F3 Wireless

F3 Wireless, a leading innovator of IoT solutions, recently announced the industry's first IoT Modem Management Agent (MMA) software for embedded Linux. Adding cellular data to a product is a complicated process. A modem can be on or off, connected or not, roaming, denied registration, in a sleep mode, misbehaving, or any other number of states. Each one of these states may require different behavior or response that is dependent on upper level application requirements. A service is needed to control the modem, the mobile data channel, and its related features. This software intelligence is what we refer to as the Modem Management Agent, or the MMA.

The major benefit of this first of its kind software, is that it allows companies to bypass the time-consuming exercise of having to learn all the corner cases and special situations presented by cellular radios, cellular networks and related device features such as power management. The MMA software program runs on an IoT focused embedded or standard computer and manages and directs the cellular radio.

Having an off the shelf solution through F3 Wireless' MMA software, helps companies take advantage of these time and money savings components:

- **Comprehensive engine:** Advanced state machine that manages the power modes, configuration, initialization, APN management, registration, roaming, and mobile data enablement, with robust error recovery.
- **Control and configuration:** Control current power state, registration state (or force roaming to certain networks), mobile data state, or set a custom APN, all through a simple key-value configuration structure that is applied in real-time.
- **Transparency to modem and network status:** Expose the detailed state of the cellular system in a simple key-value format, including power/registration status, technology (2G/3G/LTE), SIM/modem ID, signal quality, and networking/IP parameters.
- **SMS message store:** Easily send/receive messages through a local message store system. The MMA automatically receives incoming text messages and stores them to the inbox, and sends any messages in the outbox.
- **Networking:** MMA software works whether a company is running a Linux PC with a USB connection to the modem, or using a tiny microcontroller with no IP stack capability. It can handle attaching the mobile data context to a Linux machine so it shows up as a standard network interface, or make use of the internal modem stack with the MMA NetworkStack module, which exposes the stack to an application.
- **HAL:** Allow a single application/system to be deployed with more than one cell radio without changing application software. Once support for a new modem is added to the MMA, systems can use any supported modem that includes the features required for the application. The MMA acts as an abstraction layer to let the application software always work the same way, regardless of modem attached.

3 Example Cases Addressed by the MMA

Case: The AT command terminal requires a non-trivial command parser to handle the syntax of both asynchronous (unsolicited) and synchronous (command -> reply) communications.
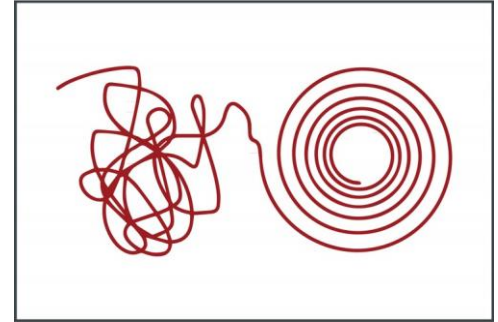
MMA: The "ATHandler" component of the MMA is a command parser engine intended to work with Cellular modems by providing not only the basic terminal I/O, but the ability to handle both synchronous AT commands as well as asynchronous Unsolicited Result Codes (URC's) from the modem. It handles the string-matching, field parsing of the AT syntax, timeouts, CME/CMS error handling, and detection of URC's from the modem.

The MMA is the interpreter and controller between the application software and cell module.

Case: There are many edge cases of a cellular modules state flow that are not obvious until they occur. For example - what is the correct course of action when your terminal fails to get a proper reply from the module, or if the PDP context is deactivated while the module is still registered with good signal quality?
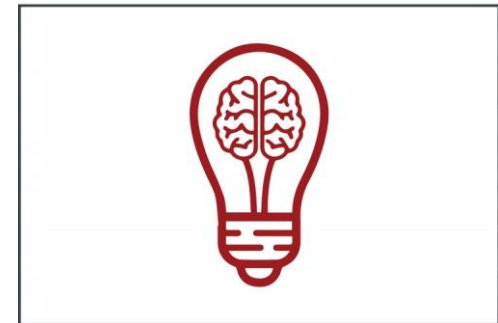
MMA: The primary state machine of the MMA will handle all operational states of the modem, including the power on and off sequences. It handles setting up the modem for usage on your type of host system (Linux, etc), and applying any of your config values. Continuous monitoring of the modem with the correct sequence of recovery protocols run in the background, to make sure dependencies are torn down and set up accