA | | AAA | | AAA | *
3 | AAAAA | | AAAAA | | AAAAA | | AAAAA | | AAAAA | *
4 | AAAAAAA | | AAAAAAA | | AAAAAAA | | AAAAAAA | | AAAAAAA | *
5 |AAAAAAAAA| |AAAAAAAAA| |AAAAAAAAA| |AAAAAAAAA| |AAAAAAAAA| *
6 | AAAAAAA | | AAAAAAA | | AAAAAAA | | AAAAAAA | | AAAAAAA | *
7 | AAAAA | | AAAAA | | AAAAA | | AAAAA | | AAAAA | *
8 | AAA | | AAA | | AAA | | AAA | | AAA | *
9 | A | | A | | A | | A | | A | *
10 |---------| |---------| |---------| |---------| |---------| *
11 *
12 |---------| |---------| |---------| |---------| |--->>>

Figure 14

3.2.15 File System example

Sample application showcasing M2MB File system API usage. Debug prints on **MAIN UART**

Features

- How to open a file in write mode and write data in it
- How to reopen the file in read mode and read data from it

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Open file in write mode
- Write data in file
- Close file
- Reopen file in read mode
- Read data from file and print it
- Close file and delete it

```
Starting FileSystem demo app. This is v1.0.7 build on Mar 26 2020 09:50:19. LEVEL: 2
Opening /my_text_file.txt in write mode..
Buffer written successfully into file. 15 bytes were written.
Closing file.
Opening /my_text_file.txt in read only mode..
Received 15 bytes from file:
<Hello from file>
Closing file.
Deleting File
File deleted
App Completed
```

Figure 15

3.2.16 GNSS example

Sample application showing how to use GNSS functionality. Debug prints on **MAIN UART**

Features

- How to enable GNSS receiver on module
- How to collect location information from receiver

Note: on MEx10G1 product family both M2MB_GNSS_SERVICE_NMEA_REPORT and M2MB_GNSS_SERVICE_POSITION_REPORT services are available, while on ME910C1 product family only M2MB_GNSS_SERVICE_POSITION_REPORT is available

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print a welcome message
- Create GNSS task and send a message to it

`gps_task.c` - Init Info feature and get module type - Init gnss, enable position/NMEA report and start it. - When a fix or a NMEA sentence is available, a message will be printed by the GNSS callback function

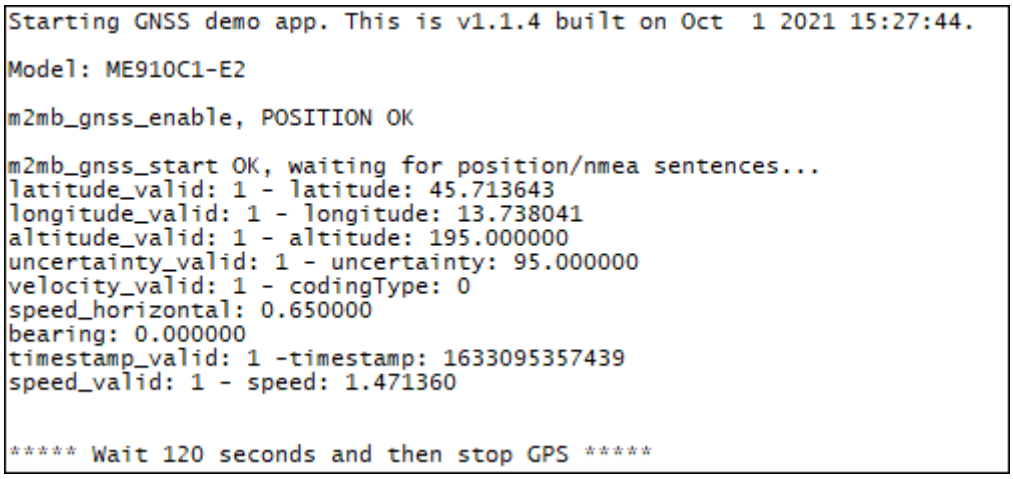

Figure 16

3.2.17 GPIO interrupt example

Sample application showing how to use GPIOs and interrupts. Debug prints on **MAIN UART**

Features

- How to open a GPIO in input mode with interrupt
- How to open a second GPIO in output mode to trigger the first one

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Open GPIO 4 as output
- Open GPIO 3 as input and set interrupt for any edge (rising and falling). **A jumper must be used to short GPIO 3 and 4 pins.**
- Toggle GPIO 4 status high and low every second
- An interrupt is generated on GPIO 3

```
Starting GPIO interrupt demo app. This is v1.0.7 built on Mar 26 2020 16:33:01.
Setting gpio 3 interrupt...
Setting GPIO 4 HIGH
CALLBACK->Interrupt on GPIO 3! Value: 1
Setting GPIO 4 LOW
CALLBACK->Interrupt on GPIO 3! Value: 0
Setting GPIO 4 HIGH
CALLBACK->Interrupt on GPIO 3! Value: 1
Setting GPIO 4 LOW
CALLBACK->Interrupt on GPIO 3! Value: 0
Setting GPIO 4 HIGH
CALLBACK->Interrupt on GPIO 3! Value: 1
Setting GPIO 4 LOW
CALLBACK->Interrupt on GPIO 3! Value: 0
```

Figure 17

3.2.18 General_INFO example

Sample application prints some Module/SIM information as IMEI, fw version, IMSI and so on; it prints also some information about registration. Debug prints on **MAIN UART**

Features

- How to print some Module information as IMEI, FW version etc
- How to print some SIM information as IMSI, ICCID
- How to get and print some informatio about Module registration as Netowrk Operator, AcT, RSSI, etc

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Init NET functionality
- Init INFO functionality
- Get and print Module and SIM info
- Wait form module to register to network
- Get and print registration INFO

```
Starting. This is v1.1.4 built on Mar 31 2021 09:56:03. LEVEL: 2

 Start General INFO application [ version: 1.000000 ]

======================

MODULE ME910C1-E2 INFO

======================

MANUFACTURER: Telit

IMEI: 353080091125422

MODEM FIRMWARE VERSION: M0B.700005

PACKAGE VERSION:
30.00.709-B005-P0B.700100
M0B.700005
P0B.700100
A0B.700000


========

SIM INFO

========

IMSI: 222015602268648

ICCID: 89390100001138084906


============================

Waiting for registration...

============================

Module is registered to HOME network cellID 0x5221
NETWORK OPERATOR (mcc mnc): 222 01
Network Technology 2G (AcT: 0) RSSI: -81
```

Figure 18

3.2.19 HTTP Client

Sample application showing how to use HTTPs client functionalities. Debug prints on **MAIN UART**

Features

- How to check module registration and activate PDP context
- How to initialize the http client, set the debug hook function and the data call-back to manage incoming data
- How to perform GET, HEAD or POST operations

NOTE: the sample app has an optional dependency on azx_base64.h if basic authentication is required (refer to `HTTP_BASIC_AUTH_GET` define in `M2MB_main.c` for further details)

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage HTTP client and start it

`httpTaskCB`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Create HTTP client options and initialize its functionality
- Create HTTP SSL config and initialize the SSL options
- Configure data management options for HTTP client
- Appy all configurations to HTTP client
- Perform a GET request to a server
- Disable PDP context

`DATA_CB`

- Print incoming data
- Set the abort flag to 0 to keep going.

```
Starting HTTP(s) client demo app. This is v1.0.13-C1 built on Aug 11 2020 16:56:28.
[DEBUG] 15.19  M2MB_main:259 - activatePdP{HttpClient}$ m2mb_os_ev_init success
[DEBUG] 15.20  M2MB_main:265 - activatePdP{HttpClient}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 15.20  M2MB_main:273 - activatePdP{HttpClient}$ Waiting for registration...
[DEBUG] 15.21  M2MB_main:119 - NetCallback{pubTspt_0}$ Module is registered to cell 0xC4CF!
[DEBUG] 15.22  M2MB_main:287 - activatePdP{HttpClient}$ Pdp context initialization
[DEBUG] 17.26  M2MB_main:297 - activatePdP{HttpClient}$ Activate PDP with APN NXT17.NET....
[DEBUG] 17.97  M2MB_main:146 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 17.97  M2MB_main:149 - PdpCallback{pubTspt_0}$ IP address: 100.77.54.97
Performing a GET request...

Host Address: linux-ip.net Port 80

Socket connected! |
<!DOCTYPE html>
<html>
<head>
    <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
    <meta name="author" content="Martin A. Brown" />
    <meta name="robots" content="index, follow"/>

    <meta property="og:title" content="http://linux-ip.net/"/>
    <meta property="og:url" content="http://linux-ip.net"/>
    <meta property="og:site_name" content="http://linux-ip.net/"/>
    <meta property="og:type" content="website"/>

    <link rel="canonical" href="http://linux-ip.net" />

    <title>http://linux-ip.net/</title>
    <meta name="viewport" content="width=device-width, initial-scale=1.0">

    <link rel="stylesheet" type="text/css" href="//netdna.bootstrapcdn.com/font-awesome/4.0.3/css/font-awesome.css" />
    <link rel="stylesheet" type="text/css" href="//netdna.bootstrapcdn.com/twitter-bootstrap/2.3.2/css/bootstrap-combined.min.css" />
    <link rel="stylesheet" type="text/css" href="http://linux-ip.net/theme/css/main.css" />

</head>

   ...
    <footer id="site-footer">
        <div class="row-fluid">
            <div class="span10 offset1">
                <address>
                    <p>
                        Powered by <a href="http://getpelican.com/">Pelican</a>
                        and <a href="http://python.org">Python</a>.
                        Theme based on <a href="http://github.com/jsliang/pelican-fresh/">Fresh</a>
                        by <a href="http://jsliang.com/">jsliang</a>
                    </p>
                </address>
            </div>
        </div>
    </footer>
</body>
</html>
Done.
[DEBUG] 22.44  M2MB_main:155 - PdpCallback{pubTspt_0}$ Context successfully deactivated!
```

Figure 19

3.2.20 HW Timer (Hardware Timer)

The sample application shows how to use HW Timers M2MB API. Debug prints on **MAIN UART**

Features

- How to open configure a HW timer
- How to use the timer to manage recurring events

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create hw timer structure
- Configure it with 100 ms timeout, periodic timer (auto fires when expires) and autostart
- Init the timer with the parameters
- Wait 10 seconds
- Stop the timer

`TimerCb`

- Print a message with an increasing counter

```
Starting HW Timers demo app. This is v1.0.7 built on Mar 26 2020 13:04:14.
[DEBUG] 14.06  M2MB_main.c:114 - M2MB_main{M2M_DamsStart}$ Set the timer attributes structure: success.
Timer successfully created
Start the timer, success.
[DEBUG] 14.18  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [0]
[DEBUG] 14.28  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [1]
[DEBUG] 14.38  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [2]
[DEBUG] 14.48  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [3]
[DEBUG] 14.58  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [4]
[DEBUG] 14.69  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [5]
[DEBUG] 14.79  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [6]
[DEBUG] 14.88  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [7]
[DEBUG] 14.98  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [8]
[DEBUG] 15.08  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [9]


[DEBUG] 23.90  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [96]
[DEBUG] 24.01  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [97]
[DEBUG] 24.11  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [98]
Stop a running timer: success
Application end
```

Figure 20

3.2.21 Hello World

The application prints “Hello World!” over selected output every two seconds. Debug prints on **MAIN UART**, using AZX log example functions

Features

- How to open an output channel using AZX LOG sample functions
- How to print logging information on the channel using AZX LOG sample functions

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print “Hello World!” every 2 seconds in a while loop

```
Starting. This is v1.0.7 built on Mar 26 2020 09:34:16. LEVEL: 2

 Start Hello world Application  [ version: 2.000000 ]

 Hello world 2.0 [ 000001 ]
 Hello world 2.0 [ 000002 ]
 Hello world 2.0 [ 000003 ]
 Hello world 2.0 [ 000004 ]
 Hello world 2.0 [ 000005 ]
 Hello world 2.0 [ 000006 ]
 Hello world 2.0 [ 000007 ]
 Hello world 2.0 [ 000008 ]
 Hello world 2.0 [ 000009 ]
```

Figure 21

3.2.22 I2C example

Sample application showing how to communicate with an I2C slave device. Debug prints on **MAIN UART**

Features

- How to open a communication channel with an I2C slave device
- How to send and receive data to/from the slave device

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Open I2C bus, setting SDA an SCL pins as 2 and 3 respectively
- Set registers to configure accelerometer -Read in a loop the 6 registers carrying the 3 axes values and show the g value for each of them

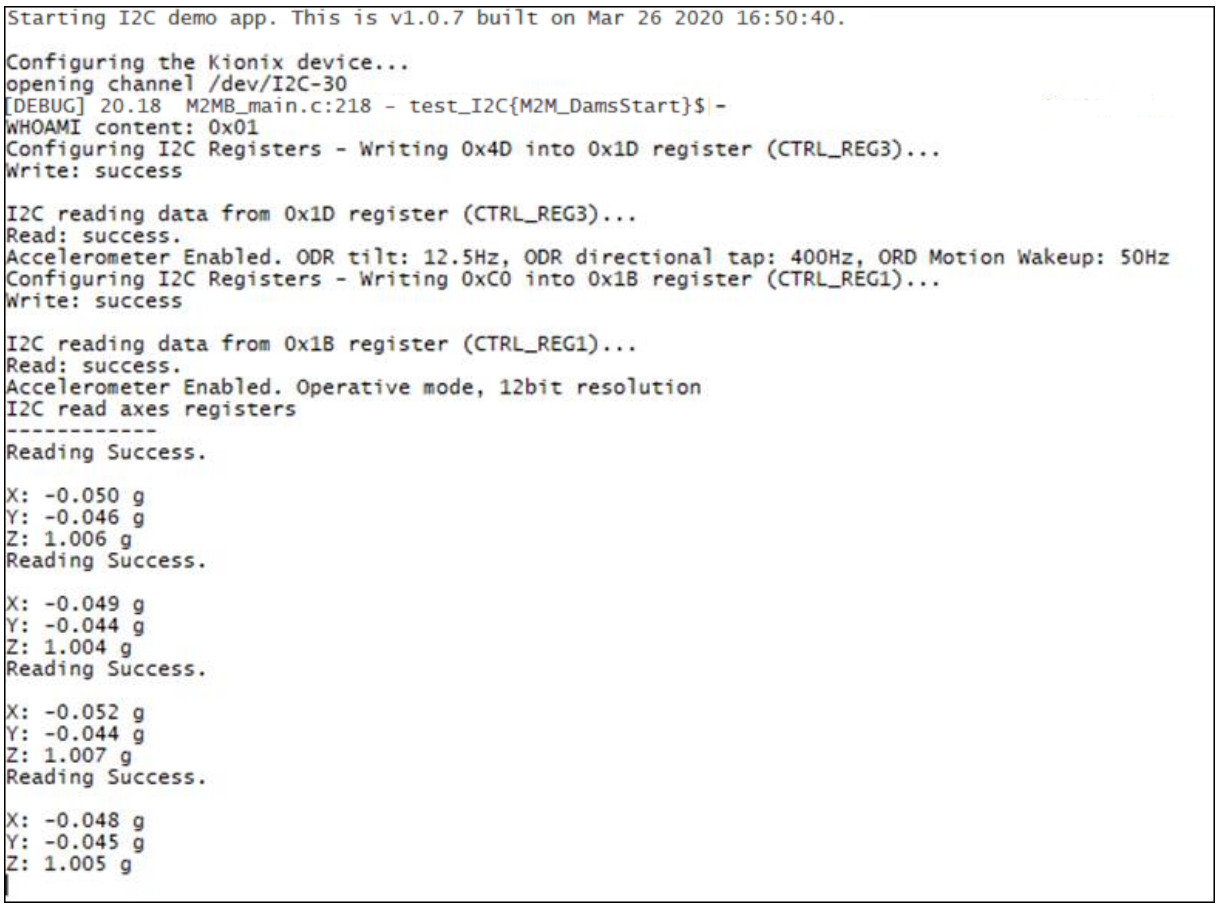

Figure 22

3.2.23 Little FileSystem 2

Sample application showing how use lfs2 porting with RAM disk and SPI data flash. Debug prints on **MAIN UART**

Features

- How to create and manage Ram Disk
- How to manage file-system in Ram disk partition
- How to create and manage SPI Flash memory partition
- How to manage file-system in SPI Flash memory partition

Application workflow

`M2MB_main.c`

- Init logging system
- Call Ram Disk tests
- Call Flash memory tests

`ram_utils_usage.c`

- Initialize Ram Disk
- Format and Mount partition
- List files
- Files creation and write content
- List files
- Read files
- Unmount and Release resources

`spi_utils_usage.c` - Initialize SPI Flash chip - Initialize SPI Flash Disk - Format and Mount partition - List files - Files creation and write content - List files - Read files - Delete files - Directories creation and deletion - Unmount and Release resources

Notes:

For SPI Flash a JSC memory is used with chip select pin connected to module GPIO2 pin. For better performances, a 33kOhm pull-down resistor on SPI clock is suggested. Please refer to SPI_echo sample app for SPI connection details.

For LE910Cx (both Linux and ThreadX based devices), `AT#SPIEN=1` command must be sent once before running the app

```
Starting lfs2 demo app. This is v1.0.14-C1 built on Oct 22 2020 09:43:08.

>>>>>>> Starting RAMDiskDemo ...
[DEBUG] 18.28  azx_lfs_uti:125 - azx_ram_initialize{M2M_DamsStart}$ Ram Memory allocated correctly from 0x40042228 to 0x40046228!!

Mounting partition...

Formatting...

Mounting...


Mounted partition...

<><><><>fileListUtils

List:
., 0, 2
.., 0, 2

file_name: file000.txt
size: 10
buffer: content000
mode: 0
RAM TYPE size: 10000


File created and closed: file000.txt


<><><><>fileListUtils
____INSIDE --->file000.txt, 10, 1

List:
., 0, 2
.., 0, 2
file000.txt, 10, 1

------>File reading

File: file000.txt, Size: 10, Buffer: content000

Nand released
Partition unmounted
[DEBUG] 20.31  azx_lfs_uti:165 - azx_ram_releaseResources{M2M_DamsStart}$ Ram Memory released correctly!!
```

```
>>>>>>> Starting FlashDiskDemo ...
Starting initialization...

table id[0] = 191
table id[1] = 1
table id[2] = 0

nandLFSCallback Callback event <1>
NAND Callback event: NAND_JSC_INITIALIZED <1>
nandLFSCallback Callback event <1>
NAND Callback event: NAND_JSC_INITIALIZED <1>

Mounting partition...

Formatting...
spiErase: address = 0, len = 131072

spiErase: address = 131072, len = 131072


Mounting...


Mounted partition...


<><><><>fileListUtils

List:
., 0, 2
.., 0, 2


Formatting...
spiErase: address = 0, len = 131072

spiErase: address = 131072, len = 131072


Mounting...


Mounted partition...


<><><><>fileListUtils

List:
., 0, 2
.., 0, 2

file_name: file000.txt
size: 10
buffer: content000
mode: 0


File created and closed: file000.txt
```

```
<><><><fileListUtils

List:
., 0, 2
.., 0, 2
file000.txt, 10, 1
file001.txt, 10, 1
file002.txt, 10, 1
file003.txt, 10, 1
file004.txt, 10, 1

------>File reading

File: file000.txt, Size: 10, Buffer: content000


File: file004.txt, Size: 10, Buffer: content004


File: file002.txt, Size: 10, Buffer: content002
------>File removing
file001.txt<<<<<<<


File removed: file001.txt
file000.txt<<<<<<<


File removed: file000.txt
file004.txt<<<<<<<


File removed: file004.txt


<><><><fileListUtils

List:
., 0, 2
.., 0, 2
file002.txt, 10, 1
file003.txt, 10, 1

spiErase: address = 59637760, len = 131072

[DEBUG] 58.61  azx_lfs_uti:648 - azx_lfsDirCreationByContext{M2M_DamsStart}$ Directory created: dir000!!
[DEBUG] 59.78  azx_lfs_uti:631 - azx_lfsDirCreationByContext{M2M_DamsStart}$ Directory already exists: dir000!!
spiErase: address = 59899904, len = 131072

[DEBUG] 61.70  azx_lfs_uti:648 - azx_lfsDirCreationByContext{M2M_DamsStart}$ Directory created: dir001!!
spiErase: address = 60162048, len = 131072

[DEBUG] 63.67  azx_lfs_uti:648 - azx_lfsDirCreationByContext{M2M_DamsStart}$ Directory created: dir002!!
```

```
<><><><fileListUtils

List:
., 0, 2
.., 0, 2
dir000, 0, 2
dir001, 0, 2
dir002, 0, 2
file002.txt, 10, 1
file003.txt, 10, 1



<><><><fileListUtils

List:
., 0, 2
.., 0, 2
dir001, 0, 2
dir002, 0, 2
file002.txt, 10, 1
file003.txt, 10, 1

Nand released
Partition unmounted

Unmounted process ended...

testAllInOneFunction ended...
```

3.2.24 Logging Demo

Sample application showing how to print on one of the available output interfaces. Debug prints on **MAIN UART**

Features

- How to open a logging channel
- How to set a logging level
- How to use different logging macros

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Print a message with every log level

```
Starting Logging demo app. This is v1.0.7 built on Mar 26 2020 13:57:06.
[WARN ] 20.17  M2MB_main.c:74 - M2MB_main{M2M_DamsStart}$ This is a WARNING MESSAGE
[ERROR] 20.18  M2MB_main.c:76 - M2MB_main{M2M_DamsStart}$ THIS IS AN ERROR MESSAGE
[CRITICAL] 20.19  M2MB_main.c:78 - M2MB_main{M2M_DamsStart}$ THIS IS AN CRITICAL MESSAGE
[DEBUG] 20.19  M2MB_main.c:80 - M2MB_main{M2M_DamsStart}$ This is a DEBUG message
[TRACE] 20.20  M2MB_main.c:82 - M2MB_main{M2M_DamsStart}$ This is a TRACE message
END.
```

Figure 23

3.2.25 MD5 example

Sample application showing how to compute MD5 hashes using m2mb crypto. Debug prints on **MAIN UART**

Features

- Compute MD5 hash of a file
- Compute MD5 hash of a string

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Create a temporary file with the expected content
- Compute MD5 hash of the provided text file
- Compare the hash with the expected one
- Compute MD5 hash of a string
- Compare the hash with the expected one
- Delete test file

```
Starting MD5 demo app. This is v1.0.7 built on Apr  7 2020 10:19:54.
Buffer written successfully into file. 45 bytes were written.

Computing hash from file...
Computed hash: bb0fa6eff92c305f166803b6938dd33a
Expected hash: bb0fa6eff92c305f166803b6938dd33a
Hashes are the same!

Computing hash from string...
Computed hash: bb0fa6eff92c305f166803b6938dd33a
Expected hash: bb0fa6eff92c305f166803b6938dd33a
Hashes are the same!
```

Figure 24

3.2.26 MQTT Client

Sample application showcasing MQTT client functionalities (with SSL). Debug prints on **MAIN UART**

Features

- How to check module registration and enable PDP context
- How to configure MQTT client parameters
- How to connect to a broker with SSL and exchange data over a subscribed topic

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage MQTT client and start it

`mqtt_demo.c`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Init MQTT client
- Configure it with all parameters (Client ID, username, password, PDP context ID, keepalive timeout...)
- Connect MQTT client to broker
- Subscribe to two topics
- Publish 10 messages with increasing counter. Even messages are sent to topic 1, odd messages on topic 2.
- Print received message in mqtt_topc_cb function
- Disconnect MQTT client and deinit it
- Disable PDP context

```
Starting MQTT demo app. This is v1.0.7 built on Apr  7 2020 10:34:08.
[DEBUG] 16.18  mqtt_demo.c:192 - MQTT_Task{MQTT_TASK}$ INIT
[DEBUG] 16.18  mqtt_demo.c:206 - MQTT_Task{MQTT_TASK}$ m2mb_os_ev_init success
[DEBUG] 16.19  mqtt_demo.c:214 - MQTT_Task{MQTT_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 16.19  mqtt_demo.c:221 - MQTT_Task{MQTT_TASK}$ Waiting for registration...
[DEBUG] 16.20  mqtt_demo.c:131 - NetCallback{pubTspt_0}$ Module is registered
[DEBUG] 16.21  mqtt_demo.c:232 - MQTT_Task{MQTT_TASK}$ Pdp context activation
[DEBUG] 18.26  mqtt_demo.c:246 - MQTT_Task{MQTT_TASK}$ Activate PDP with APN web.omnitel.it on CID 3....
[DEBUG] 18.95  mqtt_demo.c:155 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 18.96  mqtt_demo.c:159 - PdpCallback{pubTspt_0}$ IP address: 37.118.201.56
[DEBUG] 18.96  mqtt_demo.c:268 - MQTT_Task{MQTT_TASK}$ Init MQTT
[DEBUG] 18.97  mqtt_demo.c:278 - MQTT_Task{MQTT_TASK}$ m2mb_mqtt_init succeeded

Connecting to broker <api-dev.devicewise.com>:1883...
Done.
Subscribing to test_topic and test_topic2..
[DEBUG] 20.35  mqtt_demo.c:367 - MQTT_Task{MQTT_TASK}$ Done.

[DEBUG] 20.36  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 2> to topic test_topic
[DEBUG] 20.37  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 20.71  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic; data len: 27
[DEBUG] 20.72  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 2>
[DEBUG] 23.37  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 3> to topic test_topic2
[DEBUG] 23.38  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 23.92  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic2; data len: 27
[DEBUG] 23.93  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 3>
[DEBUG] 26.40  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 4> to topic test_topic
[DEBUG] 26.41  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 26.93  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic; data len: 27
[DEBUG] 26.93  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 4>
[DEBUG] 29.42  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 5> to topic test_topic2
[DEBUG] 29.43  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 29.99  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic2; data len: 27
[DEBUG] 30.00  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 5>
[DEBUG] 32.46  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 6> to topic test_topic
[DEBUG] 32.48  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 33.00  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic; data len: 27
[DEBUG] 33.01  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 6>
[DEBUG] 35.47  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 7> to topic test_topic2
[DEBUG] 35.48  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 36.01  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic2; data len: 27
[DEBUG] 36.02  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 7>
[DEBUG] 38.50  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 8> to topic test_topic
[DEBUG] 38.51  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 39.15  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic; data len: 27
[DEBUG] 39.16  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 8>
[DEBUG] 41.52  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 9> to topic test_topic2
[DEBUG] 41.53  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 42.10  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic2; data len: 27
[DEBUG] 42.12  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 9>
[DEBUG] 44.56  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 10> to topic test_topic
[DEBUG] 44.57  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 45.09  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic; data len: 28
[DEBUG] 45.11  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 10>
[DEBUG] 47.58  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 11> to topic test_topic2
[DEBUG] 47.59  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 48.12  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic2; data len: 28
[DEBUG] 48.13  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 11>

Disconnecting from MQTT broker..
[DEBUG] 50.60  mqtt_demo.c:414 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 50.61  mqtt_demo.c:443 - MQTT_Task{MQTT_TASK}$ application exit
[DEBUG] 50.62  mqtt_demo.c:453 - MQTT_Task{MQTT_TASK}$ m2mb_pdp_deactivate returned success
[DEBUG] 50.63  mqtt_demo.c:457 - MQTT_Task{MQTT_TASK}$ Application complete.
[DEBUG] 51.23  mqtt_demo.c:164 - PdpCallback{pubTspt_0}$ Context deactivated!
```

Figure 25

3.2.27 MultiTask

Sample application showcasing multi tasking functionalities with M2MB API. Debug prints on **MAIN UART**

Features

- How to create tasks using azx utilities
- How to use send messages to tasks
- How to use a semaphore to synchronize two tasks

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create three tasks with the provided utility (this calls public m2mb APIs)
- Send a message to the task1, its callback function azx_msgTask1 will be called

`azx_msgTask1`

- Print received parameters from main
- Send modified parameters to task2 (its callback function azx_msgTask2 will be called)
- wait for an InterProcess Communication semaphore to be available (released by task3)
- Once the semaphore is available, print a message and return

`azx_msgTask2`

- Print received parameters from caller
- If first parameter is bigger than a certain value, Send modified parameters to task3
- Else, use the second parameter as a task handle and print the corresponding name plus the value of the first parameter

`azx_msgTask3`

- Print received parameters from task 2
- release IPC semaphore
- send message to task 2 with first parameter below the threshold and second parameter with task3 handle

```
Starting MultiTask demo app. This is v1.0.12-C1 built on Jun 23 2020 15:36:31.

Inside "myTask1" user callback function. Received parameters from MAIN: 3 4 5
Task1 - Sending a message to task 2 with modified parameters...
Task1 - Waiting for semaphore to be released by task 3 now...

Inside "myTask2" user callback function. Received parameters: 5 7 10
Task2 - Sending a message to task 3 with modified parameters...
Task2 - Done.

Inside "myTask3" user callback function. Received parameters from Task 2: 15 14 9
Task3 - Releasing IPC semaphore...

Task1 - After semaphore! return...

Task3 - IPC semaphore released.
Task3 - Sending a message to task 2 with specific 'type' parameter value of 0 and task 3 handle as param1...

Inside "myTask2" user callback function. Received parameters: 0 1073951320 9
Task3 - Done.
Task2 - Received type 0 from task "myTask3"
Task2 - Done.
```

Figure 26

3.2.28 NTP example

The application connects to an NTP server, gets current date and time and updates module's internal clock. Debug prints on **MAIN UART**

Features

- How to get current date and time from an NTP server
- How to set current date and time on module

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Send message to ntpTask

`ntp_task.c`

NTP_task() - Waits module registration - When module is registered, initializes ntp setting CID, server url and timeout - When PDP context is correctly opened, a query to NTP server is done to get current date and time - On SET_MODULE_RTC message type reception, module RTC is set with date time value got from NTP server.

m2mb_ntp_ind_callback() - As soon as M2MB_NTP_VALID_TIME event is received, current date and time is printend and a message (with SET_MODULE_RTC type) is sent to NTP_task

```
Start NTP demo application. This is v1.0 built on Apr 16 2021 09:36:12.

Waiting for registration...
Module is registered!

Activate PDP context with APN ibox.tim.it on CID 3
Context activated, IP address: 2.195.170.123
Get current time from server 0.pool.ntp.org, PORT: 123

Current time is: Friday 2021-04-16, 07:37:33

Current time correctly set on module
Module system time is: 2021-04-16, 07:37:33
```

Figure 27

3.2.29 RTC example

Sample application that shows RTC apis functionalities: how to get/set moudle system time and timestamp. Debug prints on **MAIN UART**

Features

- How to read module timestamp
- How to read module system time
- How to set new system time

Application workflow

`M2MB_main.c`

- Init log azx and print a welcome message
- Init net functionality and wait for module registration
- Init RTC functionality and get module time in timestamp format (seconds from the epoch)
- Get moudle system time in date/time format
- Add 1 hour to timestamp, convert it to system time and set it to module

```
 Start RTC demo application. This is v1.0 built on Oct  1 2021 15:01:40.

Waiting for registration...
Module is registered!

Current time in seconds from the epoch: 1633101266
Module system time is: 2021-10-01, 15:14:26

Get current time and add an hour

Current time in seconds from the epoch: 1633101266
New time to be set : 2021-10-01, 16:14:26, tz:4, dlst:0

Set new time and check the setting
NEW module system time is: 2021-10-01, 16:14:26
```

Figure 28

3.2.30 SMS PDU

Sample application showcasing how to create and decode PDUs to be used with m2mb_sms_* API set. A SIM card and antenna must be present. Debug prints on **MAIN UART**

Features

- How to enable SMS functionality
- How to use encode an SMS PDU to be sent with m2mb_api
- How to decode a received SMS response from PDU to ASCII mode.

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Init sms functionality
- Create PDU from text message
- Send message to destination number
- Wait for response
- When SMS PDU response is received, decode it and print information about it, plus the message content

```
m2mb_sms_init() succeeded

Sending message <How are you?>...
 m2mb_sms_send() - succeeded
M2MB_SMS_SEND_RESP Callback
Send resp msg ID 10
SMS received!
SMS correctly received!

Reading SMS from memory...
 m2mb_sms_read() request succeeded

--- SMS read ---
SMS tag M2MB_SMS_TAG_MT_NOT_READ
SMS format M2MB_SMS_FORMAT_3GPP
Code type: 0
Sender type: 145
Msg len: 12
Msg bytes: 11
Msg date 19/7/17 16:7:58 (timezone: 2)
Received SMS, content: <<Fine thanks >>
Sender: +[redacted]
```

Figure 29

3.2.31 SMS_atCmd example

Sample application showcasing how to receive an SMS containing an AT command, process the AT command and send its answer to sender (configurable in sms_config.txt). A SIM card and antenna must be present. Debug prints on **MAIN UART**

Features

- How to receive an SMS with an AT command as text inside
- How to send AT command to parser and read the answer
- How to send the AT command answer back to sender via SMS

Optional configuration file to be put in `/data/azc/mod` folder, copy `sms_config.txt` file into your module running the following AT command:

```
AT#M2MWRITE="/data/azc/mod/sms_config.txt",138
>>> here receive the prompt; then type or send the file, sized 138 bytes
```

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Init SMS functionality
- Read configuration file sms_config.txt (send SMS with AT command answer back, delte SMS received)
- Init AT command parser
- Create a task to handle SMS parsing and AT command sending
- Wait for an incoming SMS

`callbacks.c`

`msgSMSparse()`

- When SMS has been received, content is decoded and printed. If there is an AT command inside, command is executed and answer printed and sent back to sender as an SMS (depending on sms_config.txt setting)

```
ÿStarting SMS with AT command demo app. This is v1.0.13-C1 built on Mar 18 2021 12:42:22.
[DEBUG] 16.61  M2MB_main:135 - M2MB_main{M2M_DamsStart}$ m2mb_os_ev_init success
m2mb_sms_init() succeeded
[DEBUG] 16.62  M2MB_main:168 - M2MB_main{M2M_DamsStart}$ M2MB_SMS_INCOMING_IND indication enabled
[DEBUG] 16.63  M2MB_main:179 - M2MB_main{M2M_DamsStart}$ M2MB_SMS_INCOMING_IND MEMORY FULL indication enabled
[DEBUG] 16.64  M2MB_main:196 - M2MB_main{M2M_DamsStart}$ Storage set to M2MB_SMS_STORAGE_SM
[DEBUG] 16.65  callbacks:114 - readConfigFromFile{M2M_DamsStart}$ Reading parameters from file
[DEBUG] 16.66  callbacks:116 - readConfigFromFile{M2M_DamsStart}$ Opening /mod/sms_config.txt in read mode..
Default: SMS with answer sending DISABLED, delete sms DISABLED
[DEBUG] 16.67  at_async:115 - at_cmd_async_init{M2M_DamsStart}$ m2mb_ati_init() on instance 0
Please send an SMS with a configuration as ("ATCMD: <atcmd>")...
```

Figure 30

3.2.32 SPI Echo

Sample application showing how to communicate over SPI with m2mb API. Debug prints on **MAIN UART**

Features

- How to open an SPI bus. MOSI and MISO will be shorted, to have an echo.
- How to communicate over SPI bus

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Open SPI bus, set parameters
- Send data on MOSI and read the same in MISO

Notes:

For LE910Cx (both Linux and ThreadX based devices), AT#SPIEN=1 command must be sent once before running the app

```
Starting SPI demo app. This is v1.0.7 built on Apr  1 2020 13:48:05.
Transfer successful. Received: hello from spi echo
```

Figure 31

3.2.33 SPI sensors

Sample application showing SPI usage, configuring two ST devices: a magnetometer (ST LIS3MDL) and a gyroscope (ST L3G4200D). The application will read values from both devices using GPIO4 and 3 (respectively) as magnetometer CS and gyro CS. Debug prints on **MAIN UART**

Features

- How to open an SPI bus with a slave device
- How to communicate with the device over the SPI bus

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Open SPI bus, set parameters
- Configure `GPIO 2` and `GPIO 3` as output, set them high (idle)
- Set registers to configure magnetometer
- Read in a loop (10 iterations) the registers carrying the 3 axes values and show the gauss value for each of them. A metal object is put close to the sensor to change the read values.
- Set registers to configure gyroscope
- Read in a loop (10 iterations) the registers carrying the 3 axes values and show the degrees per second value for each of them. The board is rotated to change the read values.

Notes:

For LE910Cx (both Linux and ThreadX based devices), `AT#SPIEN=1` command must be sent once before running the app

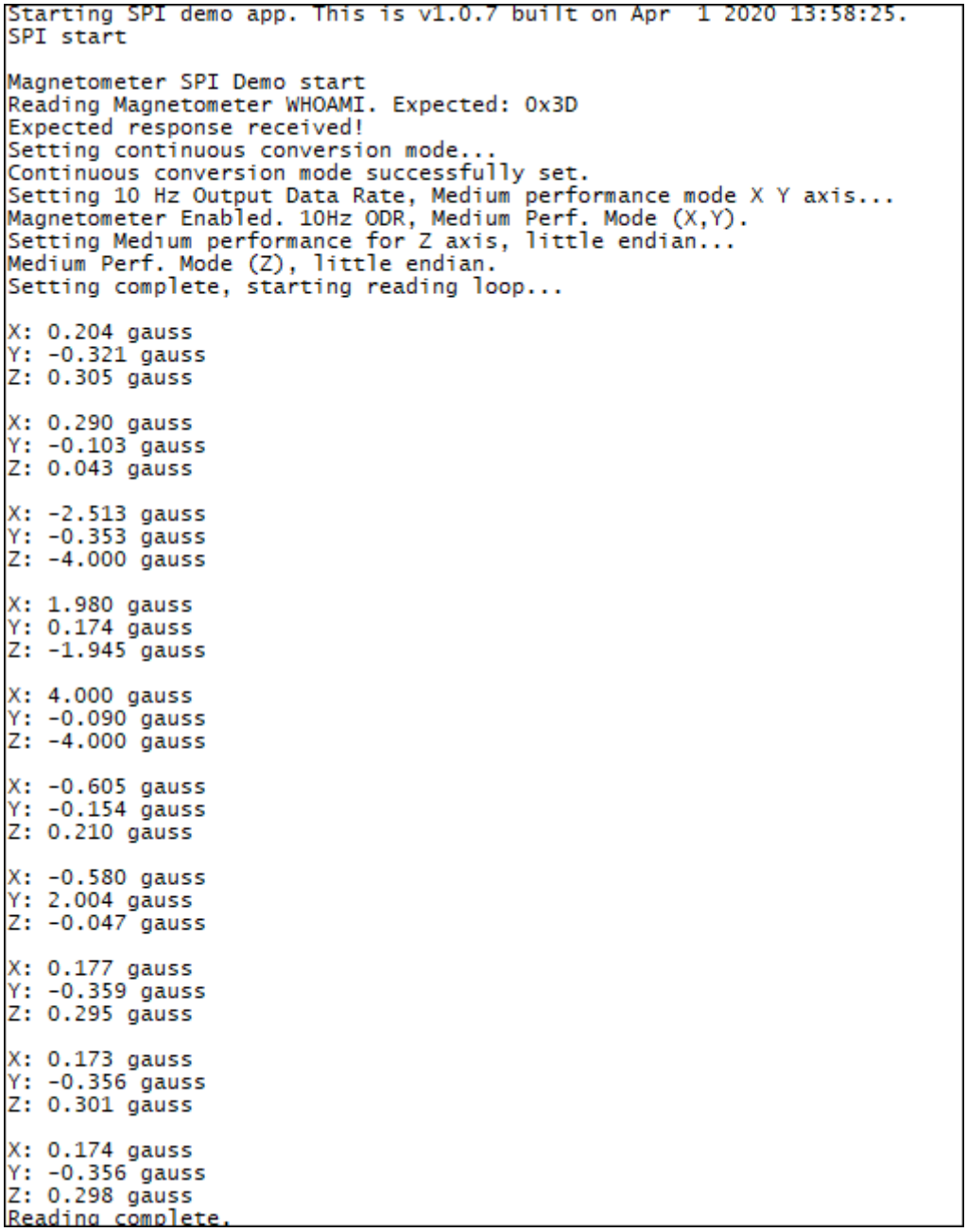
Starting SPI demo app. This is v1.0.7 built on Apr 1 2020 13:58:25.
SPI start
Magnetometer SPI Demo start
Reading Magnetometer WHOAMI. Expected: 0x3D
Expected response received!
Setting continuous conversion mode...
Continuous conversion mode successfully set.
Setting 10 Hz Output Data Rate, Medium performance mode X Y axis...
Magnetometer Enabled. 10Hz ODR, Medium Perf. Mode (X,Y).
Setting Medium performance for Z axis, little endian...
Medium Perf. Mode (Z), little endian.
Setting complete, starting reading loop...
X: 0.204 gauss
Y: -0.321 gauss
Z: 0.305 gauss
X: 0.290 gauss
Y: -0.103 gauss
Z: 0.043 gauss
X: -2.513 gauss
Y: -0.353 gauss
Z: -4.000 gauss
X: 1.980 gauss
Y: 0.174 gauss
Z: -1.945 gauss
X: 4.000 gauss
Y: -0.090 gauss
Z: -4.000 gauss
X: -0.605 gauss
Y: -0.154 gauss
Z: 0.210 gauss
X: -0.580 gauss
Y: 2.004 gauss
Z: -0.047 gauss
X: 0.177 gauss
Y: -0.359 gauss
Z: 0.295 gauss
X: 0.173 gauss
Y: -0.356 gauss
Z: 0.301 gauss
X: 0.174 gauss
Y: -0.356 gauss
Z: 0.298 gauss
Reading complete.

Figure 32

3.2.34 SW Timer (Software Timer)

The sample application shows how to use SW Timers M2MB API. Debug prints on **MAIN UART**

Features

- How to open configure a SW timer
- How to use the timer to manage recurring events

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create sw timer structure
- Configure it with 4 seconds timeout, periodic timer (auto fires when expires)
- Init the timer with the parameters
- Start the timer
- Wait 10 seconds
- Stop the timer

`timerCb`

- Print a message with inside the callback

```
Starting SW Timers demo app. This is v1.0.7 built on Apr  7 2020 09:51:25.
timer expired!
[DEBUG] 21.41  M2MB_main.c:59 - timerCb{pubTspt_0}$ timer handle: 0x4002b004
timer expired!
[DEBUG] 25.47  M2MB_main.c:59 - timerCb{pubTspt_0}$ timer handle: 0x4002b004
stopping the timer
Stop a running timer: success
Application end
```

Figure 33

3.2.35 TCP IP

Sample application showcasing TCP echo demo with M2MB API. Debug prints on **MAIN UART**

Features

- How to check module registration and activate PDP context
- How to open a TCP client socket
- How to communicate over the socket

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage socket and start it

`m2m_tcp_test.c`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Create socket and link it to the PDP context id
- Connect to the server
- Send data and receive response
- Close socket
- Disable PDP context

```
Starting TCP-IP demo app. This is v1.0.7 built on Mar 26 2020 16:20:30.
[DEBUG] 21.23  m2m_tcp_test.c:201 - M2M_msgTCPTask{TCP_TASK}$ INIT
[DEBUG] 21.25  m2m_tcp_test.c:217 - M2M_msgTCPTask{TCP_TASK}$ m2mb_os_ev_init success
[DEBUG] 21.26  m2m_tcp_test.c:223 - M2M_msgTCPTask{TCP_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 21.26  m2m_tcp_test.c:231 - M2M_msgTCPTask{TCP_TASK}$ Waiting for registration...
[DEBUG] 21.28  m2m_tcp_test.c:128 - NetCallback{pubTspt_0}$ Module is registered to cell 0x816B!
[DEBUG] 21.29  m2m_tcp_test.c:244 - M2M_msgTCPTask{TCP_TASK}$ Pdp context activation
[DEBUG] 21.30  m2m_tcp_test.c:248 - M2M_msgTCPTask{TCP_TASK}$ m2mb_pdp_init returned M2MB_RESULT_SUCCESS
[DEBUG] 23.34  m2m_tcp_test.c:263 - M2M_msgTCPTask{TCP_TASK}$ Activate PDP with APN web.omnitel.it....
[DEBUG] 24.52  m2m_tcp_test.c:155 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 24.52  m2m_tcp_test.c:158 - PdpCallback{pubTspt_0}$ IP address: 83.225.44.56
[DEBUG] 24.54  m2m_tcp_test.c:273 - M2M_msgTCPTask{TCP_TASK}$ Creating Socket...
[DEBUG] 24.54  m2m_tcp_test.c:284 - M2M_msgTCPTask{TCP_TASK}$ Socket created
[DEBUG] 24.55  m2m_tcp_test.c:294 - M2M_msgTCPTask{TCP_TASK}$ Socket ctx set to 3
[DEBUG] 24.95  m2m_tcp_test.c:307 - M2M_msgTCPTask{TCP_TASK}$ Retrieved IP: 185.86.42.218
[DEBUG] 25.17  m2m_tcp_test.c:322 - M2M_msgTCPTask{TCP_TASK}$ Socket Connected!
[DEBUG] 25.18  m2m_tcp_test.c:329 - M2M_msgTCPTask{TCP_TASK}$ Sending data over socket..
[DEBUG] 25.19  m2m_tcp_test.c:342 - M2M_msgTCPTask{TCP_TASK}$ Data send successfully (16 bytes)
[DEBUG] 27.20  m2m_tcp_test.c:356 - M2M_msgTCPTask{TCP_TASK}$ trying to receive 16 bytes..
[DEBUG] 27.21  m2m_tcp_test.c:364 - M2M_msgTCPTask{TCP_TASK}$ Data received (16): <hello from m2mb!>
[DEBUG] 27.21  m2m_tcp_test.c:373 - M2M_msgTCPTask{TCP_TASK}$ application exit
[DEBUG] 27.22  m2m_tcp_test.c:385 - M2M_msgTCPTask{TCP_TASK}$ m2mb_pdp_deactivate returned success
[DEBUG] 27.24  m2m_tcp_test.c:388 - M2M_msgTCPTask{TCP_TASK}$ Application complete.
[DEBUG] 29.43  m2m_tcp_test.c:164 - PdpCallback{pubTspt_0}$ Context successfully deactivated!
```

Figure 34

3.2.36 TCP Socket status

Sample application showcasing how to check a TPC connected socket current status. Debug prints on **MAIN UART**

Features

- How to check module registration and activate PDP context
- How to open a TCP client socket
- How to check if the TCP socket is still valid

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage socket and start it

`m2m_tcp_test.c`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Create socket and link it to the PDP context id
- Connect to the server
- Check in a loop the current socket status using the adv_select function with a 2 seconds timeout
- Close socket when the remote host closes it
- Disable PDP context

```
Starting TCP socket status check demo app. This is v1.0.14-C1 built on Sep  8 2020 14:59:25.
[DEBUG] 21.33  m2m_tcp_tes:324 - M2M_msgTCPTask{TCP_TASK}$ INIT
[DEBUG] 21.34  m2m_tcp_tes:338 - M2M_msgTCPTask{TCP_TASK}$ m2mb_os_ev_init success
[DEBUG] 21.34  m2m_tcp_tes:344 - M2M_msgTCPTask{TCP_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 21.35  m2m_tcp_tes:352 - M2M_msgTCPTask{TCP_TASK}$ Waiting for registration...
[DEBUG] 21.36  m2m_tcp_tes:365 - M2M_msgTCPTask{TCP_TASK}$ Pdp context activation
[DEBUG] 21.37  m2m_tcp_tes:369 - M2M_msgTCPTask{TCP_TASK}$ m2mb_pdp_init returned M2MB_RESULT_SUCCESS
[DEBUG] 23.41  m2m_tcp_tes:384 - M2M_msgTCPTask{TCP_TASK}$ Activate PDP with APN NXT17.NET....
[DEBUG] 24.09  m2m_tcp_tes:281 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 24.10  m2m_tcp_tes:284 - PdpCallback{pubTspt_0}$ IP address: 100.77.5.223
[DEBUG] 24.10  m2m_tcp_tes:394 - M2M_msgTCPTask{TCP_TASK}$ Creating Socket...
[DEBUG] 24.11  m2m_tcp_tes:405 - M2M_msgTCPTask{TCP_TASK}$ Socket created
[DEBUG] 24.11  m2m_tcp_tes:415 - M2M_msgTCPTask{TCP_TASK}$ Socket ctx set to 3
[DEBUG] 24.60  m2m_tcp_tes:428 - M2M_msgTCPTask{TCP_TASK}$ Retrieved IP: 185.86.42.218
[DEBUG] 24.93  m2m_tcp_tes:443 - M2M_msgTCPTask{TCP_TASK}$ Socket Connected!
[DEBUG] 26.98  m2m_tcp_tes:461 - M2M_msgTCPTask{TCP_TASK}$ Socket does not have any event, try again...
[DEBUG] 29.03  m2m_tcp_tes:461 - M2M_msgTCPTask{TCP_TASK}$ Socket does not have any event, try again...

...

[DEBUG] 82.18  m2m_tcp_tes:461 - M2M_msgTCPTask{TCP_TASK}$ Socket does not have any event, try again...
[DEBUG] 84.23  m2m_tcp_tes:461 - M2M_msgTCPTask{TCP_TASK}$ Socket does not have any event, try again...
[DEBUG] 86.28  m2m_tcp_tes:461 - M2M_msgTCPTask{TCP_TASK}$ Socket does not have any event, try again...
[DEBUG] 88.31  m2m_tcp_tes:461 - M2M_msgTCPTask{TCP_TASK}$ Socket does not have any event, try again...
[DEBUG] 88.90  m2m_tcp_tes:154 - adv_select{TCP_TASK}$ Data is available on socket <0x40032b3c>
[DEBUG] 88.92  m2m_tcp_tes:160 - adv_select{TCP_TASK}$ There are <0> pending bytes on socket
Socket was closed by remote!
[DEBUG] 88.92  m2m_tcp_tes:494 - M2M_msgTCPTask{TCP_TASK}$ application exit
[DEBUG] 88.94  m2m_tcp_tes:506 - M2M_msgTCPTask{TCP_TASK}$ m2mb_pdp_deactivate returned success
[DEBUG] 88.94  m2m_tcp_tes:509 - M2M_msgTCPTask{TCP_TASK}$ Application complete.
[DEBUG] 89.31  m2m_tcp_tes:290 - PdpCallback{pubTspt_0}$ Context successfully deactivated!
```

Figure 35

3.2.37 TCP Server

Sample application showcasing TCP listening socket demo with M2MB API. Debug prints on **MAIN UART**

Features

- How to check module registration and activate PDP context
- How to open a TCP listening socket
- How to manage external hosts connection and exchange data

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage socket and start it

`m2m_tcp_test.c`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Create socket and set it in non-blocking mode
- Bind the socket to the listening port
- Start listening for incoming connection
- Check if a connection is incoming using m2mb_socket_bsd_select function
- If a client connects, perform accept on the child socket
- Send a “START” message to the client
- Send some data
- Wait for data from client and print it
- Close the child socket
- Start listening again, up to 3 times
- Close listening socket
- Disable PDP context

Debug Log

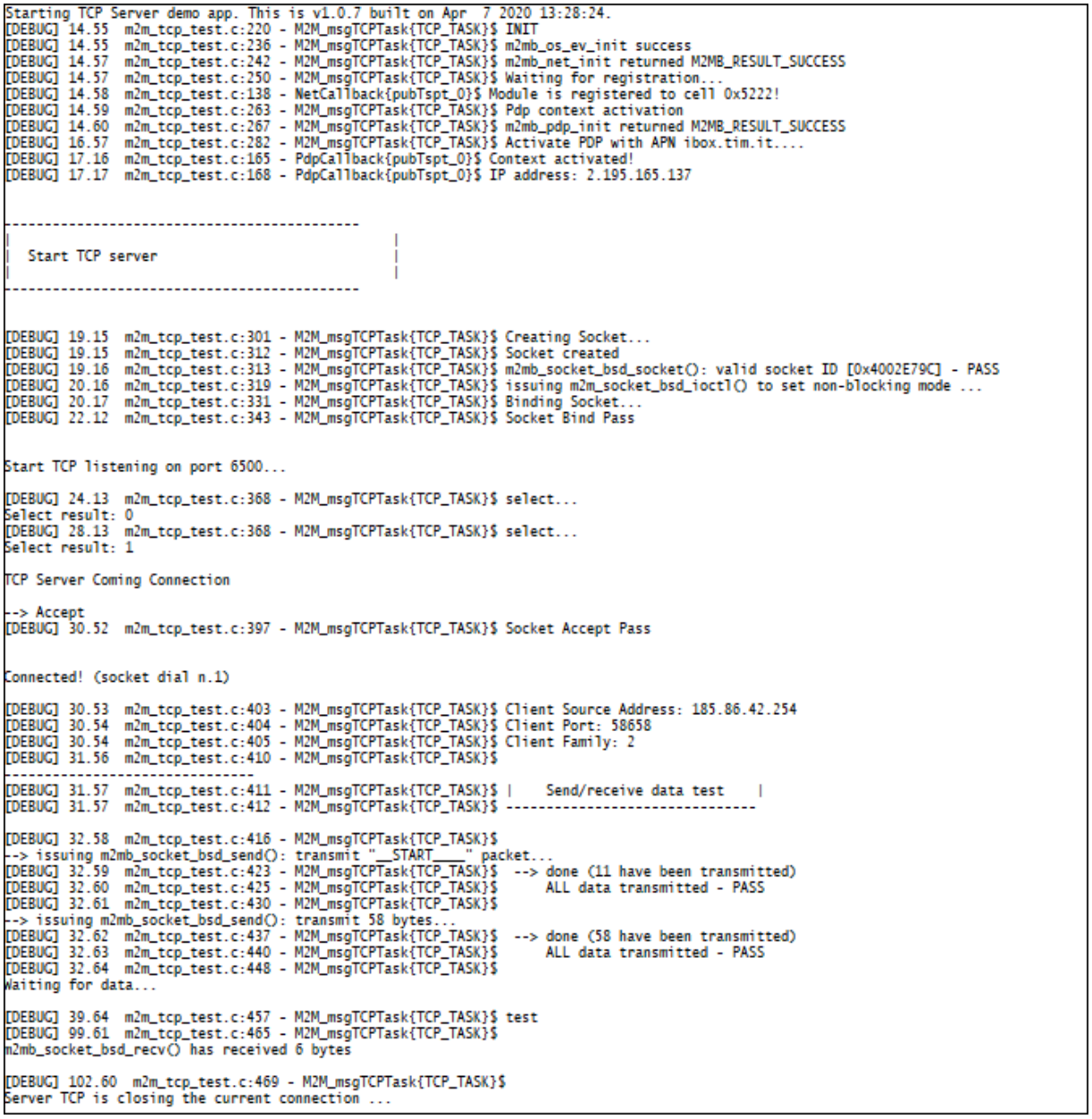

Figure 36

Data on a PuTTY terminal

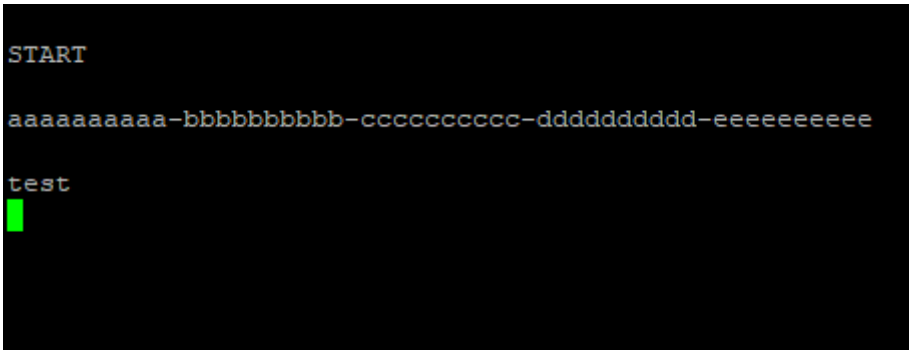
START
aaaaaaaaaa-bbbbbbbbbb-cccccccccc-dddddddddd-eeeeeeeeee
test

Figure 37

3.2.38 TLS SSL Client

Sample application showcasing TLS/SSL with client certificates usage with M2MB API. Debug prints on **MAIN UART**

Features

- How to check module registration and enable PDP context
- How to open a SSL client socket
- How to communicate over SSL socket

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Create a task to manage the connection and start it

`ssl_test.c`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Create socket and link it to the PDP context id
- Connect to the server over TCP socket
- Initialize the TLS parameters (TLS1.2) andh auth mode (server+client auth in the example)
- Create SSL context
- Read certificates files and store them
- Create secure socket and connect to the server using SSL
- Send data and receive response
- Close secure socket
- Close socket
- Delete SSL context
- Disable PDP context

The application requires the certificates to be stored in `/data/azc/mod/ssl_certs/` folder. It can be created with

```
AT#M2MMKDIR=/data/azc/mod/ssl_certs
```

Certificates can then be loaded with

```
AT#M2MWRITE="/data/azc/mod/ssl_certs/data/azc/modulesCA.crt",1740
```

and providing the file content in RAW mode (for example using the “Transfer Data” button in Telit AT Controller)

For client certificates (if required), the commands will be

```
AT#M2MWRITE="/data/azc/mod/ssl_certs/data/azc/modulesClient.crt",1651
AT#M2MWRITE="/data/azc/mod/ssl_certs/data/azc/modulesClient_pkcs1.key",1679
```

PLEASE NOTE: always verify the file sizes to be used in the commands above as they might change

```
Starting TLS-SSL demo app. This is v1.1.2 built on Mar  3 2021 10:15:00.
[DEBUG] 10.85  ssl_test:252 - msgHTTPSTask{TLS_TASK}$ INIT
[DEBUG] 10.85  ssl_test:266 - msgHTTPSTask{TLS_TASK}$ m2mb_os_ev_init success
[DEBUG] 10.85  ssl_test:270 - msgHTTPSTask{TLS_TASK}$ Init SSL session test app
[DEBUG] 10.85  ssl_test:285 - msgHTTPSTask{TLS_TASK}$ m2mb_ssl_create_config sslConfigHndl = 0x40037958, sslRes= 0
[DEBUG] 10.85  ssl_test:294 - msgHTTPSTask{TLS_TASK}$ m2mb_ssl_create_config PASSED
[DEBUG] 10.85  ssl_test:306 - msgHTTPSTask{TLS_TASK}$ m2mb_ssl_create_ctxt PASSED
[DEBUG] 10.85  ssl_test:311 - msgHTTPSTask{TLS_TASK}$ loading CA CERT from file /mod/ssl_certs/modulesCA.crt
[DEBUG] 10.85  ssl_test:315 - msgHTTPSTask{TLS_TASK}$ file size: 1740
[DEBUG] 10.85  ssl_test:328 - msgHTTPSTask{TLS_TASK}$ Reading content from file. Size: 1740
Buffer successfully received from file. 1740 bytes were loaded.
Closing file.
[DEBUG] 10.85  ssl_test:361 - msgHTTPSTask{TLS_TASK}$ loading client CERT from file /mod/ssl_certs/modulesClient.crt
[DEBUG] 10.85  ssl_test:365 - msgHTTPSTask{TLS_TASK}$ file size: 1651
[DEBUG] 10.85  ssl_test:378 - msgHTTPSTask{TLS_TASK}$ Reading content from file. Size: 1651
Buffer successfully received from file. 1651 bytes were loaded.
Closing file.
[DEBUG] 10.85  ssl_test:401 - msgHTTPSTask{TLS_TASK}$ loading client KEY from file /mod/ssl_certs/modulesClient_pkcs1.key
[DEBUG] 10.85  ssl_test:405 - msgHTTPSTask{TLS_TASK}$ file size: 1679
[DEBUG] 10.85  ssl_test:418 - msgHTTPSTask{TLS_TASK}$ Reading content from file. Size: 1679
Buffer successfully received from file. 1679 bytes were loaded.
Closing file.
[DEBUG] 10.85  ssl_test:448 - msgHTTPSTask{TLS_TASK}$ certificates successfully stored!
[DEBUG] 10.85  ssl_test:457 - msgHTTPSTask{TLS_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 10.85  ssl_test:465 - msgHTTPSTask{TLS_TASK}$ Waiting for registration...
[DEBUG] 10.86  ssl_test:171 - NetCallback{pubTspt_0}$ Module is registered to cell 0x468E!
[DEBUG] 10.86  ssl_test:477 - msgHTTPSTask{TLS_TASK}$ Pdp context activation
[DEBUG] 10.86  ssl_test:481 - msgHTTPSTask{TLS_TASK}$ m2mb_pdp_init returned M2MB_RESULT_SUCCESS
[DEBUG] 12.87  ssl_test:496 - msgHTTPSTask{TLS_TASK}$ Activate PDP with APN web.omnitel.it....
[DEBUG] 13.71  ssl_test:197 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 13.71  ssl_test:200 - PdpCallback{pubTspt_0}$ IP address: 2.41.76.63
[DEBUG] 13.71  ssl_test:514 - msgHTTPSTask{TLS_TASK}$ Creating Socket...
[DEBUG] 13.71  ssl_test:525 - msgHTTPSTask{TLS_TASK}$ Socket created
[DEBUG] 13.71  ssl_test:535 - msgHTTPSTask{TLS_TASK}$ Socket ctx set to 3
[DEBUG] 13.92  ssl_test:548 - msgHTTPSTask{TLS_TASK}$ Retrieved IP: 185.86.42.218
[DEBUG] 14.05  ssl_test:562 - msgHTTPSTask{TLS_TASK}$ Socket Connected!
[DEBUG] 15.97  ssl_test:587 - msgHTTPSTask{TLS_TASK}$ m2mb_ssl_connect ret 0
[DEBUG] 17.99  ssl_test:593 - msgHTTPSTask{TLS_TASK}$ Sending bytes..
```

```
[DEBUG] 17.99  ssl_test:593 - msgHTTPSTask{TLS_TASK}$ Sending bytes..
[DEBUG] 17.99  ssl_test:596 - msgHTTPSTask{TLS_TASK}$ SSL write result = 44
[DEBUG] 22.03  ssl_test:608 - msgHTTPSTask{TLS_TASK}$ pending bytes: 1087
[DEBUG] 22.03  ssl_test:612 - msgHTTPSTask{TLS_TASK}$ trying to receive 1087 bytes..
[DEBUG] 22.03  ssl_test:618 - msgHTTPSTask{TLS_TASK}$ Server response: (269)<HTTP/1.1 200 OK
Date: Wed, 03 Mar 2021 09:18:22 GMT
Server: Apache/2.2.15 (CentOS)
Last-Modified: Mon, 22 Jan 2018 10:57:39 GMT
ETag: "1fffc-27f-5635b4c6f12b3"
Accept-Ranges: bytes
Content-Length: 639
Connection: close
Content-Type: text/html; charset=UTF-8

>
[DEBUG] 22.03  ssl_test:634 - msgHTTPSTask{TLS_TASK}$ pending bytes: 762
[DEBUG] 22.03  ssl_test:638 - msgHTTPSTask{TLS_TASK}$ trying to receive remaining 762 bytes..
[DEBUG] 22.03  ssl_test:644 - msgHTTPSTask{TLS_TASK}$ Server response: (639)<<html>
<head>
 <title>module.telit.com</title>
 <meta content="text/html; charset=utf-8" />
</head>
<body>
 <table border=0 align=center>
 <tr>
 <td height="100" align=center><h2>modules.telit.com - Test HTML page</h2></td>
 </tr>
 <tr>
 <td align=center><img src=Telit.jpg alt="Telit logo" height="126" width="410"></img></td>
 </tr>
 <tr>
 <td height="200" align=center> This is a simple HTML page, </br>
 made with simple HTML code,</br>
 just for test!
 </td>
 </tr>
 <tr>
 <td height="100" align=center><font size="3">Telit &copy; 2015 - 2017 All rights reserved</font></td>
 </tr>
 </table>
</body>
</html>
>
[DEBUG] 22.03  ssl_test:662 - msgHTTPSTask{TLS_TASK}$ application exit
[DEBUG] 22.03  ssl_test:680 - msgHTTPSTask{TLS_TASK}$ m2mb_pdp_deactivate returned success
[DEBUG] 22.03  ssl_test:683 - msgHTTPSTask{TLS_TASK}$ Application complete.
[DEBUG] 22.77  ssl_test:206 - PdpCallback{pubTspt_0}$ Context deactivated!
```

3.2.39 Uart To Server

Sample application showcasing how to send data from main UART to a connected TCP server. Debug messages are printed on AUX UART port.

Features

- How to open main UART to receive data
- How to connect to a server
- How to transmit received data from the UART to the server and viceversa

Application workflow

`M2MB_main.c`

- Open UART for data and USB1 for debug
- Init socket, activate PDP context and connect to server
- Init UART, set its callback function, create tasks to handle input from UART and response from server (optional)
- Send a confirmation on UART
- Wait for data, when it is received, send it to the server
- When a response is received, print it on UART.

Main UART:

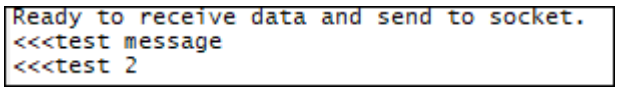

Figure 38

Debug log on USB1:

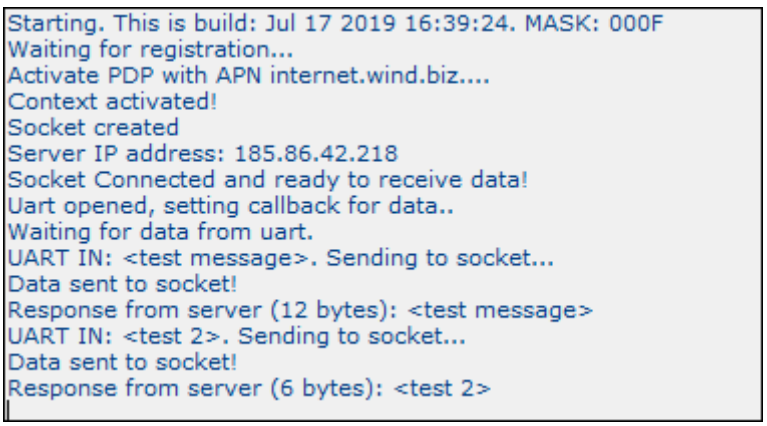

Figure 39

3.2.40 UDP client

Sample application showcasing UDP echo demo with M2MB API. Debug prints on **MAIN UART**

Features

- How to check module registration and activate PDP context
- How to open a UDP client socket
- How to communicate over the socket

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task and start it

`m2m_udp_test.c` - Initialize Network structure and check registration - Initialize PDP structure and start PDP context - Create socket and link it to the PDP context id - Send data and receive response - Close socket - Disable PDP context

```
Starting UDP client demo app. This is v1.0.7 built on Apr  1 2020 14:57:13.
INIT
[DEBUG] 21.23  m2m_udp_test.c:223 - M2M_msgUDPTask{UDP_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
Waiting for registration...
[DEBUG] 21.25  m2m_udp_test.c:131 - NetCallback{pubTspt_0}$ Module is registered to cell 0xC4CF!
[DEBUG] 21.26  m2m_udp_test.c:241 - M2M_msgUDPTask{UDP_TASK}$ Pdp context initialization
[DEBUG] 21.26  m2m_udp_test.c:245 - M2M_msgUDPTask{UDP_TASK}$ m2mb_pdp_init returned M2MB_RESULT_SUCCESS
Activate PDP with APN web.omnitel.it....
[DEBUG] 24.11  m2m_udp_test.c:157 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 24.11  m2m_udp_test.c:160 - PdpCallback{pubTspt_0}$ IP address: 109.113.222.12
[DEBUG] 24.12  m2m_udp_test.c:268 - M2M_msgUDPTask{UDP_TASK}$ Creating Socket...
[DEBUG] 24.13  m2m_udp_test.c:280 - M2M_msgUDPTask{UDP_TASK}$ Socket created
Socket ctx set to 3
[DEBUG] 24.41  m2m_udp_test.c:306 - M2M_msgUDPTask{UDP_TASK}$ Retrieved IP: 185.86.42.218
Socket ready.
Data successfully sent (16 bytes)
Socket recv...
[DEBUG] 26.47  m2m_udp_test.c:352 - M2M_msgUDPTask{UDP_TASK}$ m2mb_socket_bsd_set_sock_opt() M2MB_SOCKET_BSD_SO_RCVTIMEO - success
trying to receive 16 bytes..
Data received (16): <hello from m2mb!>
[DEBUG] 26.48  m2m_udp_test.c:377 - M2M_msgUDPTask{UDP_TASK}$ application exit
Socket Closed
[DEBUG] 26.49  m2m_udp_test.c:399 - M2M_msgUDPTask{UDP_TASK}$ m2mb_pdp_deactivate returned success
Application complete.
[DEBUG] 27.04  m2m_udp_test.c:166 - PdpCallback{pubTspt_0}$ Context successfully deactivated!
```

Figure 40

3.2.41 USB Cable Check

Sample application showing how to check if USB cable is plugged in or not. Debug prints on **MAIN UART**

Features

- How to open an USB channel and configure it with a callback function
- How to manage USB cable events in the callback function

Application workflow

`M2MB_main.c`

- Open UART/UART_AUX for debug
- open usb channel and set the callback
- Print greeting message
- Print current usb status

`USB_Cb`

- if the event is a connection/disconnection, show the current status

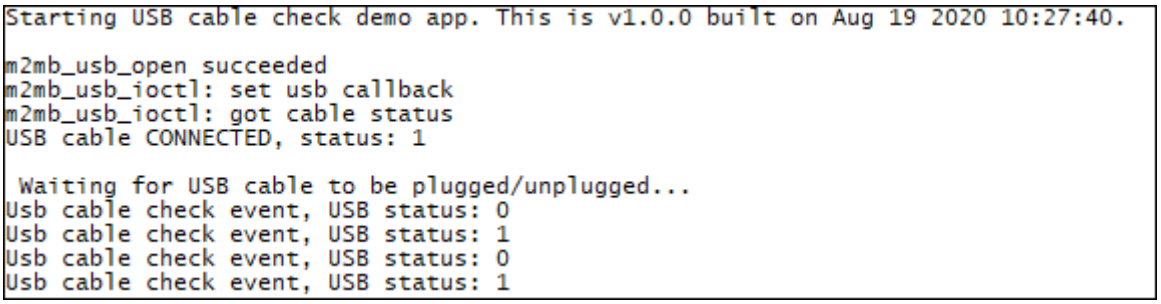

Figure 41

3.2.42 Basic USB read/write example

Sample application that shows how to use the basic read/write USB apis. Synchronous or asynchronous mode is available setting SYNC to 1 or 0. Debug prints on **MAIN UART**

Features

- Read and write on USB (synchoronous mode)
- Read and write on USB (asynchronous mode)

Application workflow

`M2MB_main.c`

- Open USB port (USB0)
- Set rx and tx timeouts
- **SYNC**
- read until some data are availableon USB
- as soon as some data are available on USB read them and write on USB data received
- **ASYNC**
- set the USB callback
- write some data on USB and wait for data to be read
- as soon as some data are available on USB M2MB_USB_RX_EVENT is generated and handled by callback. Data are read and printed on serial com port.

```
Starting USB read write demo app. This is v1.0.0 built on Nov  4 2021 15:38:20.


Open USB port
m2mb_usb_open succeeded
m2mb_usb_ioctl: got cable status
USB cable CONNECTED, status: 1
Synchronous read and write
Read until some bytes are received...
rx timeout expired
```

Figure 42

3.2.43 ZLIB example

Sample application showing how to compress/uncompress with ZLIB. Debug prints on **MAIN UART**

Features

- How to compress a file
- How to uncompress a file

In order to execute the entire test, copy `test.gz` file into your module running the following AT command:

```
AT#M2MWRITE="/data/azc/mod/test.gz",138
>>> here receive the prompt; then type or send the file, sized 138 bytes
```

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Test the compression and decompression of a data string
- Test the decompression of a .gz file (test.gz), expected to be in `/data/azc/mod` folder, into its content `test.txt`. The file must be uploaded by the user (see steps above).

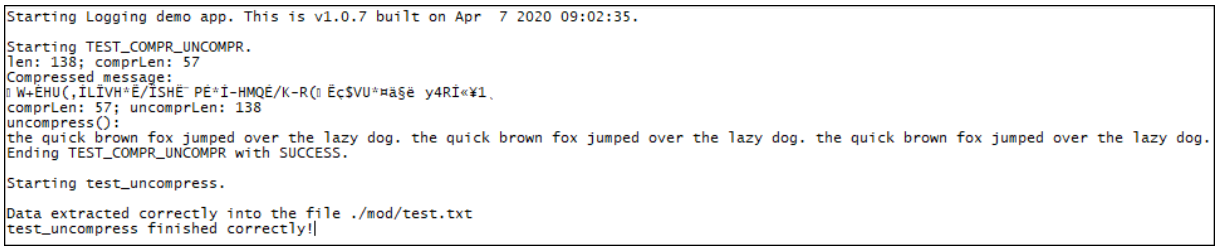

Figure 43

3.3 BASIC

Basic applications showing simple operations with minimum code overhead

3.3.1 Basic Hello World (Main UART)

The application prints “Hello World!” on Main UART every 2 seconds using

Features

- How to open Main UART as an output channel
- How to print messages out of the channel

Application workflow

`M2MB_main.c`

- Open Main UART with **`m2mb_uart_open`** function
- write a welcome message using **`m2mb_uart_write`**
- write “Hello World!” every 2 seconds in a while loop, using **`m2mb_uart_write`**

```
Start Hello world Application  [ version: 2.000000 ]

Hello world 2.0 [ 000001 ]
Hello world 2.0 [ 000002 ]
Hello world 2.0 [ 000003 ]
Hello world 2.0 [ 000004 ]
Hello world 2.0 [ 000005 ]
Hello world 2.0 [ 000006 ]
Hello world 2.0 [ 000007 ]
Hello world 2.0 [ 000008 ]
Hello world 2.0 [ 000009 ]
```

Figure 44

3.3.2 Basic Hello World (USB0)

The application prints “Hello World!” on USB 0 every 2 seconds using

Features

- How to open USB 0 as an output channel
- How to print messages out of the channel

Application workflow

M2MB_main.c

- Open USB 0 with **m2mb_usb_open** function
- write a welcome message using **m2mb_usb_write**
- write “Hello World!” every 2 seconds in a while loop, using **m2mb_usb_write**

```
Start Hello world Application  [ version: 2.000000 ]

Hello world 2.0 [ 000001 ]
Hello world 2.0 [ 000002 ]
Hello world 2.0 [ 000003 ]
Hello world 2.0 [ 000004 ]
Hello world 2.0 [ 000005 ]
Hello world 2.0 [ 000006 ]
Hello world 2.0 [ 000007 ]
Hello world 2.0 [ 000008 ]
Hello world 2.0 [ 000009 ]
```

Figure 45

3.3.3 Basic Task

The application shows how to create and manage tasks with m2mb APIs. Debug prints on MAIN UART (can be changed in M2MB_Main function)

Features

- How to create a new task using m2mb APIs
- How to start the task and send messages to it
- how to destroy the task

Application workflow

`M2MB_main.c`

- Open UART
- Print welcome message
- Configure and create message queue for task
- Configure and create task
- Send 2 messages to the task queue

`task_entry_function`

- Receive messages from the task queue in a loop
- Print the message data when one arrives

```
Starting Basic Task demo app. This is v1.0.8 built on Apr 16 2020 06:40:40.
Successfully created a queue area buffer of 720 bytes.
Queue successfully created.
Creating the task...
Task created and ready to receive messages!
[DEBUG] 16.88  M2MB_main:411 - M2MB_main{M2M_DamsStart}$ Sending a message to the task...
[DEBUG] 16.88  M2MB_main:125 - task_entry_function{mytask}$ Received a message with a 5 bytes payload: <hello>
[DEBUG] 18.90  M2MB_main:420 - M2MB_main{M2M_DamsStart}$ Sending a second message to the task...
[DEBUG] 18.90  M2MB_main:430 - M2MB_main{M2M_DamsStart}$ Result code at the end: 0
[DEBUG] 18.91  M2MB_main:125 - task_entry_function{mytask}$ Received a message with a 5 bytes payload: <world>
Clearing resources...
Done. App complete
```

Figure 46

3.3.4 UART USB tunnel example

Sample application that opens a tunnel between main UART and USB0 port.

Features

- Opens Main UART port with a callback function
- Opens USB0 port with a callback function
- Creates a simple task to manage data exchange between ports

Application workflow

M2MB_main function

- Create Main UART handle and configure its parameters
- Create USB0 handle and configure its parameters
- Create the data management task
- Write **READY** on both ports when the tunneling is ready

USB_Cb

- When data are received on the USB0 port, retrieve the available amount and send the value to the data management task with the proper command

UART_Cb

- When data are received on the Main UART port, retrieve the available amount and send the value to the data management task with the proper command

dataTask_Cb

- if command is TASK_UART_READ_AND_USB_WRITE, read the requested amount from the Main UART port and write it on USB0
- if command is TASK_USB_READ_AND_UART_WRITE, read the requested amount from the USB0 port and write it on Main UART

UART output received from USB0 (in RED, the user input data from UART)

```
READYHello from UART
Hello from USB0
```

USB0 output received from UART (in RED, the user input data from USB0)

```
READYHello from UART
Hello from USB0
```

3.4 USB0

Applications that provide usage examples for various functionalities, log output on USB0

3.4.1 ATI (AT Instance)

Sample application showing how to use AT Instance functionality (sending AT commands from code). The example supports both sync and async (using a callback) modes. Debug prints on **USB0**

Features

- How to open an AT interface from the application
- How to send AT commands and receive responses on the AT interface

Application workflow, sync mode

M2MB_main.c

- Open USB/UART/UART_AUX
- Init AT0 (first AT instance)
- Send AT+CGMR command
- Print response.
- Release AT0

at_sync.c

- Init ati functionality and take AT0
- Send AT+CGMR command, then read response after 2 seconds, then return it
- Deinit ati, releasing AT0

```
Starting AT demo app. This is v1.0.7 built on Apr  1 2020 15:12:58.
[DEBUG] 17.15  at_sync.c:53 - at_cmd_sync_init{M2M_DamsStart}$ m2mb_ati_init() on instance 0
Sending command AT+CGMR in sync mode
[DEBUG] 17.16  at_sync.c:79 - send_sync_at_command{M2M_DamsStart}$ Sending AT Command: AT+CGMR
Command response: <AT+CGMR
M0B.950004-B008

OK
>

[DEBUG] 19.21  at_sync.c:61 - at_cmd_sync_deinit{M2M_DamsStart}$ m2mb_ati_deinit() on instance 0
Application end
```

Figure 47

Application workflow, async mode

M2MB_main.c

- Open USB/UART/UART_AUX
- Init AT0 (first AT instance)
- Send AT+CGMR command
- Print response.
- Release AT0

at_async.c

- Init ati functionality and take AT0, register AT events callback
- Send AT+CGMR command, wait for response semaphore (released in callback), then read it and return it
- Deinit ati, releasing AT0

```
Starting AT demo app. This is v1.0.7 built on Apr  1 2020 15:07:45.
[DEBUG] 17.13  at_async.c:116 - at_cmd_async_init{M2M_DamsStart}$ m2mb_ati_init() on instance 0
Sending command AT+CGMR in async mode
[DEBUG] 17.15  at_async.c:153 - send_async_at_command{M2M_DamsStart}$ Sending AT Command: AT+CGMR
[DEBUG] 17.15  at_async.c:169 - send_async_at_command{M2M_DamsStart}$ waiting command response...
[DEBUG] 17.17  at_async.c:88 - at_cmd_async_callback{pubTspt_0}$ Callback - available bytes: 25
[DEBUG] 17.18  at_async.c:181 - send_async_at_command{M2M_DamsStart}$ Receive response...
Command response: <AT+CGMR
M0B.950004-B008

OK
>

[DEBUG] 17.19  at_async.c:136 - at_cmd_async_deinit{M2M_DamsStart}$ m2mb_ati_deinit() on instance 0
Application end
```

Figure 48

3.4.2 AWS demo

Sample application showcasing AWS Iot Core MQTT communication. Debug prints on **USB0**

Features

- How to check module registration and enable PDP context
- How to load certificates into device SSL session storage
- How to configure MQTT client parameters
- How to connect to AWS server with SSL and exchange data over a topic

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage MQTT client and start it

`aws_demo.c`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Init MQTT client
- Configure it with all parameters (Client ID, PDP context ID, keepalive timeout…)
- Initialize the TLS parameters (TLS1.2) andh auth mode (server+client auth in the example)
- Create SSL context
- Read certificates files and store them
- Connect MQTT client to broker
- Subscribe to topic
- Publish 10 messages with increasing counter
- Print received message in mqtt_topc_cb function
- Disconnect MQTT client and deinit it
- Disable PDP context

3.4.3 How to get started with AWS IoT

- Go to AWS console and create an account if one is not available yet.
- Go to **IoT Core** section
- Go to **Secure** > **Policies** section
- Create a new policy, which describes what the device will be allowed to do (e.g. subscribe, publish)
- Give it a name, then configure it using the configuration below (it is possible to copy/paste by clicking on **Add statements** section, then **Advanced mode**) :

```
{
  "Version": "2012-10-17",
  "Statement": [
  {
"Action": [
  "iot:Publish",
  "iot:Subscribe",
  "iot:Connect",
  "iot:Receive"
],
"Effect": "Allow",
"Resource": [
  "*"
]
  }
  ]
}
```

- Click on create to complete the policy creation.
- Go to **Manage** section
- Press **Create**, then **Create a single thing**
- Give the new thing a name, then click on Next
- Select **One-click certificate creation (recommended)** by clicking on **Create certificate**
- Once presented with the **Certificate created** page, download all certificates and keys
- Click on the **Activate** button to enable the certificate authentication of the newly created device
- Click on **Attach a policy** and select the policy created in a previous step

For further information, please refer to the full AWS IoT documentation

3.4.4 Application setup

- Set **CLIENTCERTFILE** and **CLIENTKEYFILE** defines in **aws_demo.c file** in order to match the certificate and key created in the previous section.
- Set **AWS_BROKER_ADDRESS** to the correct AWS URL. It can be retrieved from AWS IoT **Manage** > **Things** > **Interact** in the HTTPS **Rest API Endpoint** URL.
- Set **CLIENT_ID** to the desired Client ID for your AWS device
- (Optional) if required, change **CACERTFILE** to match the one to be used.

3.4.5 Device setup

The application requires the certificates (provided in sample app **certs** subfolder) to be stored in **/data/azc/mod/ssl_certs/** folder. It can be created with

```
AT#M2MMKDIR=/data/azc/mod/ssl_certs
```

Certificates can then be loaded with

```
AT#M2MWRITE="/data/azc/mod/ssl_certs/preload_CACert_01.crt",1468
AT#M2MWRITE="/data/azc/mod/ssl_certs/Amazon-IoT.crt",1646
```

providing the file content in RAW mode (for example using the “Transfer Data” button in Telit AT Controller)

For client certificates, the commands will be

```
AT#M2MWRITE="/data/azc/mod/ssl_certs/xxxxx.crt",yyyy
AT#M2MWRITE="/data/azc/mod/ssl_certs/xxxxx.key",zzzz
```

PLEASE NOTE: always verify the file sizes to be used in the commands above as they might change

```
Starting AWS IoT Core MQTT demo app. This is v1.1.5 built on Apr 30 2021 09:05:17.
[DEBUG] 15.51  aws_demo:607 - AWS_Task{MQTT_TASK}$ Init MQTT client for AWS
[DEBUG] 15.52  aws_demo:265 - PrepareSSLEnvironment{MQTT_TASK}$ m2mb_ssl_config SNI succeeded
[DEBUG] 15.52  aws_demo:271 - PrepareSSLEnvironment{MQTT_TASK}$ Root CA cert file /mod/ssl_certs/preload_CACert_01.crt
[DEBUG] 15.52  aws_demo:297 - PrepareSSLEnvironment{MQTT_TASK}$ Buffer successfully received from file. 1468 bytes were loaded.
[DEBUG] 15.52  aws_demo:308 - PrepareSSLEnvironment{MQTT_TASK}$ Cross Signed CA cert file /mod/ssl_certs/Amazon-IoT.crt
[DEBUG] 15.52  aws_demo:334 - PrepareSSLEnvironment{MQTT_TASK}$ Buffer successfully received from file. 1646 bytes were loaded.
[DEBUG] 15.52  aws_demo:360 - PrepareSSLEnvironment{MQTT_TASK}$ Client certificate file /mod/ssl_certs/ab71          -certificate.pem.crt
[DEBUG] 15.52  aws_demo:384 - PrepareSSLEnvironment{MQTT_TASK}$ Buffer successfully received from file. 1224 bytes were loaded.
[DEBUG] 15.52  aws_demo:396 - PrepareSSLEnvironment{MQTT_TASK}$ Client Key file /mod/ssl_certs/ab71          -private.pem.key
[DEBUG] 15.52  aws_demo:422 - PrepareSSLEnvironment{MQTT_TASK}$ Buffer successfully received from file. 1679 bytes were loaded.

SSL environment preparation completed
[DEBUG] 15.52  aws_demo:726 - AWS_Task{MQTT_TASK}$ Waiting for registration...
[DEBUG] 15.52  aws_demo:514 - NetCallback{pubTspt_0}$ Module is registered
[DEBUG] 15.52  aws_demo:738 - AWS_Task{MQTT_TASK}$ PDP context initialization
[DEBUG] 17.55  aws_demo:753 - AWS_Task{MQTT_TASK}$ Activate PDP with APN web.omnitel.it on CID 1....
[DEBUG] 18.37  aws_demo:557 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 18.37  aws_demo:561 - PdpCallback{pubTspt_0}$ IP address: 109.114.102.21

Connecting to Server <angy83rl5oizs-ats.iot.eu-west-2.amazonaws.com>:8883...
Done.
[DEBUG] 27.87  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 2, "data": {"RSSI": -72, "tm":"2021-04-30,09:05:50"} }> to topic
device/35308109          /updates
[DEBUG] 27.87  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 30.94  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 3, "data": {"RSSI": -72, "tm":"2021-04-30,09:05:53"} }> to topic
device/353081090         /updates
[DEBUG] 30.94  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 33.99  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 4, "data": {"RSSI": -72, "tm":"2021-04-30,09:05:56"} }> to topic
device/35308109          /updates
[DEBUG] 34.00  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 37.00  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 5, "data": {"RSSI": -72, "tm":"2021-04-30,09:05:59"} }> to topic
device/35308109          /updates
[DEBUG] 37.00  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 40.03  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 6, "data": {"RSSI": -72, "tm":"2021-04-30,09:06:02"} }> to topic
device/35308109          /updates
[DEBUG] 40.03  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 43.05  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 7, "data": {"RSSI": -72, "tm":"2021-04-30,09:06:05"} }> to topic
device/353081            /updates
[DEBUG] 43.05  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 46.13  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 8, "data": {"RSSI": -72, "tm":"2021-04-30,09:06:08"} }> to topic
device/3530810           /updates
[DEBUG] 46.13  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 49.15  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 9, "data": {"RSSI": -72, "tm":"2021-04-30,09:06:11"} }> to topic
device/3530810           /updates
[DEBUG] 49.15  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 52.19  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 10, "data": {"RSSI": -72, "tm":"2021-04-30,09:06:14"} }> to topic
device/3530810           /updates
[DEBUG] 52.19  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 55.22  aws_demo:852 - AWS_Task{MQTT_TASK}$ PUBLISHING <{ "ID": 11, "data": {"RSSI": -72, "tm":"2021-04-30,09:06:17"} }> to topic
device/3530810           /updates
[DEBUG] 55.22  aws_demo:857 - AWS_Task{MQTT_TASK}$ Done.

Disconnecting from MQTT broker..
[DEBUG] 58.27  aws_demo:878 - AWS_Task{MQTT_TASK}$ Done.
[DEBUG] 58.27  aws_demo:908 - AWS_Task{MQTT_TASK}$ application exit
[DEBUG] 58.27  aws_demo:918 - AWS_Task{MQTT_TASK}$ m2mb_pdp_deactivate returned success
[DEBUG] 58.27  aws_demo:924 - AWS_Task{MQTT_TASK}$ Application complete.
```

Figure 49

Data received from a subscriber:

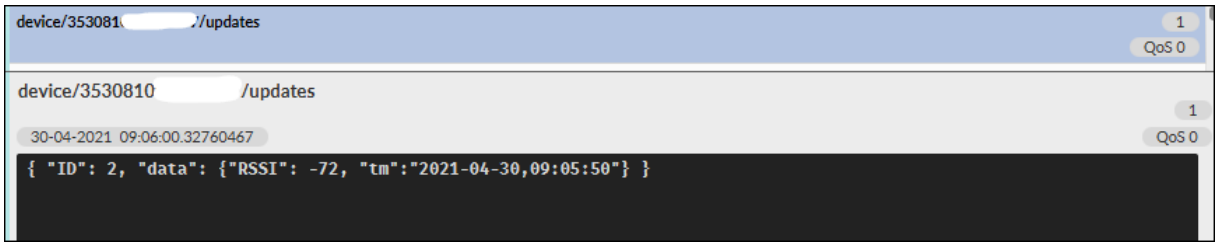

Figure 50

3.4.6 App Manager

Sample application showing how to manage AppZone apps from m2mb code. Debug prints on **USB0**

Features

- How to get how many configured apps are available
- How to get the handle to manage the running app (change start delay, enable/disable)
- How to create the handle for a new binary app, enable it and set its parameters
- How to start the new app without rebooting the device, then stop it after a while.

3.4.6.1 Prerequisites

This app will try to manage another app called “second.bin”, which already exists in the module filesystem and can be anything (e.g. another sample app as GPIO toggle). the app must be built using the flag ROM_START=

in the Makefile to set a different starting address than the main app (by default, 0x40000000). For example, 0x41000000.

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- get a non existing app handle and verify it is NULL
- get the current app handle, then get the start delay **set in the INI file (so persistent)**
- change the current app delay value **in the INI file**
- verify that the change has been stored
- get current app state
- create an handle for a second application binary.
- add it to the INI file
- set its execution flag to 0
- get the delay time and the state from INI file for the new app
- get the current set address for the new app
- set the app delay **in RAM, INI will not be affected**.
- start the new app without reboot, using the right set delay
- wait some time, then get the app state and the used RAM amount
- wait 10 seconds, then stop the second app.
- set its execution flag to 1 so it will run at next boot.

```
Starting App Manager demo app. This is v1.0.14-C1 built on Sep 24 2020 12:33:25.
There are 2 configured apps.
Not existing app handle test (should be 0): 0x0
Manager app handle: 0x809e20e0
Manager app delay from nv memory: 5 seconds

Changing Manager app delay time (on non volatile configuration) to 5 seconds..
Manager app delay from nv memory is now 5 seconds
Manager app state is M2MB_APPMNG_STATE_RUN

Trying to get Second app handle...
Second app handle is valid
2nd app delay from nv memory is 1
2nd app current state is M2MB_APPMNG_STATE_READY
Second app current address is 0x41000000
Setting volatile Second app delay (not stored in nvm) to 0 seconds...
Starting Second app on the fly (without reboot)...
Waiting 2 seconds...
2nd app current state is M2MB_APPMNG_STATE_RUN
Second app is running!
Second App is using 475136 bytes of RAM
Stopping Second app now...
wait 10 seconds...
2nd app current state is M2MB_APPMNG_STATE_STOP
Set permanent run permission for Second app.
Done. Second App will also run from next boot-up
```

Figure 51

3.4.7 App update OTA via FTP

Sample application showcasing Application OTA over FTP with AZX FTP. Debug prints on **USB0**

Features

- How to check module registration and activate PDP context
- How to connect to a FTP server
- How to download an application binary and update the local version

The app uses a predefined set of parameters. To load custom parameters, upload the `ota_config.txt` file (provided in project's `/src` folder) in module's `/data/azc/mod` folder, for example with

```
AT#M2MWRITE="/data/azc/mod/ota_config.txt",<filesize>
```

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage app OTA and start it

`ftp_utils.c`

- Set parameters to default
- Try to load parameters from `ota_config.txt` file
- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Initialize FTP client
- Connect to FTP server and log in
- Get new App binary file size on remote server
- Download the file in `/data/azc/mod` folder, with the provided name
- Close FTP connection
- Disable PDP context
- Update applications configuration in **app_utils.c**

`app_utils.c`

- Set new application as default

- Delete old app binary
- Restart module

```
Starting FTP APP OTA demo app. This is v1.0.7 built on Apr  7 2020 17:04:05.
[DEBUG] 21.23  ftp_utils.c:447 - msgFTPTask{FTPOTA_TASK}$ INIT
[DEBUG] 21.25  ftp_utils.c:152 - readConfigFromFile{FTPOTA_TASK}$ Reading parameters from file
[DEBUG] 21.26  ftp_utils.c:154 - readConfigFromFile{FTPOTA_TASK}$ Opening /mod/ota_config.txt in read mode..
Set APN to: <<web.omnitel.it>>
Set FTP URL to: <<ftp.telit.com>>
Set FTP PORT to: 21
Set FTP USER to: <<[illegible]>>
Set FTP PASS to: <<[illegible]>>
Set FTP FILE URI to: <</samples/APP_OTA/helloworld.bin>>
Set LOCAL FINAL APP NAME to: <<helloworld.bin>>
Set LOCAL ORIGINAL APP NAME to: <<m2mapz.bin>>
[DEBUG] 23.53  ftp_utils.c:464 - msgFTPTask{FTPOTA_TASK}$ m2mb_os_ev_init success
[DEBUG] 23.54  ftp_utils.c:470 - msgFTPTask{FTPOTA_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 23.55  ftp_utils.c:478 - msgFTPTask{FTPOTA_TASK}$ Waiting for registration...
[DEBUG] 23.56  ftp_utils.c:371 - NetCallback{pubTspt_0}$ Module is registered to network
[DEBUG] 23.56  ftp_utils.c:491 - msgFTPTask{FTPOTA_TASK}$ Pdp context activation
[DEBUG] 23.57  ftp_utils.c:495 - msgFTPTask{FTPOTA_TASK}$ m2mb_pdp_init returned M2MB_RESULT_SUCCESS
[DEBUG] 25.61  ftp_utils.c:504 - msgFTPTask{FTPOTA_TASK}$ Activate PDP with APN web.omnitel.it on cid 3....
[DEBUG] 26.30  ftp_utils.c:398 - PdpCallback{pubTspt_0}$ Context active
[DEBUG] 26.30  ftp_utils.c:401 - PdpCallback{pubTspt_0}$ IP address: 176.246.110.148
Start ftp client...
[DEBUG] 27.36  ftp_utils.c:533 - msgFTPTask{FTPOTA_TASK}$ Connected.
[DEBUG] 28.87  ftp_utils.c:546 - msgFTPTask{FTPOTA_TASK}$ FTP login successful.
Get remote file /samples/APP_OTA/helloworld.bin size
[DEBUG] 29.31  ftp_utils.c:568 - msgFTPTask{FTPOTA_TASK}$ Done. File size: 116224.
Starting download of remote file /samples/APP_OTA/helloworld.bin into local /mod/helloworld.bin
/samples/APP_OTA/helloworld.bin  4.68% 5440
/samples/APP_OTA/helloworld.bin  9.36% 10880
/samples/APP_OTA/helloworld.bin 14.04% 16320
/samples/APP_OTA/helloworld.bin 18.72% 21760
/samples/APP_OTA/helloworld.bin 23.40% 27200
/samples/APP_OTA/helloworld.bin 28.08% 32640
/samples/APP_OTA/helloworld.bin 32.76% 38080
/samples/APP_OTA/helloworld.bin 37.44% 43520
/samples/APP_OTA/helloworld.bin 42.13% 48960
/samples/APP_OTA/helloworld.bin 46.81% 54400
/samples/APP_OTA/helloworld.bin 51.49% 59840
/samples/APP_OTA/helloworld.bin 56.17% 65280
/samples/APP_OTA/helloworld.bin 60.85% 70720
/samples/APP_OTA/helloworld.bin 65.53% 76160
/samples/APP_OTA/helloworld.bin 70.21% 81600
/samples/APP_OTA/helloworld.bin 74.89% 87040
/samples/APP_OTA/helloworld.bin 79.57% 92480
/samples/APP_OTA/helloworld.bin 84.25% 97920
/samples/APP_OTA/helloworld.bin 88.93% 103360
/samples/APP_OTA/helloworld.bin 93.61% 108800
/samples/APP_OTA/helloworld.bin 97.42% 113220
[DEBUG] 43.54  ftp_utils.c:608 - msgFTPTask{FTPOTA_TASK}$ download successful.
FTP quit...
[DEBUG] 43.77  ftp_utils.c:632 - msgFTPTask{FTPOTA_TASK}$ Deactivating PDP
[DEBUG] 43.77  ftp_utils.c:642 - msgFTPTask{FTPOTA_TASK}$ m2mb_pdp_deactivate returned success
[DEBUG] 44.20  ftp_utils.c:407 - PdpCallback{pubTspt_0}$ Context deactive
[DEBUG] 45.44  app_utils.c:76 - update_app{FTPOTA_TASK}$ Application successfully configured.
[DEBUG] 45.45  app_utils.c:82 - update_app{FTPOTA_TASK}$ Deleting old application /mod/m2mapz.bin
€ÿStarting. This is v1.0.7 built on Apr  7 2020 17:02:52. LEVEL: 2

 Start Hello world Application  [ version: 2.000000 ]

 Hello world 2.0 [ 000001 ]
 Hello world 2.0 [ 000002 ]
 Hello world 2.0 [ 000003 ]
```

Figure 52

3.4.8 CJSON example:

Sample application showcasing how to manage JSON objects. Debug prints on **USB0**

Features

- How to read a JSON using cJSON library
- How to write a JSON
- How to manipulate JSON objects

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Parse an example string into a JSON object and print the result in a formatted string
- Print some test outcomes (e.g. non existing item correctly not found)
- Retrieve single elements from the parsed JSON object and use them to format a descriptive string
- Delete the JSON object
- Create a new JSON object appending elements to it
- Print the result JSON string from the object

```
Starting Logging demo app. This is v1.0.7 built on Apr  7 2020 08:33:03.
And here is what we got:
{
	"name":	"Atlantic Ocean",
	"format":	{
		"type":	"salt",
		"volume":	310410900,
		"depth":	-8486,
		"volume_percent":	23.300000,
		"tide":	-3.500000,
		"calm":	false,
		"life":	["plankton", "corals", "fish", "mammals"]
	}
}
inexistent key not found
name found: Atlantic Ocean
format found (null)
Our JSON string contains info about an ocean named Atlantic Ocean,
has a volume of 310410900 km^3 of salt water with -8486 meters max depth,
represents 23.3% of total oceans volume,
has an average low tide of -3.5 meters,
hosts a huge number of living creatures such as plankton, corals, fish, mammals,
and is not always calm.

Let's build a TR50 command with a proprety.publish and an alarm.publish for MQTT (no auth).
And here is what we got:
{
	"1":	{
		"command":	"property.publish",
		"params":	{
			"thingKey":	"mything",
			"key": "mykey",
			"value":	123.144000
		}
	},
	"2":	{
		"command":	"alarm.publish",
		"params":	{
			"thingKey":	"mything",
			"key": "mykey",
			"state":	3,
			"msg": "Message."
		}
	}
}
END.
```

Figure 53

3.4.9 Easy AT example

Sample application showcasing Easy AT functionalities. Debug prints on **USB0**

Features

- Shows how to register custom commands

3.4.10 Events

Sample application showcasing events setup and usage. Debug prints on **USB0**

Features

- How to setup OS events with a custom bitmask
- How to wait for events and generate them in callback functions to synchronize blocks of code

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Create an event handler
- Create a timer to generate an event, with a 2 seconds expiration time
- Wait for a specific event bit on the event handler
- At timer expiration, set the same event bit and verify that the code flow went through after the event.

```
Starting Events demo app. This is v1.0.7 built on Apr  7 2020 08:44:29.
[DEBUG] 20.55  M2MB_main.c:171 - M2MB_main{M2M_DamsStart}$ m2mb_os_ev_init success
Set the timer attributes structure success.
Timer successfully created
[DEBUG] 20.57  M2MB_main.c:125 - setup_timer{M2M_DamsStart}$ Start the timer, success.
[DEBUG] 22.60  M2MB_main.c:60 - hwTimerCb{pubTspt_0}$ Timer Callback, generate event!
[DEBUG] 22.61  M2MB_main.c:183 - M2MB_main{M2M_DamsStart}$ event occurred!
```

Figure 54

3.4.11 Events - Barrier (multi events)

Sample application showcasing how to setup and use multiple events to create a barrier. Debug prints on **USB0**

Features

- How to setup OS events to be used as a barrier
- How to wait for multiple events in the same point, and generate them in call-back functions to synchronize blocks of code

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Create an event handler
- Create a timer to generate an event, with a 3 seconds expiration time
- Create another timer to generate an event, with a 6 seconds expiration time
- Start both timers
- Wait for both event bits on the event handler (each one will be set by one of the timers)
- At first timer expiration, set the first event bit and verify that the code flow does not procede.
- At second timer expiration, set the second event bit and verify that the code flow went through after the event (implementing a barrier).

```
Starting Barrier demo app. This is v1.0.7 built on Apr  7 2020 08:48:30.
[DEBUG] 20.01  M2MB_main.c:179 - M2MB_main{M2M_DamsStart}$ m2mb_os_ev_init success
Set the timer attributes structure success.
Timer successfully created with 3000 timeout (ms)
Set the timer attributes structure success.
Timer successfully created with 6000 timeout (ms)
[DEBUG] 23.08  M2MB_main.c:66 - hwTimerCb1{pubTspt_0}$ Timer Callback, generate event 1!
[DEBUG] 26.12  M2MB_main.c:75 - hwTimerCb2{pubTspt_0}$ Timer Callback, generate event 2!
[DEBUG] 26.13  M2MB_main.c:214 - M2MB_main{M2M_DamsStart}$ BOTH events occurred!
```

Figure 55

3.4.12 FOTA example

Sample application showcasing FOTA usage with M2MB API. Debug prints on **USB0**

Features

- How download a delta file from a remote server
- How to apply the delta and update the module firmware

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a main task to manage connectivity.
- create a fota task to manage FOTA and start it with INIT option

`fota.c`

fotaTask()

- Initialize FOTA system then reset parameters.
- Check current FOTA state, if not in IDLE, return error.
- Send a message to mainTask so networking is initialized.
- after PdPCallback() notifies the correct context activation, configure the fota client parameters such as FTP server URL, username and password
- get delta file from server. when it is completed, FOTADownloadCallback is called.
- If delta download went fine, check it.
- If delta file is correct, apply it. Once complete, restart the module.

mainTask()

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context. Event will be received on **PdP-Callback** function
- Disable PDP context when required to stop the app

PdpCallback()

- When PDP context is enabled, send a message to fotaTask to start the download

```
Starting FOTA demo app. This is v1.1.7 built on Jun 11 2021 12:20:43.
[DEBUG] 23.60  fota:187 - fotaTask{FOTA_TASK}$ Init FOTA...

Session file not present, procede with FOTA...
[DEBUG] 23.61  fota:236 - fotaTask{FOTA_TASK}$ m2mb_fota_reset PASS
[DEBUG] 23.61  fota:260 - fotaTask{FOTA_TASK}$ m2mb_fota_state_get  M2MB_FOTA_STATE_IDLE
[DEBUG] 23.62  fota:379 - mainTask{MAIN_TASK}$ INIT
[DEBUG] 23.62  fota:392 - mainTask{MAIN_TASK}$ m2mb_os_ev_init success
[DEBUG] 23.63  fota:398 - mainTask{MAIN_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 23.63  fota:405 - mainTask{MAIN_TASK}$ Waiting for registration...
[DEBUG] 23.64  fota:131 - NetCallback{pubTspt_0}$ Module is registered to network
[DEBUG] 23.65  fota:418 - mainTask{MAIN_TASK}$ Pdp context initialization
[DEBUG] 25.70  fota:431 - mainTask{MAIN_TASK}$ Activate PDP with APN web.omnitel.it on cid 1....
[DEBUG] 35.42  fota:152 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 35.43  fota:155 - PdpCallback{pubTspt_0}$ IP address: 2.41.116.139

[DEBUG] 35.43  fota:285 - fotaTask{FOTA_TASK}$
Trying to download "samples/FOTA/37.00.003.3_to_37.00.003.1_ME310G1_NANVWWAU.bin" delta file...
[DEBUG] 35.45  fota:295 - fotaTask{FOTA_TASK}$ m2mb_fota_get_delta OK - Waiting for the completion callback
[DEBUG] 119.43  fota:96 - FOTADownloadCallBack{pubTspt_0}$ FOTA download Success - performing packet validation...
[DEBUG] 119.44  fota:301 - fotaTask{FOTA_TASK}$ Validating delta file...
[DEBUG] 156.36  fota:317 - fotaTask{FOTA_TASK}$ Packet is valid, start update...
[DEBUG] 156.40  fota:329 - fotaTask{FOTA_TASK}$ m2mb_fota_start PASS
[DEBUG] 158.36  fota:342 - fotaTask{FOTA_TASK}$
Rebooting...After reboot there will be the new FW running on module!

#OTAEV: Module Upgraded To New Fw
Starting FOTA demo app. This is v1.1.7 built on Jun 11 2021 12:20:43.
[DEBUG] 29.24  fota:187 - fotaTask{FOTA_TASK}$ Init FOTA...

Session file is already present, stop.
```

Figure 56

3.4.13 FTP

Sample application showcasing FTP client demo with AZX FTP. Debug prints on **USB0**

Features

- How to check module registration and activate PDP context
- How to connect to a FTP server
- How to exchange data with the server

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage FTP client and start it

`ftp_test.c`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Init FTP client and set the debug function for it
- Connect to the server
- Perform log in
- Check remote file size and last modification time
- Download file from server to local filesystem. A data callback is set to report periodic info about the download status
- Upload the same file to the server with a different name. A data callback is set to report periodic info about the upload status
- Download another file content in a buffer instead of a file. A data callback is set to report periodic info about the download status
- Close the connection with FTP server
- Disable PDP context

```
Starting FTP demo app. This is v1.0.7 built on Apr  7 2020 11:17:36.
[DEBUG] 21.23  ftp_test.c:290 - msgFTPTask{FTP_TASK}$ INIT
[DEBUG] 21.23  ftp_test.c:304 - msgFTPTask{FTP_TASK}$ m2mb_os_ev_init success
[DEBUG] 21.23  ftp_test.c:310 - msgFTPTask{FTP_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 21.23  ftp_test.c:318 - msgFTPTask{FTP_TASK}$ Waiting for registration...
[DEBUG] 21.25  ftp_test.c:214 - NetCallback{pubTspt_0}$ Module is registered to network
[DEBUG] 21.26  ftp_test.c:331 - msgFTPTask{FTP_TASK}$ Pdp context activation
[DEBUG] 21.27  ftp_test.c:335 - msgFTPTask{FTP_TASK}$ m2mb_pdp_init returned M2MB_RESULT_SUCCESS
[DEBUG] 23.31  ftp_test.c:344 - msgFTPTask{FTP_TASK}$ Activate PDP with APN web.omnitel.it on cid 3....
[DEBUG] 24.09  ftp_test.c:241 - PdpCallback{pubTspt_0}$ Context active
[DEBUG] 24.10  ftp_test.c:244 - PdpCallback{pubTspt_0}$ IP address: 176.244.166.181
Start ftp client...
[DEBUG] 24.82  ftp_test.c:373 - msgFTPTask{FTP_TASK}$ Connected.
[DEBUG] 26.32  ftp_test.c:386 - msgFTPTask{FTP_TASK}$ FTP login successful.
Get remote file /samples/pattern_big.txt size
[DEBUG] 26.69  ftp_test.c:428 - msgFTPTask{FTP_TASK}$ Done. File size: 20026.
Get remote file /samples/pattern_big.txt last modification date
[DEBUG] 26.89  ftp_test.c:450 - msgFTPTask{FTP_TASK}$ Done. File last mod date: 20200407090654
.

Starting download of remote file /samples/pattern_big.txt into local /mod/_pattern_big.txt
/samples/pattern_big.txt 47.54% 9520
/samples/pattern_big.txt 100.00% 20026
[DEBUG] 29.75  ftp_test.c:488 - msgFTPTask{FTP_TASK}$ download successful.
[DEBUG] 29.76  ftp_test.c:522 - msgFTPTask{FTP_TASK}$
Local file /mod/_pattern_big.txt size: 20026

Starting upload of local file /mod/_pattern_big.txt
/mod/_pattern_big.txt 81.81% 16384
Upload successful.

Starting download of remote file /samples/pattern.txt into local buffer
Getting remote file /samples/pattern.txt size..
[DEBUG] 32.97  ftp_test.c:583 - msgFTPTask{FTP_TASK}$ Done. File size: 988.
Starting download of remote file /samples/pattern.txt to buffer
[DEBUG] 34.08  ftp_test.c:145 - buf_data_cb{FTP_TASK}$ Received START event
[DEBUG] 34.09  ftp_test.c:149 - buf_data_cb{FTP_TASK}$ Received DATA: 988 bytes on buffer 0x400399e0
[DEBUG] 34.26  ftp_test.c:153 - buf_data_cb{FTP_TASK}$ Received END event
[DEBUG] 34.26  ftp_test.c:623 - msgFTPTask{FTP_TASK}$ Download successful. Received 988 bytes<<<
0    |---------|    |---------|    |---------|    |---------|    |---------|   *
1    |    A    |    |    A    |    |    A    |    |    A    |    |    A    |    *
2    |   AAA   |    |   AAA   |    |   AAA   |    |   AAA   |    |   AAA   |     *
3    |  AAAAA  |    |  AAAAA  |    |  AAAAA  |    |  AAAAA  |    |  AAAAA  |      *
4    | AAAAAAA |    | AAAAAAA |    | AAAAAAA |    | AAAAAAA |    | AAAAAAA |       *
5    |AAAAAAAAA|    |AAAAAAAAA|    |AAAAAAAAA|    |AAAAAAAAA|    |AAAAAAAAA|        *
6    | AAAAAAA |    | AAAAAAA |    | AAAAAAA |    | AAAAAAA |    | AAAAAAA |       *
7    |  AAAAA  |    |  AAAAA  |    |  AAAAA  |    |  AAAAA  |    |  AAAAA  |      *
8    |   AAA   |    |   AAA   |    |   AAA   |    |   AAA   |    |   AAA   |     *
9    |    A    |    |    A    |    |    A    |    |    A    |    |    A    |    *
10   |---------|    |---------|    |---------|    |---------|    |---------|   *
11                                                                             *
12   |---------|    |---------|    |---------|    |---------|    |--->>>
```

Figure 57

3.4.14 File System example

Sample application showcasing M2MB File system API usage. Debug prints on **USB0**

Features

- How to open a file in write mode and write data in it
- How to reopen the file in read mode and read data from it

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Open file in write mode
- Write data in file
- Close file
- Reopen file in read mode
- Read data from file and print it
- Close file and delete it

```
Starting FileSystem demo app. This is v1.0.7 build on Mar 26 2020 09:50:19. LEVEL: 2
Opening /my_text_file.txt in write mode..
Buffer written successfully into file. 15 bytes were written.
Closing file.
Opening /my_text_file.txt in read only mode..
Received 15 bytes from file:
<Hello from file>
Closing file.
Deleting File
File deleted
App Completed
```

Figure 58

3.4.15 GNSS example

Sample application showing how to use GNSS functionality. Debug prints on **USB0**

Features

- How to enable GNSS receiver on module
- How to collect location information from receiver

Note: on MEx10G1 product family both M2MB_GNSS_SERVICE_NMEA_REPORT and M2MB_GNSS_SERVICE_POSITION_REPORT services are available, while on ME910C1 product family only M2MB_GNSS_SERVICE_POSITION_REPORT is available

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print a welcome message
- Create GNSS task and send a message to it

`gps_task.c` - Init Info feature and get module type - Init gnss, enable position/NMEA report and start it. - When a fix or a NMEA sentence is available, a message will be printed by the GNSS callback function

```
Starting GNSS demo app. This is v1.1.4 built on Oct  1 2021 15:27:44.

Model: ME910C1-E2

m2mb_gnss_enable, POSITION OK

m2mb_gnss_start OK, waiting for position/nmea sentences...
latitude_valid: 1 - latitude: 45.713643
longitude_valid: 1 - longitude: 13.738041
altitude_valid: 1 - altitude: 195.000000
uncertainty_valid: 1 - uncertainty: 95.000000
velocity_valid: 1 - codingType: 0
speed_horizontal: 0.650000
bearing: 0.000000
timestamp_valid: 1 -timestamp: 1633095357439
speed_valid: 1 - speed: 1.471360


***** Wait 120 seconds and then stop GPS *****
```

Figure 59

3.4.16 GPIO interrupt example

Sample application showing how to use GPIOs and interrupts. Debug prints on **USB0**

Features

- How to open a GPIO in input mode with interrupt
- How to open a second GPIO in output mode to trigger the first one

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Open GPIO 4 as output
- Open GPIO 3 as input and set interrupt for any edge (rising and falling). **A jumper must be used to short GPIO 3 and 4 pins.**
- Toggle GPIO 4 status high and low every second
- An interrupt is generated on GPIO 3

```
Starting GPIO interrupt demo app. This is v1.0.7 built on Mar 26 2020 16:33:01.
Setting gpio 3 interrupt...
Setting GPIO 4 HIGH
CALLBACK->Interrupt on GPIO 3! Value: 1
Setting GPIO 4 LOW
CALLBACK->Interrupt on GPIO 3! Value: 0
Setting GPIO 4 HIGH
CALLBACK->Interrupt on GPIO 3! Value: 1
Setting GPIO 4 LOW
CALLBACK->Interrupt on GPIO 3! Value: 0
Setting GPIO 4 HIGH
CALLBACK->Interrupt on GPIO 3! Value: 1
Setting GPIO 4 LOW
CALLBACK->Interrupt on GPIO 3! Value: 0
```

Figure 60

3.4.17 General_INFO example

Sample application prints some Module/SIM information as IMEI, fw version, IMSI and so on; it prints also some information about registration. Debug prints on **USB0**

Features

- How to print some Module information as IMEI, FW version etc
- How to print some SIM information as IMSI, ICCID
- How to get and print some informatio about Module registration as Netowrk Operator, AcT, RSSI, etc

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Init NET functionality
- Init INFO functionality
- Get and print Module and SIM info
- Wait form module to register to network
- Get and print registration INFO

```
Starting. This is v1.1.4 built on Mar 31 2021 09:56:03. LEVEL: 2

 Start General INFO application [ version: 1.000000 ]

======================

MODULE ME910C1-E2 INFO

======================

MANUFACTURER: Telit

IMEI: 353080091125422

MODEM FIRMWARE VERSION: M0B.700005

PACKAGE VERSION:
30.00.709-B005-P0B.700100
M0B.700005
P0B.700100
A0B.700000


========

SIM INFO

========

IMSI: 222015602268648

ICCID: 89390100001138084906


============================

Waiting for registration...

============================

Module is registered to HOME network cellID 0x5221
NETWORK OPERATOR (mcc mnc): 222 01
Network Technology 2G (AcT: 0) RSSI: -81
```

Figure 61

3.4.18 HTTP Client

Sample application showing how to use HTTPs client functionalities. Debug prints on **USB0**

Features

- How to check module registration and activate PDP context
- How to initialize the http client, set the debug hook function and the data call-back to manage incoming data
- How to perform GET, HEAD or POST operations

NOTE: the sample app has an optional dependency on azx_base64.h if basic authentication is required (refer to `HTTP_BASIC_AUTH_GET` define in `M2MB_main.c` for further details)

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage HTTP client and start it

`httpTaskCB`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Create HTTP client options and initialize its functionality
- Create HTTP SSL config and initialize the SSL options
- Configure data management options for HTTP client
- Appy all configurations to HTTP client
- Perform a GET request to a server
- Disable PDP context

`DATA_CB`

- Print incoming data
- Set the abort flag to 0 to keep going.


Starting HTTP(s) client demo app. This is v1.0.13-C1 built on Aug 11 2020 16:56:28.
[DEBUG] 15.19 M2MB_main:259 - activatePdP{HttpClient}$ m2mb_os_ev_init success
[DEBUG] 15.20 M2MB_main:265 - activatePdP{HttpClient}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 15.20 M2MB_main:273 - activatePdP{HttpClient}$ Waiting for registration...
[DEBUG] 15.21 M2MB_main:119 - NetCallback{pubTspt_0}$ Module is registered to cell 0xC4CF!
[DEBUG] 15.22 M2MB_main:287 - activatePdP{HttpClient}$ Pdp context initialization
[DEBUG] 17.26 M2MB_main:297 - activatePdP{HttpClient}$ Activate PDP with APN NXT17.NET....
[DEBUG] 17.97 M2MB_main:146 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 17.97 M2MB_main:149 - PdpCallback{pubTspt_0}$ IP address: 100.77.54.97
Performing a GET request...
Host Address: linux-ip.net Port 80
Socket connected!
<!DOCTYPE html>
<html>
<head>
<meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
<meta name="author" content="Martin A. Brown" />
<meta name="robots" content="index, follow"/>
<meta property="og:title" content="http://linux-ip.net/"/>
<meta property="og:url" content="http://linux-ip.net"/>
<meta property="og:site_name" content="http://linux-ip.net/"/>
<meta property="og:type" content="website"/>
<link rel="canonical" href="http://linux-ip.net" />
<title>http://linux-ip.net/</title>
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<link rel="stylesheet" type="text/css" href="//netdna.bootstrapcdn.com/font-awesome/4.0.3/css/font-awesome.css" />
<link rel="stylesheet" type="text/css" href="//netdna.bootstrapcdn.com/twitter-bootstrap/2.3.2/css/bootstrap-combined.min.css" />
<link rel="stylesheet" type="text/css" href="http://linux-ip.net/theme/css/main.css" />
</head>
...
<footer id="site-footer">

<address>

Powered by Pelican
and Python.
Theme based on Fresh
by jsliang

</address>

</footer>
</body>
</html>
Done.
[DEBUG] 22.44 M2MB_main:155 - PdpCallback{pubTspt_0}$ Context successfully deactivated!

Figure 62

3.4.19 HW Timer (Hardware Timer)

The sample application shows how to use HW Timers M2MB API. Debug prints on **USB0**

Features

- How to open configure a HW timer
- How to use the timer to manage recurring events

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create hw timer structure
- Configure it with 100 ms timeout, periodic timer (auto fires when expires) and autostart
- Init the timer with the parameters
- Wait 10 seconds
- Stop the timer

`TimerCb`

- Print a message with an increasing counter

```
Starting HW Timers demo app. This is v1.0.7 built on Mar 26 2020 13:04:14.
[DEBUG] 14.06  M2MB_main.c:114 - M2MB_main{M2M_DamsStart}$ Set the timer attributes structure: success.
Timer successfully created
Start the timer, success.
[DEBUG] 14.18  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [0]
[DEBUG] 14.28  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [1]
[DEBUG] 14.38  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [2]
[DEBUG] 14.48  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [3]
[DEBUG] 14.58  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [4]
[DEBUG] 14.69  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [5]
[DEBUG] 14.79  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [6]
[DEBUG] 14.88  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [7]
[DEBUG] 14.98  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [8]
[DEBUG] 15.08  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [9]


[DEBUG] 23.90  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [96]
[DEBUG] 24.01  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [97]
[DEBUG] 24.11  M2MB_main.c:55 - TimerCb{pubTspt_0}$ Callback Count: [98]
Stop a running timer: success
Application end
```

Figure 63

3.4.20 Hello World

The application prints “Hello World!” over selected output every two seconds. Debug prints on **USB0**, using AZX log example functions

Features

- How to open an output channel using AZX LOG sample functions
- How to print logging information on the channel using AZX LOG sample functions

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print “Hello World!” every 2 seconds in a while loop

```
Starting. This is v1.0.7 built on Mar 26 2020 09:34:16. LEVEL: 2

 Start Hello world Application  [ version: 2.000000 ]

 Hello world 2.0 [ 000001 ]
 Hello world 2.0 [ 000002 ]
 Hello world 2.0 [ 000003 ]
 Hello world 2.0 [ 000004 ]
 Hello world 2.0 [ 000005 ]
 Hello world 2.0 [ 000006 ]
 Hello world 2.0 [ 000007 ]
 Hello world 2.0 [ 000008 ]
 Hello world 2.0 [ 000009 ]
```

Figure 64

3.4.21 I2C example

Sample application showing how to communicate with an I2C slave device. Debug prints on **USB0**

Features

- How to open a communication channel with an I2C slave device
- How to send and receive data to/from the slave device

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Open I2C bus, setting SDA an SCL pins as 2 and 3 respectively
- Set registers to configure accelerometer -Read in a loop the 6 registers carrying the 3 axes values and show the g value for each of them

```
Starting I2C demo app. This is v1.0.7 built on Mar 26 2020 16:50:40.

Configuring the Kionix device...
opening channel /dev/I2C-30
[DEBUG] 20.18  M2MB_main.c:218 - test_I2C{M2M_DamsStart}$ -
WHOAMI content: 0x01
Configuring I2C Registers - Writing 0x4D into 0x1D register (CTRL_REG3)...
Write: success

I2C reading data from 0x1D register (CTRL_REG3)...
Read: success.
Accelerometer Enabled. ODR tilt: 12.5Hz, ODR directional tap: 400Hz, ORD Motion Wakeup: 50Hz
Configuring I2C Registers - Writing 0xC0 into 0x1B register (CTRL_REG1)...
Write: success

I2C reading data from 0x1B register (CTRL_REG1)...
Read: success.
Accelerometer Enabled. Operative mode, 12bit resolution
I2C read axes registers
------------
Reading Success.

X: -0.050 g
Y: -0.046 g
Z: 1.006 g
Reading Success.

X: -0.049 g
Y: -0.044 g
Z: 1.004 g
Reading Success.

X: -0.052 g
Y: -0.044 g
Z: 1.007 g
Reading Success.

X: -0.048 g
Y: -0.045 g
Z: 1.005 g
```

Figure 65

3.4.22 Little FileSystem 2

Sample application showing how use lfs2 porting with RAM disk and SPI data flash. Debug prints on **USB0**

Features

- How to create and manage Ram Disk
- How to manage file-system in Ram disk partition
- How to create and manage SPI Flash memory partition
- How to manage file-system in SPI Flash memory partition

Application workflow

`M2MB_main.c`

- Init logging system
- Call Ram Disk tests
- Call Flash memory tests

`ram_utils_usage.c`

- Initialize Ram Disk
- Format and Mount partition
- List files
- Files creation and write content
- List files
- Read files
- Unmount and Release resources

`spi_utils_usage.c` - Initialize SPI Flash chip - Initialize SPI Flash Disk - Format and Mount partition - List files - Files creation and write content - List files - Read files - Delete files - Directories creation and deletion - Unmount and Release resources

Notes:

For SPI Flash a JSC memory is used with chip select pin connected to module GPIO2 pin. For better performances, a 33kOhm pull-down resistor on SPI clock is suggested. Please refer to SPI_echo sample app for SPI connection details.

For LE910Cx (both Linux and ThreadX based devices), AT#SPIEN=1 command must be sent once before running the app

```
Starting lfs2 demo app. This is v1.0.14-C1 built on Oct 22 2020 09:43:08.

>>>>>>> Starting RAMDiskDemo ...
[DEBUG] 18.28  azx_lfs_uti:125 - azx_ram_initialize{M2M_DamsStart}$ Ram Memory allocated correctly from 0x40042228 to 0x40046228!!

Mounting partition...

Formatting...

Mounting...


Mounted partition...

<><><><>fileListUtils

List:
., 0, 2
.., 0, 2

file_name: file000.txt
size: 10
buffer: content000
mode: 0
RAM TYPE size: 10000


File created and closed: file000.txt


<><><><>fileListUtils
____INSIDE --->file000.txt, 10, 1

List:
., 0, 2
.., 0, 2
file000.txt, 10, 1

------>File reading

File: file000.txt, Size: 10, Buffer: content000

Nand released
Partition unmounted
[DEBUG] 20.31  azx_lfs_uti:165 - azx_ram_releaseResources{M2M_DamsStart}$ Ram Memory released correctly!!
```

```
>>>>>>> Starting FlashDiskDemo ...
Starting initialization...

table id[0] = 191
table id[1] = 1
table id[2] = 0

nandLFSCallback Callback event <1>
NAND Callback event: NAND_JSC_INITIALIZED <1>
nandLFSCallback Callback event <1>
NAND Callback event: NAND_JSC_INITIALIZED <1>

Mounting partition...

Formatting...
spiErase: address = 0, len = 131072

spiErase: address = 131072, len = 131072


Mounting...


Mounted partition...


<><><><>fileListUtils

List:
., 0, 2
.., 0, 2


Formatting...
spiErase: address = 0, len = 131072

spiErase: address = 131072, len = 131072


Mounting...


Mounted partition...


<><><><>fileListUtils

List:
., 0, 2
.., 0, 2

file_name: file000.txt
size: 10
buffer: content000
mode: 0


File created and closed: file000.txt
```

```
<><><><fileListUtils

List:
., 0, 2
.., 0, 2
file000.txt, 10, 1
file001.txt, 10, 1
file002.txt, 10, 1
file003.txt, 10, 1
file004.txt, 10, 1

------>File reading

File: file000.txt, Size: 10, Buffer: content000


File: file004.txt, Size: 10, Buffer: content004


File: file002.txt, Size: 10, Buffer: content002
------>File removing
file001.txt<<<<<<<


File removed: file001.txt
file000.txt<<<<<<<


File removed: file000.txt
file004.txt<<<<<<<


File removed: file004.txt


<><><><fileListUtils

List:
., 0, 2
.., 0, 2
file002.txt, 10, 1
file003.txt, 10, 1

spiErase: address = 59637760, len = 131072

[DEBUG] 58.61  azx_lfs_uti:648 - azx_lfsDirCreationByContext{M2M_DamsStart}$ Directory created: dir000!!
[DEBUG] 59.78  azx_lfs_uti:631 - azx_lfsDirCreationByContext{M2M_DamsStart}$ Directory already exists: dir000!!
spiErase: address = 59899904, len = 131072

[DEBUG] 61.70  azx_lfs_uti:648 - azx_lfsDirCreationByContext{M2M_DamsStart}$ Directory created: dir001!!
spiErase: address = 60162048, len = 131072

[DEBUG] 63.67  azx_lfs_uti:648 - azx_lfsDirCreationByContext{M2M_DamsStart}$ Directory created: dir002!!
```

```
<><><><fileListUtils

List:
., 0, 2
.., 0, 2
dir000, 0, 2
dir001, 0, 2
dir002, 0, 2
file002.txt, 10, 1
file003.txt, 10, 1



<><><><fileListUtils

List:
., 0, 2
.., 0, 2
dir001, 0, 2
dir002, 0, 2
file002.txt, 10, 1
file003.txt, 10, 1

Nand released
Partition unmounted

Unmounted process ended...

testAllInOneFunction ended...
```

3.4.23 Logging Demo

Sample application showing how to print on one of the available output interfaces. Debug prints on **USB0**

Features

- How to open a logging channel
- How to set a logging level
- How to use different logging macros

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Print a message with every log level

```
Starting Logging demo app. This is v1.0.7 built on Mar 26 2020 13:57:06.
[WARN ] 20.17  M2MB_main.c:74 - M2MB_main{M2M_DamsStart}$ This is a WARNING MESSAGE
[ERROR] 20.18  M2MB_main.c:76 - M2MB_main{M2M_DamsStart}$ THIS IS AN ERROR MESSAGE
[CRITICAL] 20.19  M2MB_main.c:78 - M2MB_main{M2M_DamsStart}$ THIS IS AN CRITICAL MESSAGE
[DEBUG] 20.19  M2MB_main.c:80 - M2MB_main{M2M_DamsStart}$ This is a DEBUG message
[TRACE] 20.20  M2MB_main.c:82 - M2MB_main{M2M_DamsStart}$ This is a TRACE message
END.
```

Figure 66

3.4.24 MD5 example

Sample application showing how to compute MD5 hashes using m2mb crypto. Debug prints on **USB0**

Features

- Compute MD5 hash of a file
- Compute MD5 hash of a string

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Create a temporary file with the expected content
- Compute MD5 hash of the provided text file
- Compare the hash with the expected one
- Compute MD5 hash of a string
- Compare the hash with the expected one
- Delete test file

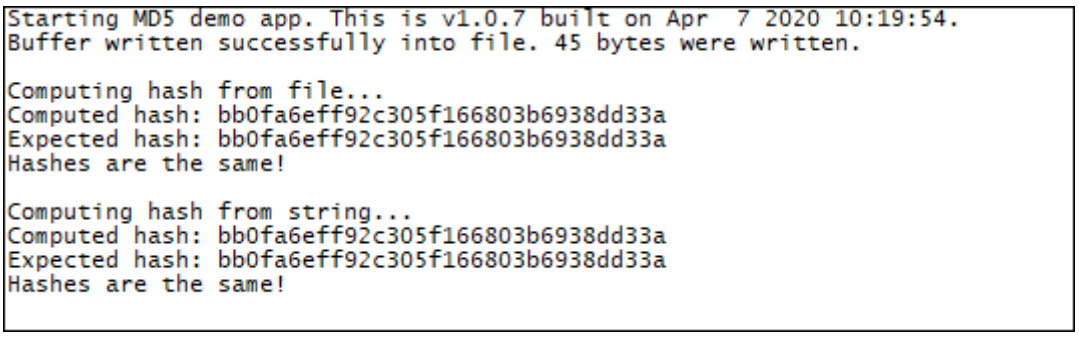

Figure 67

3.4.25 MQTT Client

Sample application showcasing MQTT client functionalities (with SSL). Debug prints on **USB0**

Features

- How to check module registration and enable PDP context
- How to configure MQTT client parameters
- How to connect to a broker with SSL and exchange data over a subscribed topic

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage MQTT client and start it

`mqtt_demo.c`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Init MQTT client
- Configure it with all parameters (Client ID, username, password, PDP context ID, keepalive timeout...)
- Connect MQTT client to broker
- Subscribe to two topics
- Publish 10 messages with increasing counter. Even messages are sent to topic 1, odd messages on topic 2.
- Print received message in mqtt_topc_cb function
- Disconnect MQTT client and deinit it
- Disable PDP context

```
Starting MQTT demo app. This is v1.0.7 built on Apr  7 2020 10:34:08.
[DEBUG] 16.18  mqtt_demo.c:192 - MQTT_Task{MQTT_TASK}$ INIT
[DEBUG] 16.18  mqtt_demo.c:206 - MQTT_Task{MQTT_TASK}$ m2mb_os_ev_init success
[DEBUG] 16.19  mqtt_demo.c:214 - MQTT_Task{MQTT_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 16.19  mqtt_demo.c:221 - MQTT_Task{MQTT_TASK}$ Waiting for registration...
[DEBUG] 16.20  mqtt_demo.c:131 - NetCallback{pubTspt_0}$ Module is registered
[DEBUG] 16.21  mqtt_demo.c:232 - MQTT_Task{MQTT_TASK}$ Pdp context activation
[DEBUG] 18.26  mqtt_demo.c:246 - MQTT_Task{MQTT_TASK}$ Activate PDP with APN web.omnitel.it on CID 3....
[DEBUG] 18.95  mqtt_demo.c:155 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 18.96  mqtt_demo.c:159 - PdpCallback{pubTspt_0}$ IP address: 37.118.201.56
[DEBUG] 18.96  mqtt_demo.c:268 - MQTT_Task{MQTT_TASK}$ Init MQTT
[DEBUG] 18.97  mqtt_demo.c:278 - MQTT_Task{MQTT_TASK}$ m2mb_mqtt_init succeeded

Connecting to broker <api-dev.devicewise.com>:1883...
Done.
Subscribing to test_topic and test_topic2..
[DEBUG] 20.35  mqtt_demo.c:367 - MQTT_Task{MQTT_TASK}$ Done.

[DEBUG] 20.36  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 2> to topic test_topic
[DEBUG] 20.37  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 20.71  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic; data len: 27
[DEBUG] 20.72  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 2>
[DEBUG] 23.37  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 3> to topic test_topic2
[DEBUG] 23.38  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 23.92  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic2; data len: 27
[DEBUG] 23.93  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 3>
[DEBUG] 26.40  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 4> to topic test_topic
[DEBUG] 26.41  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 26.93  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic; data len: 27
[DEBUG] 26.93  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 4>
[DEBUG] 29.42  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 5> to topic test_topic2
[DEBUG] 29.43  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 29.99  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic2; data len: 27
[DEBUG] 30.00  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 5>
[DEBUG] 32.46  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 6> to topic test_topic
[DEBUG] 32.48  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 33.00  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic; data len: 27
[DEBUG] 33.01  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 6>
[DEBUG] 35.47  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 7> to topic test_topic2
[DEBUG] 35.48  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 36.01  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic2; data len: 27
[DEBUG] 36.02  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 7>
[DEBUG] 38.50  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 8> to topic test_topic
[DEBUG] 38.51  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 39.15  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic; data len: 27
[DEBUG] 39.16  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 8>
[DEBUG] 41.52  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 9> to topic test_topic2
[DEBUG] 41.53  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 42.10  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic2; data len: 27
[DEBUG] 42.12  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 9>
[DEBUG] 44.56  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 10> to topic test_topic
[DEBUG] 44.57  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 45.09  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic; data len: 28
[DEBUG] 45.11  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 10>
[DEBUG] 47.58  mqtt_demo.c:392 - MQTT_Task{MQTT_TASK}$ PUBLISHING <Hello from M2MB MQTT! ID: 11> to topic test_topic2
[DEBUG] 47.59  mqtt_demo.c:397 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 48.12  mqtt_demo.c:103 - mqtt_topic_cb{MQTT_Async}$ MQTT Message on Topic test_topic2; data len: 28
[DEBUG] 48.13  mqtt_demo.c:107 - mqtt_topic_cb{MQTT_Async}$ Message: <Hello from M2MB MQTT! ID: 11>

Disconnecting from MQTT broker..
[DEBUG] 50.60  mqtt_demo.c:414 - MQTT_Task{MQTT_TASK}$ Done.
[DEBUG] 50.61  mqtt_demo.c:443 - MQTT_Task{MQTT_TASK}$ application exit
[DEBUG] 50.62  mqtt_demo.c:453 - MQTT_Task{MQTT_TASK}$ m2mb_pdp_deactivate returned success
[DEBUG] 50.63  mqtt_demo.c:457 - MQTT_Task{MQTT_TASK}$ Application complete.
[DEBUG] 51.23  mqtt_demo.c:164 - PdpCallback{pubTspt_0}$ Context deactivated!
```

Figure 68

3.4.26 MultiTask

Sample application showcasing multi tasking functionalities with M2MB API. Debug prints on **USB0**

Features

- How to create tasks using azx utilities
- How to use send messages to tasks
- How to use a semaphore to synchronize two tasks

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create three tasks with the provided utility (this calls public m2mb APIs)
- Send a message to the task1, its callback function azx_msgTask1 will be called

`azx_msgTask1`

- Print received parameters from main
- Send modified parameters to task2 (its callback function azx_msgTask2 will be called)
- wait for an InterProcess Communication semaphore to be available (released by task3)
- Once the semaphore is available, print a message and return

`azx_msgTask2`

- Print received parameters from caller
- If first parameter is bigger than a certain value, Send modified parameters to task3
- Else, use the second parameter as a task handle and print the corresponding name plus the value of the first parameter

`azx_msgTask3`

- Print received parameters from task 2
- release IPC semaphore
- send message to task 2 with first parameter below the threshold and second parameter with task3 handle

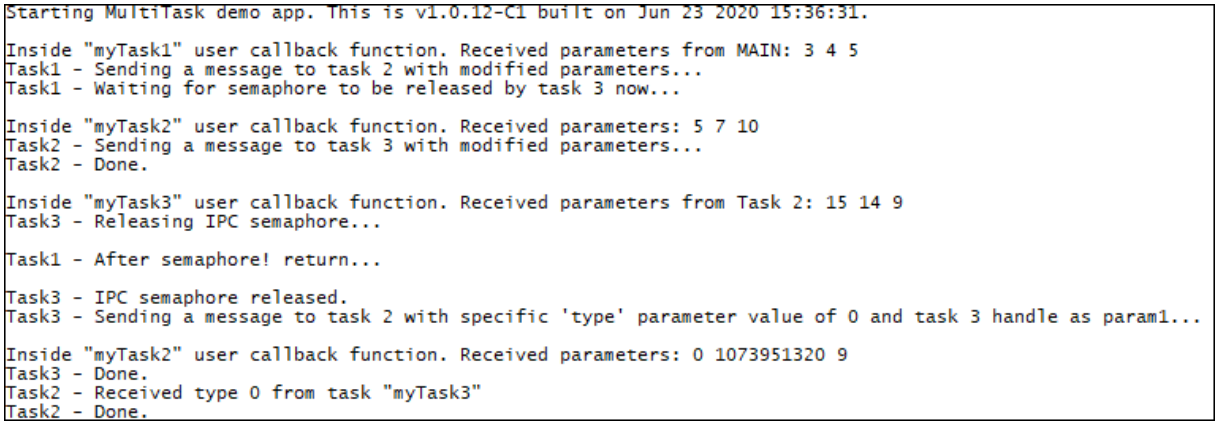
Starting MultiTask demo app. This is v1.0.12-C1 built on Jun 23 2020 15:36:31.
Inside "myTask1" user callback function. Received parameters from MAIN: 3 4 5
Task1 - Sending a message to task 2 with modified parameters...
Task1 - Waiting for semaphore to be released by task 3 now...
Inside "myTask2" user callback function. Received parameters: 5 7 10
Task2 - Sending a message to task 3 with modified parameters...
Task2 - Done.
Inside "myTask3" user callback function. Received parameters from Task 2: 15 14 9
Task3 - Releasing IPC semaphore...
Task1 - After semaphore! return...
Task3 - IPC semaphore released.
Task3 - Sending a message to task 2 with specific 'type' parameter value of 0 and task 3 handle as param1...
Inside "myTask2" user callback function. Received parameters: 0 1073951320 9
Task3 - Done.
Task2 - Received type 0 from task "myTask3"
Task2 - Done.

Figure 69

3.4.27 NTP example

The application connects to an NTP server, gets current date and time and updates module's internal clock. Debug prints on **USB0**

Features

- How to get current date and time from an NTP server
- How to set current date and time on module

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Send message to ntpTask

`ntp_task.c`

NTP_task() - Waits module registration - When module is registered, initializes ntp setting CID, server url and timeout - When PDP context is correctly opened, a query to NTP server is done to get current date and time - On SET_MODULE_RTC message type reception, module RTC is set with date time value got from NTP server.

m2mb_ntp_ind_callback() - As soon as M2MB_NTP_VALID_TIME event is received, current date and time is printend and a message (with SET_MODULE_RTC type) is sent to NTP_task

```
Start NTP demo application. This is v1.0 built on Apr 16 2021 09:36:12.

Waiting for registration...
Module is registered!

Activate PDP context with APN ibox.tim.it on CID 3
Context activated, IP address: 2.195.170.123
Get current time from server 0.pool.ntp.org, PORT: 123

Current time is: Friday 2021-04-16, 07:37:33

Current time correctly set on module
Module system time is: 2021-04-16, 07:37:33
```

Figure 70

3.4.28 RTC example

Sample application that shows RTC apis functionalities: how to get/set moudle system time and timestamp. Debug prints on **USB0**

Features

- How to read module timestamp
- How to read module system time
- How to set new system time

Application workflow

`M2MB_main.c`

- Init log azx and print a welcome message
- Init net functionality and wait for module registration
- Init RTC functionality and get module time in timestamp format (seconds from the epoch)
- Get moudle system time in date/time format
- Add 1 hour to timestamp, convert it to system time and set it to module

```
 Start RTC demo application. This is v1.0 built on Oct  1 2021 15:01:40.

Waiting for registration...
Module is registered!

Current time in seconds from the epoch: 1633101266
Module system time is: 2021-10-01, 15:14:26

Get current time and add an hour

Current time in seconds from the epoch: 1633101266
New time to be set : 2021-10-01, 16:14:26, tz:4, dlst:0

Set new time and check the setting
NEW module system time is: 2021-10-01, 16:14:26
```

Figure 71

3.4.29 SMS PDU

Sample application showcasing how to create and decode PDUs to be used with m2mb_sms_* API set. A SIM card and antenna must be present. Debug prints on **USB0**

Features

- How to enable SMS functionality
- How to use encode an SMS PDU to be sent with m2mb_api
- How to decode a received SMS response from PDU to ASCII mode.

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Init sms functionality
- Create PDU from text message
- Send message to destination number
- Wait for response
- When SMS PDU response is received, decode it and print information about it, plus the message content

```
m2mb_sms_init() succeeded

Sending message <How are you?>...
 m2mb_sms_send() - succeeded
M2MB_SMS_SEND_RESP Callback
Send resp msg ID 10
SMS received!
SMS correctly received!

Reading SMS from memory...
 m2mb_sms_read() request succeeded

--- SMS read ---
SMS tag M2MB_SMS_TAG_MT_NOT_READ
SMS format M2MB_SMS_FORMAT_3GPP
Code type: 0
Sender type: 145
Msg len: 12
Msg bytes: 11
Msg date 19/7/17 16:7:58 (timezone: 2)
Received SMS, content: <<Fine thanks >>
Sender: +[redacted]
```

Figure 72

3.4.30 SMS_atCmd example

Sample application showcasing how to receive an SMS containing an AT command, process the AT command and send its answer to sender (configurable in sms_config.txt). A SIM card and antenna must be present. Debug prints on **USB0**

Features

- How to receive an SMS with an AT command as text inside
- How to send AT command to parser and read the answer
- How to send the AT command answer back to sender via SMS

Optional configuration file to be put in `/data/azc/mod` folder, copy `sms_config.txt` file into your module running the following AT command:

```
AT#M2MWRITE="/data/azc/mod/sms_config.txt",138
>>> here receive the prompt; then type or send the file, sized 138 bytes
```

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Init SMS functionality
- Read configuration file sms_config.txt (send SMS with AT command answer back, delte SMS received)
- Init AT command parser
- Create a task to handle SMS parsing and AT command sending
- Wait for an incoming SMS

`callbacks.c`

`msgSMSparse()`

- When SMS has been received, content is decoded and printed. If there is an AT command inside, command is executed and answer printed and sent back to sender as an SMS (depending on sms_config.txt setting)

```
ÿStarting SMS with AT command demo app. This is v1.0.13-C1 built on Mar 18 2021 12:42:22.
[DEBUG] 16.61  M2MB_main:135 - M2MB_main{M2M_DamsStart}$ m2mb_os_ev_init success
m2mb_sms_init() succeeded
[DEBUG] 16.62  M2MB_main:168 - M2MB_main{M2M_DamsStart}$ M2MB_SMS_INCOMING_IND indication enabled
[DEBUG] 16.63  M2MB_main:179 - M2MB_main{M2M_DamsStart}$ M2MB_SMS_INCOMING_IND MEMORY FULL indication enabled
[DEBUG] 16.64  M2MB_main:196 - M2MB_main{M2M_DamsStart}$ Storage set to M2MB_SMS_STORAGE_SM
[DEBUG] 16.65  callbacks:114 - readConfigFromFile{M2M_DamsStart}$ Reading parameters from file
[DEBUG] 16.66  callbacks:116 - readConfigFromFile{M2M_DamsStart}$ Opening /mod/sms_config.txt in read mode..
Default: SMS with answer sending DISABLED, delete sms DISABLED
[DEBUG] 16.67  at_async:115 - at_cmd_async_init{M2M_DamsStart}$ m2mb_ati_init() on instance 0
Please send an SMS with a configuration as ("ATCMD: <atcmd>")...
```

Figure 73

3.4.31 SPI Echo

Sample application showing how to communicate over SPI with m2mb API. Debug prints on **USB0**

Features

- How to open an SPI bus. MOSI and MISO will be shorted, to have an echo.
- How to communicate over SPI bus

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Open SPI bus, set parameters
- Send data on MOSI and read the same in MISO

Notes:

For LE910Cx (both Linux and ThreadX based devices), AT#SPIEN=1 command must be sent once before running the app

```
Starting SPI demo app. This is v1.0.7 built on Apr  1 2020 13:48:05.
Transfer successful. Received: hello from spi echo
```

Figure 74

3.4.32 SPI sensors

Sample application showing SPI usage, configuring two ST devices: a magnetometer (ST LIS3MDL) and a gyroscope (ST L3G4200D). The application will read values from both devices using GPIO4 and 3 (respectively) as magnetometer CS and gyro CS. Debug prints on **USB0**

Features

- How to open an SPI bus with a slave device
- How to communicate with the device over the SPI bus

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Open SPI bus, set parameters
- Configure `GPIO 2` and `GPIO 3` as output, set them high (idle)
- Set registers to configure magnetometer
- Read in a loop (10 iterations) the registers carrying the 3 axes values and show the gauss value for each of them. A metal object is put close to the sensor to change the read values.
- Set registers to configure gyroscope
- Read in a loop (10 iterations) the registers carrying the 3 axes values and show the degrees per second value for each of them. The board is rotated to change the read values.

Notes:

For LE910Cx (both Linux and ThreadX based devices), `AT#SPIEN=1` command must be sent once before running the app

```
Starting SPI demo app. This is v1.0.7 built on Apr  1 2020 13:58:25.
SPI start

Magnetometer SPI Demo start
Reading Magnetometer WHOAMI. Expected: 0x3D
Expected response received!
Setting continuous conversion mode...
Continuous conversion mode successfully set.
Setting 10 Hz Output Data Rate, Medium performance mode X Y axis...
Magnetometer Enabled. 10Hz ODR, Medium Perf. Mode (X,Y).
Setting Medium performance for Z axis, little endian...
Medium Perf. Mode (Z), little endian.
Setting complete, starting reading loop...

X: 0.204 gauss
Y: -0.321 gauss
Z: 0.305 gauss

X: 0.290 gauss
Y: -0.103 gauss
Z: 0.043 gauss

X: -2.513 gauss
Y: -0.353 gauss
Z: -4.000 gauss

X: 1.980 gauss
Y: 0.174 gauss
Z: -1.945 gauss

X: 4.000 gauss
Y: -0.090 gauss
Z: -4.000 gauss

X: -0.605 gauss
Y: -0.154 gauss
Z: 0.210 gauss

X: -0.580 gauss
Y: 2.004 gauss
Z: -0.047 gauss

X: 0.177 gauss
Y: -0.359 gauss
Z: 0.295 gauss

X: 0.173 gauss
Y: -0.356 gauss
Z: 0.301 gauss

X: 0.174 gauss
Y: -0.356 gauss
Z: 0.298 gauss
Reading complete.
```

Figure 75

3.4.33 SW Timer (Software Timer)

The sample application shows how to use SW Timers M2MB API. Debug prints on **USB0**

Features

- How to open configure a SW timer
- How to use the timer to manage recurring events

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create sw timer structure
- Configure it with 4 seconds timeout, periodic timer (auto fires when expires)
- Init the timer with the parameters
- Start the timer
- Wait 10 seconds
- Stop the timer

`timerCb`

- Print a message with inside the callback

```
Starting SW Timers demo app. This is v1.0.7 built on Apr  7 2020 09:51:25.
timer expired!
[DEBUG] 21.41  M2MB_main.c:59 - timerCb{pubTspt_0}$ timer handle: 0x4002b004
timer expired!
[DEBUG] 25.47  M2MB_main.c:59 - timerCb{pubTspt_0}$ timer handle: 0x4002b004
stopping the timer
Stop a running timer: success
Application end
```

Figure 76

3.4.34 TCP IP

Sample application showcasing TCP echo demo with M2MB API. Debug prints on **USB0**

Features

- How to check module registration and activate PDP context
- How to open a TCP client socket
- How to communicate over the socket

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage socket and start it

`m2m_tcp_test.c`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Create socket and link it to the PDP context id
- Connect to the server
- Send data and receive response
- Close socket
- Disable PDP context

```
Starting TCP-IP demo app. This is v1.0.7 built on Mar 26 2020 16:20:30.
[DEBUG] 21.23  m2m_tcp_test.c:201 - M2M_msgTCPTask{TCP_TASK}$ INIT
[DEBUG] 21.25  m2m_tcp_test.c:217 - M2M_msgTCPTask{TCP_TASK}$ m2mb_os_ev_init success
[DEBUG] 21.26  m2m_tcp_test.c:223 - M2M_msgTCPTask{TCP_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 21.26  m2m_tcp_test.c:231 - M2M_msgTCPTask{TCP_TASK}$ Waiting for registration...
[DEBUG] 21.28  m2m_tcp_test.c:128 - NetCallback{pubTspt_0}$ Module is registered to cell 0x816B!
[DEBUG] 21.29  m2m_tcp_test.c:244 - M2M_msgTCPTask{TCP_TASK}$ Pdp context activation
[DEBUG] 21.30  m2m_tcp_test.c:248 - M2M_msgTCPTask{TCP_TASK}$ m2mb_pdp_init returned M2MB_RESULT_SUCCESS
[DEBUG] 23.34  m2m_tcp_test.c:263 - M2M_msgTCPTask{TCP_TASK}$ Activate PDP with APN web.omnitel.it....
[DEBUG] 24.52  m2m_tcp_test.c:155 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 24.52  m2m_tcp_test.c:158 - PdpCallback{pubTspt_0}$ IP address: 83.225.44.56
[DEBUG] 24.54  m2m_tcp_test.c:273 - M2M_msgTCPTask{TCP_TASK}$ Creating Socket...
[DEBUG] 24.54  m2m_tcp_test.c:284 - M2M_msgTCPTask{TCP_TASK}$ Socket created
[DEBUG] 24.55  m2m_tcp_test.c:294 - M2M_msgTCPTask{TCP_TASK}$ Socket ctx set to 3
[DEBUG] 24.95  m2m_tcp_test.c:307 - M2M_msgTCPTask{TCP_TASK}$ Retrieved IP: 185.86.42.218
[DEBUG] 25.17  m2m_tcp_test.c:322 - M2M_msgTCPTask{TCP_TASK}$ Socket Connected!
[DEBUG] 25.18  m2m_tcp_test.c:329 - M2M_msgTCPTask{TCP_TASK}$ Sending data over socket..
[DEBUG] 25.19  m2m_tcp_test.c:342 - M2M_msgTCPTask{TCP_TASK}$ Data send successfully (16 bytes)
[DEBUG] 27.20  m2m_tcp_test.c:356 - M2M_msgTCPTask{TCP_TASK}$ trying to receive 16 bytes..
[DEBUG] 27.21  m2m_tcp_test.c:364 - M2M_msgTCPTask{TCP_TASK}$ Data received (16): <hello from m2mb!>
[DEBUG] 27.21  m2m_tcp_test.c:373 - M2M_msgTCPTask{TCP_TASK}$ application exit
[DEBUG] 27.22  m2m_tcp_test.c:385 - M2M_msgTCPTask{TCP_TASK}$ m2mb_pdp_deactivate returned success
[DEBUG] 27.24  m2m_tcp_test.c:388 - M2M_msgTCPTask{TCP_TASK}$ Application complete.
[DEBUG] 29.43  m2m_tcp_test.c:164 - PdpCallback{pubTspt_0}$ Context successfully deactivated!
```

Figure 77

3.4.35 TCP Socket status

Sample application showcasing how to check a TPC connected socket current status. Debug prints on **USB0**

Features

- How to check module registration and activate PDP context
- How to open a TCP client socket
- How to check if the TCP socket is still valid

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage socket and start it

`m2m_tcp_test.c`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Create socket and link it to the PDP context id
- Connect to the server
- Check in a loop the current socket status using the adv_select function with a 2 seconds timeout
- Close socket when the remote host closes it
- Disable PDP context

```
Starting TCP socket status check demo app. This is v1.0.14-C1 built on Sep  8 2020 14:59:25.
[DEBUG] 21.33  m2m_tcp_tes:324 - M2M_msgTCPTask{TCP_TASK}$ INIT
[DEBUG] 21.34  m2m_tcp_tes:338 - M2M_msgTCPTask{TCP_TASK}$ m2mb_os_ev_init success
[DEBUG] 21.34  m2m_tcp_tes:344 - M2M_msgTCPTask{TCP_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 21.35  m2m_tcp_tes:352 - M2M_msgTCPTask{TCP_TASK}$ Waiting for registration...
[DEBUG] 21.36  m2m_tcp_tes:365 - M2M_msgTCPTask{TCP_TASK}$ Pdp context activation
[DEBUG] 21.37  m2m_tcp_tes:369 - M2M_msgTCPTask{TCP_TASK}$ m2mb_pdp_init returned M2MB_RESULT_SUCCESS
[DEBUG] 23.41  m2m_tcp_tes:384 - M2M_msgTCPTask{TCP_TASK}$ Activate PDP with APN NXT17.NET....
[DEBUG] 24.09  m2m_tcp_tes:281 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 24.10  m2m_tcp_tes:284 - PdpCallback{pubTspt_0}$ IP address: 100.77.5.223
[DEBUG] 24.10  m2m_tcp_tes:394 - M2M_msgTCPTask{TCP_TASK}$ Creating Socket...
[DEBUG] 24.11  m2m_tcp_tes:405 - M2M_msgTCPTask{TCP_TASK}$ Socket created
[DEBUG] 24.11  m2m_tcp_tes:415 - M2M_msgTCPTask{TCP_TASK}$ Socket ctx set to 3
[DEBUG] 24.60  m2m_tcp_tes:428 - M2M_msgTCPTask{TCP_TASK}$ Retrieved IP: 185.86.42.218
[DEBUG] 24.93  m2m_tcp_tes:443 - M2M_msgTCPTask{TCP_TASK}$ Socket Connected!
[DEBUG] 26.98  m2m_tcp_tes:461 - M2M_msgTCPTask{TCP_TASK}$ Socket does not have any event, try again...
[DEBUG] 29.03  m2m_tcp_tes:461 - M2M_msgTCPTask{TCP_TASK}$ Socket does not have any event, try again...

...

[DEBUG] 82.18  m2m_tcp_tes:461 - M2M_msgTCPTask{TCP_TASK}$ Socket does not have any event, try again...
[DEBUG] 84.23  m2m_tcp_tes:461 - M2M_msgTCPTask{TCP_TASK}$ Socket does not have any event, try again...
[DEBUG] 86.28  m2m_tcp_tes:461 - M2M_msgTCPTask{TCP_TASK}$ Socket does not have any event, try again...
[DEBUG] 88.31  m2m_tcp_tes:461 - M2M_msgTCPTask{TCP_TASK}$ Socket does not have any event, try again...
[DEBUG] 88.90  m2m_tcp_tes:154 - adv_select{TCP_TASK}$ Data is available on socket <0x40032b3c>
[DEBUG] 88.92  m2m_tcp_tes:160 - adv_select{TCP_TASK}$ There are <0> pending bytes on socket
Socket was closed by remote!
[DEBUG] 88.92  m2m_tcp_tes:494 - M2M_msgTCPTask{TCP_TASK}$ application exit
[DEBUG] 88.94  m2m_tcp_tes:506 - M2M_msgTCPTask{TCP_TASK}$ m2mb_pdp_deactivate returned success
[DEBUG] 88.94  m2m_tcp_tes:509 - M2M_msgTCPTask{TCP_TASK}$ Application complete.
[DEBUG] 89.31  m2m_tcp_tes:290 - PdpCallback{pubTspt_0}$ Context successfully deactivated!
```

Figure 78

3.4.36 TCP Server

Sample application showcasing TCP listening socket demo with M2MB API. Debug prints on **USB0**

Features

- How to check module registration and activate PDP context
- How to open a TCP listening socket
- How to manage external hosts connection and exchange data

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task to manage socket and start it

`m2m_tcp_test.c`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Create socket and set it in non-blocking mode
- Bind the socket to the listening port
- Start listening for incoming connection
- Check if a connection is incoming using m2mb_socket_bsd_select function
- If a client connects, perform accept on the child socket
- Send a “START” message to the client
- Send some data
- Wait for data from client and print it
- Close the child socket
- Start listening again, up to 3 times
- Close listening socket
- Disable PDP context

Debug Log

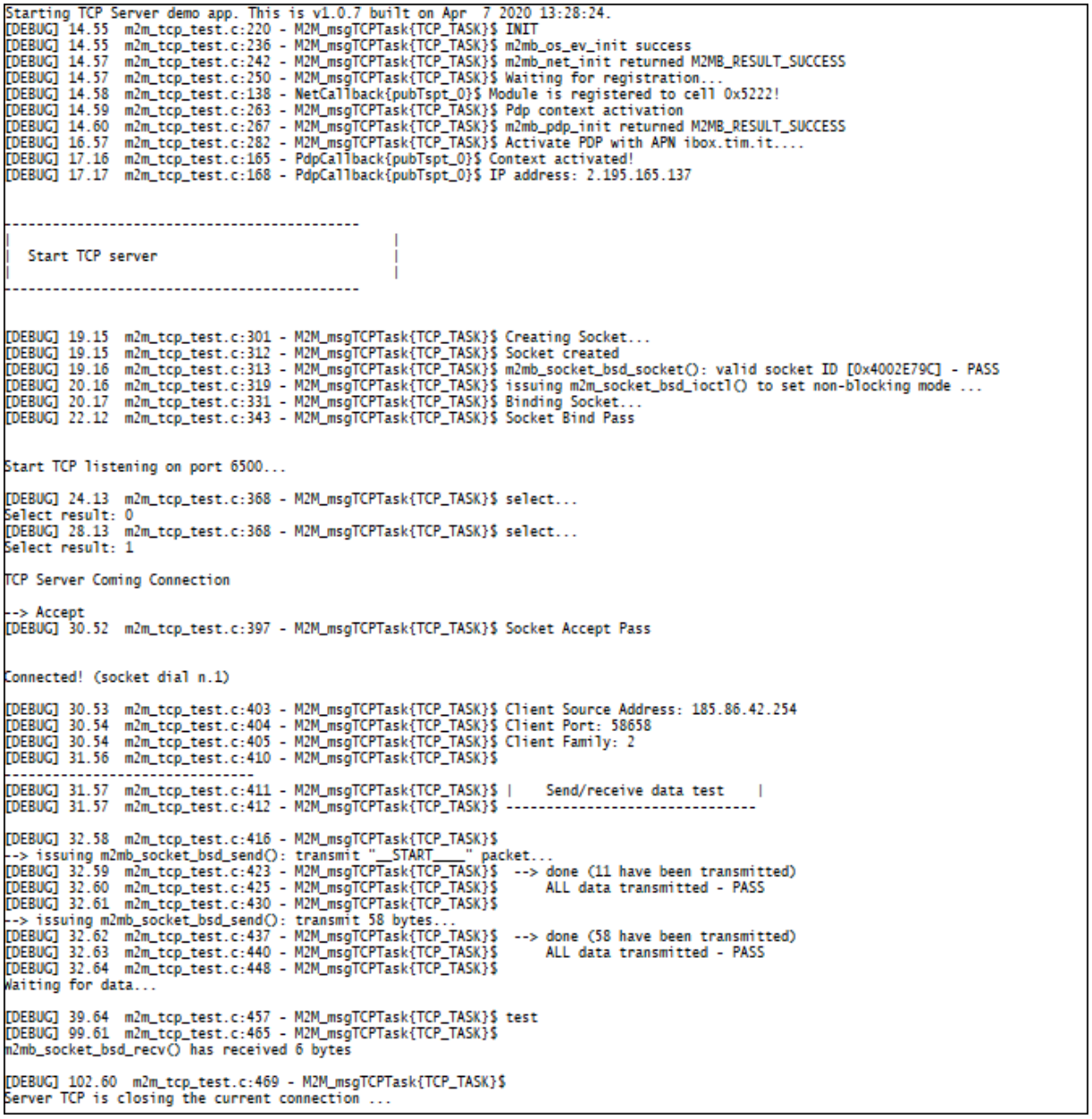

Figure 79

Data on a PuTTY terminal

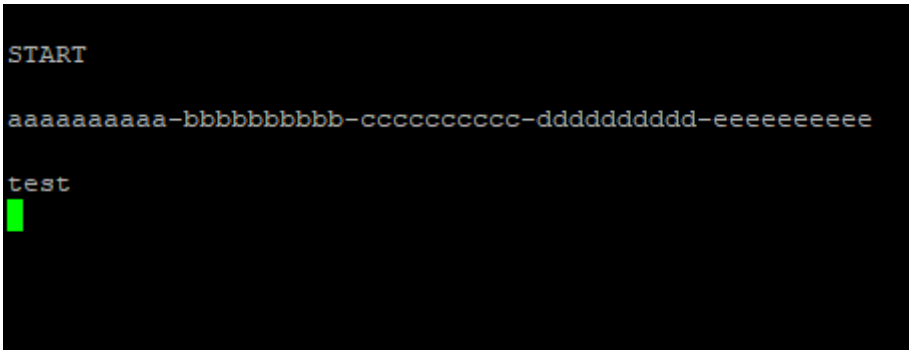
START
aaaaaaaaaa-bbbbbbbbbb-cccccccccc-dddddddddd-eeeeeeeeee
test

Figure 80

3.4.37 TLS SSL Client

Sample application showcasing TLS/SSL with client certificates usage with M2MB API. Debug prints on **USB0**

Features

- How to check module registration and enable PDP context
- How to open a SSL client socket
- How to communicate over SSL socket

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Create a task to manage the connection and start it

`ssl_test.c`

- Initialize Network structure and check registration
- Initialize PDP structure and start PDP context
- Create socket and link it to the PDP context id
- Connect to the server over TCP socket
- Initialize the TLS parameters (TLS1.2) andh auth mode (server+client auth in the example)
- Create SSL context
- Read certificates files and store them
- Create secure socket and connect to the server using SSL
- Send data and receive response
- Close secure socket
- Close socket
- Delete SSL context
- Disable PDP context

The application requires the certificates to be stored in `/data/azc/mod/ssl_certs/` folder. It can be created with

```
AT#M2MMKDIR=/data/azc/mod/ssl_certs
```

Certificates can then be loaded with

```
AT#M2MWRITE="/data/azc/mod/ssl_certs/data/azc/modulesCA.crt",1740
```

and providing the file content in RAW mode (for example using the “Transfer Data” button in Telit AT Controller)

For client certificates (if required), the commands will be

```
AT#M2MWRITE="/data/azc/mod/ssl_certs/data/azc/modulesClient.crt",1651
AT#M2MWRITE="/data/azc/mod/ssl_certs/data/azc/modulesClient_pkcs1.key",1679
```

PLEASE NOTE: always verify the file sizes to be used in the commands above as they might change

```
Starting TLS-SSL demo app. This is v1.1.2 built on Mar  3 2021 10:15:00.
[DEBUG] 10.85  ssl_test:252 - msgHTTPSTask{TLS_TASK}$ INIT
[DEBUG] 10.85  ssl_test:266 - msgHTTPSTask{TLS_TASK}$ m2mb_os_ev_init success
[DEBUG] 10.85  ssl_test:270 - msgHTTPSTask{TLS_TASK}$ Init SSL session test app
[DEBUG] 10.85  ssl_test:285 - msgHTTPSTask{TLS_TASK}$ m2mb_ssl_create_config sslConfigHndl = 0x40037958, sslRes= 0
[DEBUG] 10.85  ssl_test:294 - msgHTTPSTask{TLS_TASK}$ m2mb_ssl_create_config PASSED
[DEBUG] 10.85  ssl_test:306 - msgHTTPSTask{TLS_TASK}$ m2mb_ssl_create_ctxt PASSED
[DEBUG] 10.85  ssl_test:311 - msgHTTPSTask{TLS_TASK}$ loading CA CERT from file /mod/ssl_certs/modulesCA.crt
[DEBUG] 10.85  ssl_test:315 - msgHTTPSTask{TLS_TASK}$ file size: 1740
[DEBUG] 10.85  ssl_test:328 - msgHTTPSTask{TLS_TASK}$ Reading content from file. Size: 1740
Buffer successfully received from file. 1740 bytes were loaded.
Closing file.
[DEBUG] 10.85  ssl_test:361 - msgHTTPSTask{TLS_TASK}$ loading client CERT from file /mod/ssl_certs/modulesClient.crt
[DEBUG] 10.85  ssl_test:365 - msgHTTPSTask{TLS_TASK}$ file size: 1651
[DEBUG] 10.85  ssl_test:378 - msgHTTPSTask{TLS_TASK}$ Reading content from file. Size: 1651
Buffer successfully received from file. 1651 bytes were loaded.
Closing file.
[DEBUG] 10.85  ssl_test:401 - msgHTTPSTask{TLS_TASK}$ loading client KEY from file /mod/ssl_certs/modulesClient_pkcs1.key
[DEBUG] 10.85  ssl_test:405 - msgHTTPSTask{TLS_TASK}$ file size: 1679
[DEBUG] 10.85  ssl_test:418 - msgHTTPSTask{TLS_TASK}$ Reading content from file. Size: 1679
Buffer successfully received from file. 1679 bytes were loaded.
Closing file.
[DEBUG] 10.85  ssl_test:448 - msgHTTPSTask{TLS_TASK}$ certificates successfully stored!
[DEBUG] 10.85  ssl_test:457 - msgHTTPSTask{TLS_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
[DEBUG] 10.85  ssl_test:465 - msgHTTPSTask{TLS_TASK}$ Waiting for registration...
[DEBUG] 10.86  ssl_test:171 - NetCallback{pubTspt_0}$ Module is registered to cell 0x468E!
[DEBUG] 10.86  ssl_test:477 - msgHTTPSTask{TLS_TASK}$ Pdp context activation
[DEBUG] 10.86  ssl_test:481 - msgHTTPSTask{TLS_TASK}$ m2mb_pdp_init returned M2MB_RESULT_SUCCESS
[DEBUG] 12.87  ssl_test:496 - msgHTTPSTask{TLS_TASK}$ Activate PDP with APN web.omnitel.it....
[DEBUG] 13.71  ssl_test:197 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 13.71  ssl_test:200 - PdpCallback{pubTspt_0}$ IP address: 2.41.76.63
[DEBUG] 13.71  ssl_test:514 - msgHTTPSTask{TLS_TASK}$ Creating Socket...
[DEBUG] 13.71  ssl_test:525 - msgHTTPSTask{TLS_TASK}$ Socket created
[DEBUG] 13.71  ssl_test:535 - msgHTTPSTask{TLS_TASK}$ Socket ctx set to 3
[DEBUG] 13.92  ssl_test:548 - msgHTTPSTask{TLS_TASK}$ Retrieved IP: 185.86.42.218
[DEBUG] 14.05  ssl_test:562 - msgHTTPSTask{TLS_TASK}$ Socket Connected!
[DEBUG] 15.97  ssl_test:587 - msgHTTPSTask{TLS_TASK}$ m2mb_ssl_connect ret 0
[DEBUG] 17.99  ssl_test:593 - msgHTTPSTask{TLS_TASK}$ Sending bytes..
```

```
[DEBUG] 17.99  ssl_test:593 - msgHTTPSTask{TLS_TASK}$ Sending bytes..
[DEBUG] 17.99  ssl_test:596 - msgHTTPSTask{TLS_TASK}$ SSL write result = 44
[DEBUG] 22.03  ssl_test:608 - msgHTTPSTask{TLS_TASK}$ pending bytes: 1087
[DEBUG] 22.03  ssl_test:612 - msgHTTPSTask{TLS_TASK}$ trying to receive 1087 bytes..
[DEBUG] 22.03  ssl_test:618 - msgHTTPSTask{TLS_TASK}$ Server response: (269)<HTTP/1.1 200 OK
Date: Wed, 03 Mar 2021 09:18:22 GMT
Server: Apache/2.2.15 (CentOS)
Last-Modified: Mon, 22 Jan 2018 10:57:39 GMT
ETag: "1fffc-27f-5635b4c6f12b3"
Accept-Ranges: bytes
Content-Length: 639
Connection: close
Content-Type: text/html; charset=UTF-8

>
[DEBUG] 22.03  ssl_test:634 - msgHTTPSTask{TLS_TASK}$ pending bytes: 762
[DEBUG] 22.03  ssl_test:638 - msgHTTPSTask{TLS_TASK}$ trying to receive remaining 762 bytes..
[DEBUG] 22.03  ssl_test:644 - msgHTTPSTask{TLS_TASK}$ Server response: (639)<<html>
<head>
 <title>module.telit.com</title>
 <meta content="text/html; charset=utf-8" />
</head>
<body>
 <table border=0 align=center>
 <tr>
 <td height="100" align=center><h2>modules.telit.com - Test HTML page</h2></td>
 </tr>
 <tr>
 <td align=center><img src=Telit.jpg alt="Telit logo" height="126" width="410"></img></td>
 </tr>
 <tr>
 <td height="200" align=center> This is a simple HTML page, </br>
 made with simple HTML code,</br>
 just for test!
 </td>
 </tr>
 <tr>
 <td height="100" align=center><font size="3">Telit &copy; 2015 - 2017 All rights reserved</font></td>
 </tr>
 </table>
</body>
</html>
>
[DEBUG] 22.03  ssl_test:662 - msgHTTPSTask{TLS_TASK}$ application exit
[DEBUG] 22.03  ssl_test:680 - msgHTTPSTask{TLS_TASK}$ m2mb_pdp_deactivate returned success
[DEBUG] 22.03  ssl_test:683 - msgHTTPSTask{TLS_TASK}$ Application complete.
[DEBUG] 22.77  ssl_test:206 - PdpCallback{pubTspt_0}$ Context deactivated!
```

3.4.38 UDP client

Sample application showcasing UDP echo demo with M2MB API. Debug prints on **USB0**

Features

- How to check module registration and activate PDP context
- How to open a UDP client socket
- How to communicate over the socket

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Print welcome message
- Create a task and start it

`m2m_udp_test.c` - Initialize Network structure and check registration - Initialize PDP structure and start PDP context - Create socket and link it to the PDP context id - Send data and receive response - Close socket - Disable PDP context

```
Starting UDP client demo app. This is v1.0.7 built on Apr  1 2020 14:57:13.
INIT
[DEBUG] 21.23  m2m_udp_test.c:223 - M2M_msgUDPTask{UDP_TASK}$ m2mb_net_init returned M2MB_RESULT_SUCCESS
Waiting for registration...
[DEBUG] 21.25  m2m_udp_test.c:131 - NetCallback{pubTspt_0}$ Module is registered to cell 0xC4CF!
[DEBUG] 21.26  m2m_udp_test.c:241 - M2M_msgUDPTask{UDP_TASK}$ Pdp context initialization
[DEBUG] 21.26  m2m_udp_test.c:245 - M2M_msgUDPTask{UDP_TASK}$ m2mb_pdp_init returned M2MB_RESULT_SUCCESS
Activate PDP with APN web.omnitel.it....
[DEBUG] 24.11  m2m_udp_test.c:157 - PdpCallback{pubTspt_0}$ Context activated!
[DEBUG] 24.11  m2m_udp_test.c:160 - PdpCallback{pubTspt_0}$ IP address: 109.113.222.12
[DEBUG] 24.12  m2m_udp_test.c:268 - M2M_msgUDPTask{UDP_TASK}$ Creating Socket...
[DEBUG] 24.13  m2m_udp_test.c:280 - M2M_msgUDPTask{UDP_TASK}$ Socket created
Socket ctx set to 3
[DEBUG] 24.41  m2m_udp_test.c:306 - M2M_msgUDPTask{UDP_TASK}$ Retrieved IP: 185.86.42.218
Socket ready.
Data successfully sent (16 bytes)
Socket recv...
[DEBUG] 26.47  m2m_udp_test.c:352 - M2M_msgUDPTask{UDP_TASK}$ m2mb_socket_bsd_set_sock_opt() M2MB_SOCKET_BSD_SO_RCVTIMEO - success
trying to receive 16 bytes..
Data received (16): <hello from m2mb!>
[DEBUG] 26.48  m2m_udp_test.c:377 - M2M_msgUDPTask{UDP_TASK}$ application exit
Socket Closed
[DEBUG] 26.49  m2m_udp_test.c:399 - M2M_msgUDPTask{UDP_TASK}$ m2mb_pdp_deactivate returned success
Application complete.
[DEBUG] 27.04  m2m_udp_test.c:166 - PdpCallback{pubTspt_0}$ Context successfully deactivated!
```

Figure 81

3.4.39 ZLIB example

Sample application showing how to compress/uncompress with ZLIB. Debug prints on **USB0**

Features

- How to compress a file
- How to uncompress a file

In order to execute the entire test, copy `test.gz` file into your module running the following AT command:

```
AT#M2MWRITE="/data/azc/mod/test.gz",138
>>> here receive the prompt; then type or send the file, sized 138 bytes
```

Application workflow

`M2MB_main.c`

- Open USB/UART/UART_AUX
- Test the compression and decompression of a data string
- Test the decompression of a .gz file (test.gz), expected to be in `/data/azc/mod` folder, into its content `test.txt`. The file must be uploaded by the user (see steps above).

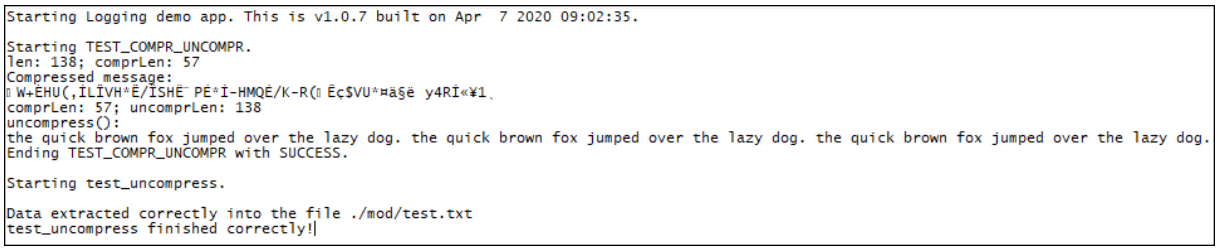

Figure 82

4 Installing beta version libraries Plug-in

4.1 New beta plug-in installation

To install a new plug-in for a beta firmware into the IDE, first receive plug-in ".zip" packet, then unzip the file in a local folder and open the SDK IDE.

PLEASE DO NOT USE BETA PLUGINS FOR PRODUCTION DEPLOYMENTS, SOFTWARE IS PROVIDED AS IS AND CUSTOMER ACKNOWLEDGES THAT IT IS POSSIBLE THE DEVICE MAY MISFUNCTION. PLEASE REFER TO Contact Information, Support section

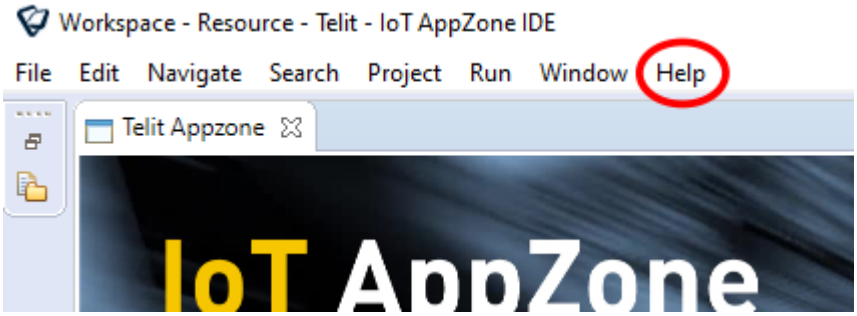

Figure 83

Click on "Help" tag and choose "Install New Software...". This window will appear:

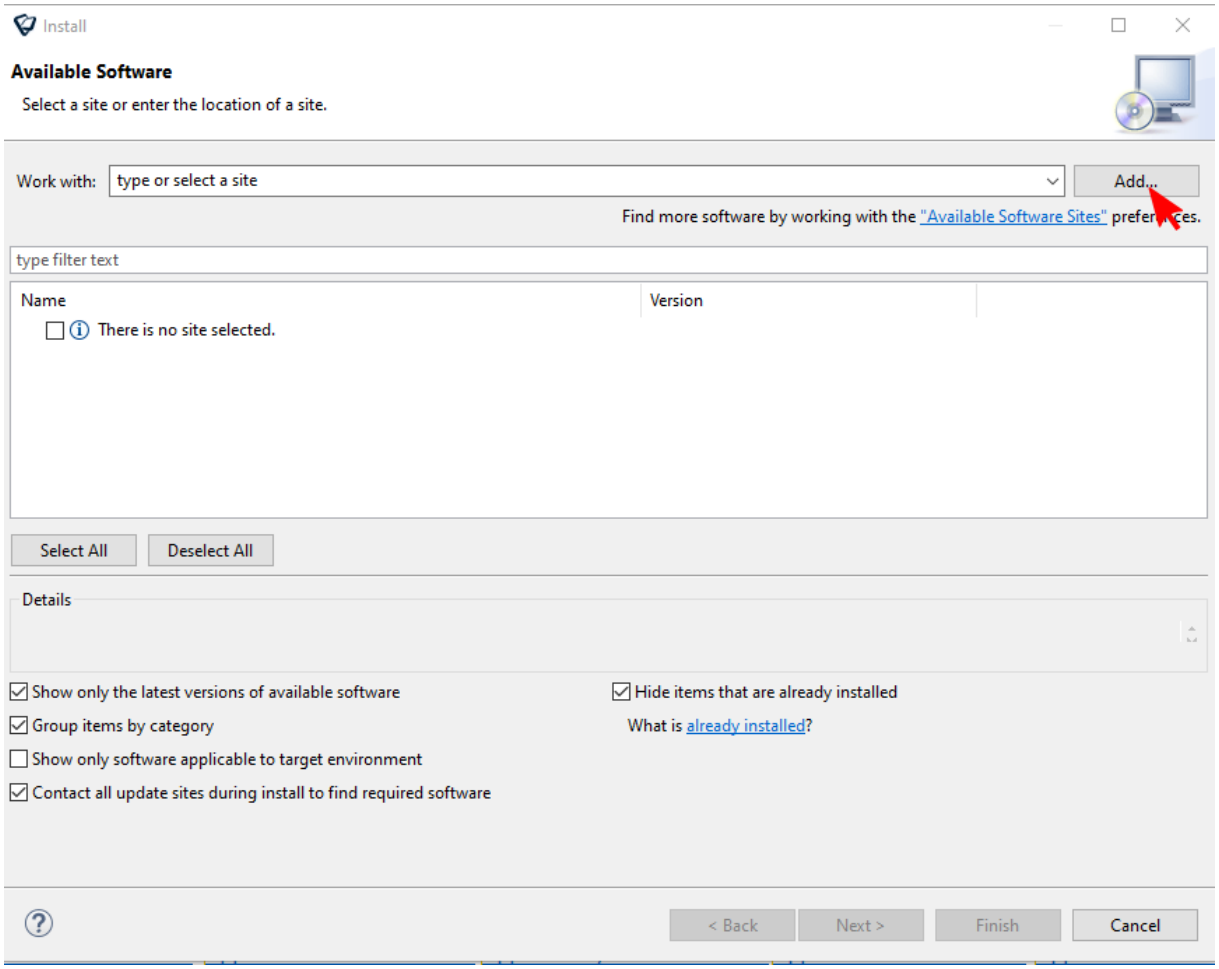

Figure 84

Click on “Add…” button and then in the following window click on “Local…” to select the unzipped folder with the plug-in content.

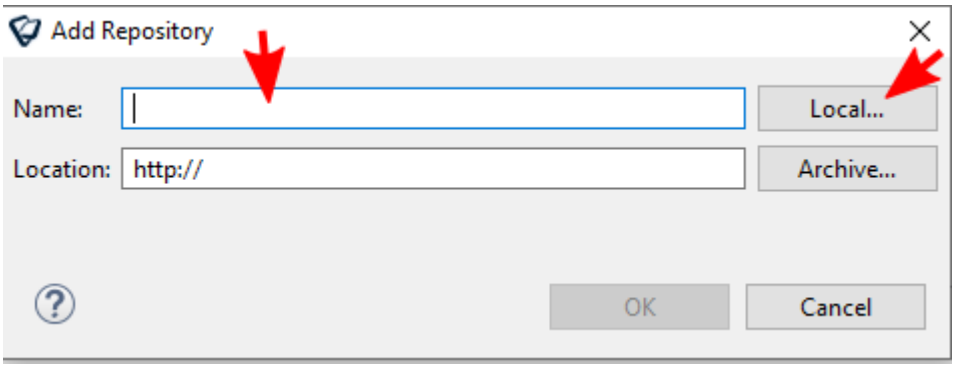

Figure 85

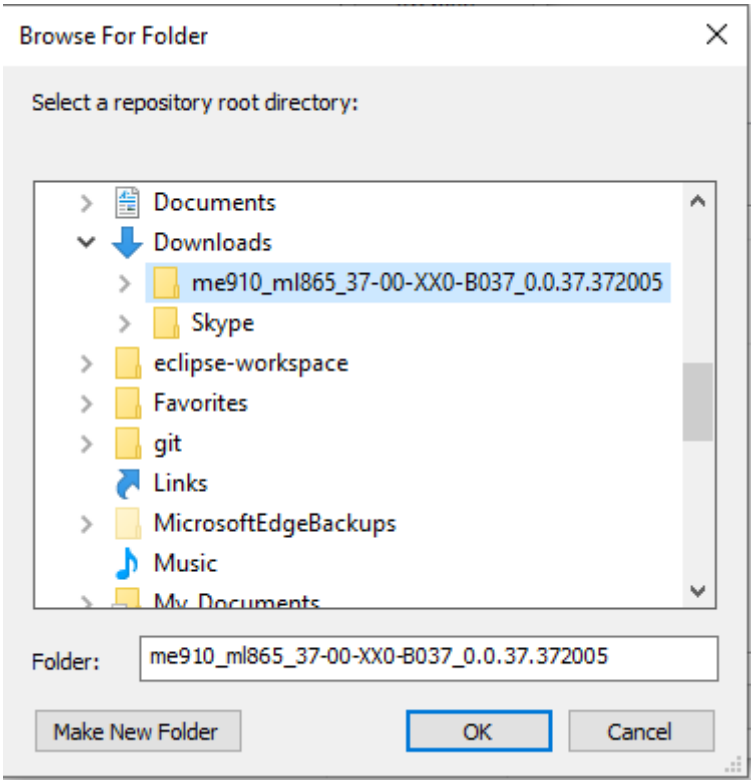

Figure 86

Once selected the plug-in folder, the “Location:” form will present the selected path. Now in “Name:” write a name for the new libraries (for example 37.00.xx0_B037) and click on “OK” button.

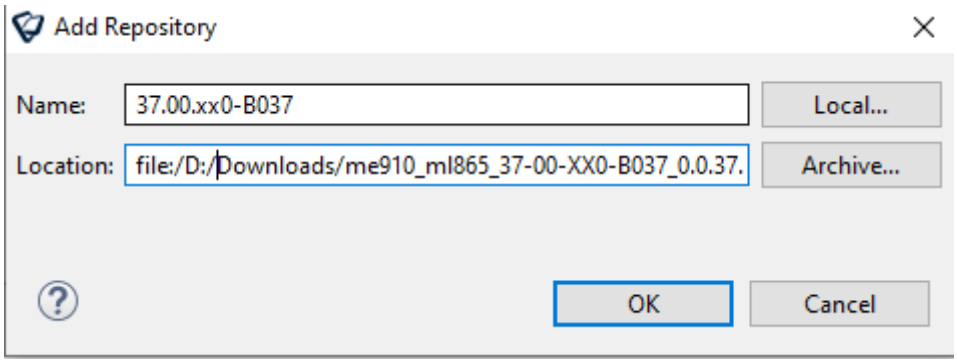

Figure 87

The new packet is now ready to be installed: select it and click on “Next >” button until “Review Licenses” window will appear.

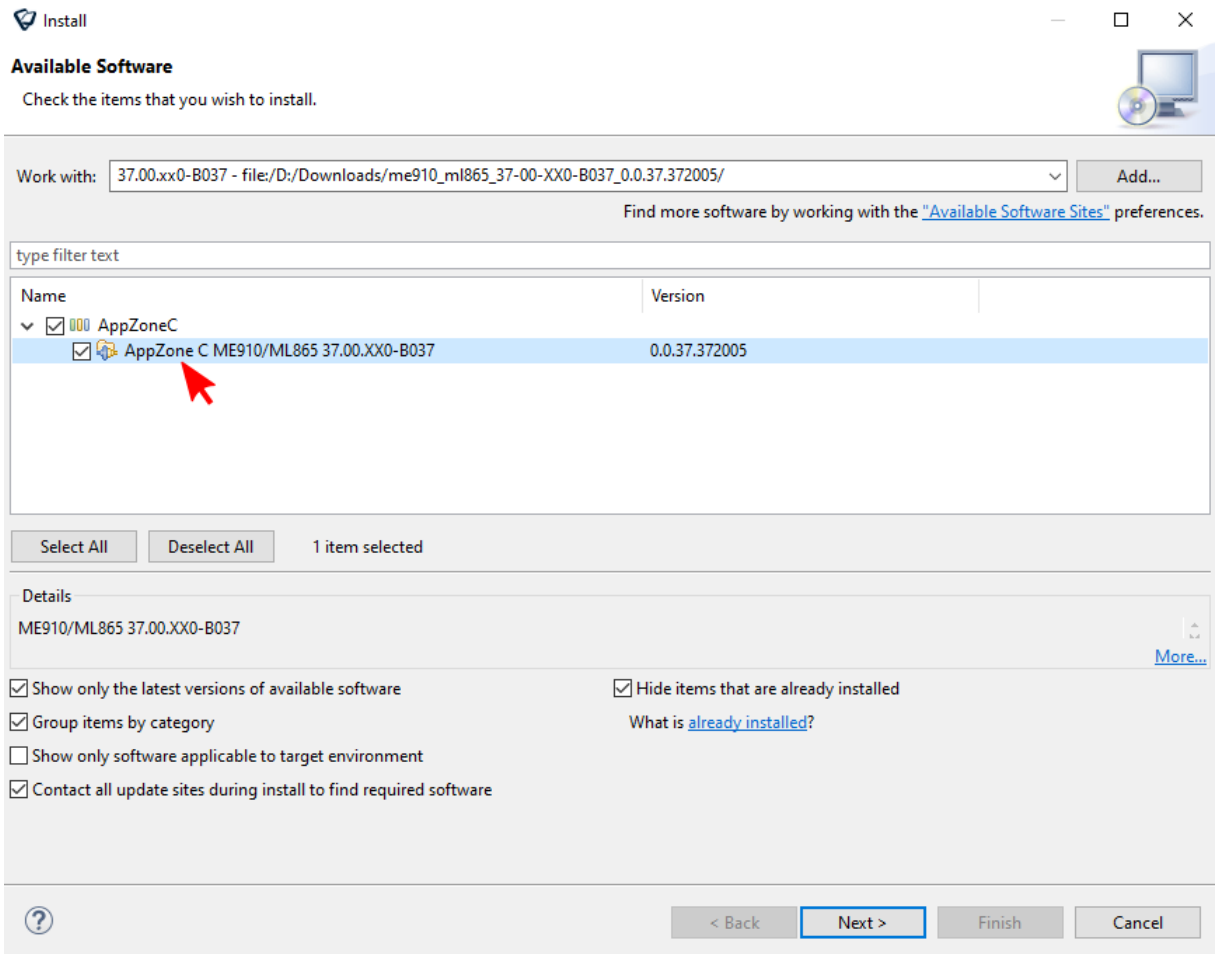

Figure 88

Accept the licenses when required and click on “Finish” button to complete the installation.

4.2 Change existing project libraries

To align an old project to the new libraries, right click on the project and choose “Properties”.

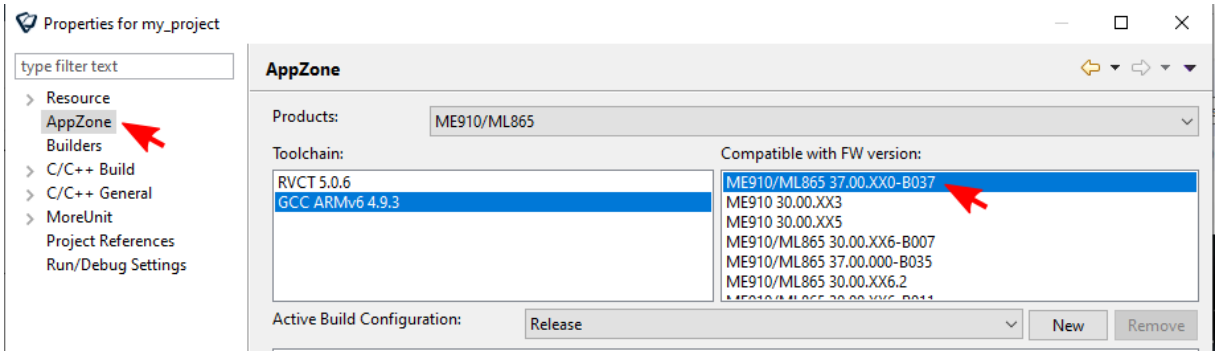

Figure 89

Now select “AppZone” on the left side of the window, and on the right choose the packet with the same name as the firmware version to be used. Then click on “OK” (or “Apply”) button.

4.3 Create a project with the new plug-in

To use the new libraries, create a new project: “File”-> “New” -> “Telit Project”

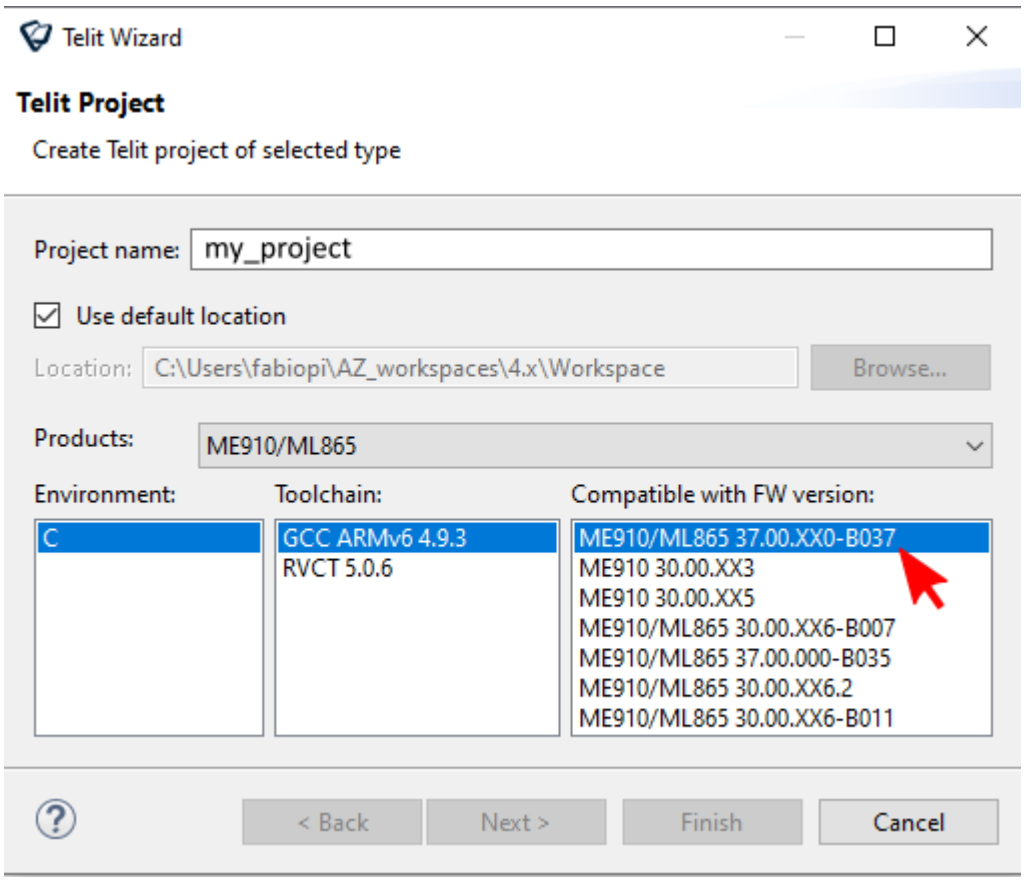

Figure 90

Select the new firmware version (37.00.xx0-B037) and create an empty project.

SUPPORT INQUIRIES

Link to **www.telit.com** and contact our technical support team for any questions related to technical issues.

www.telit.com

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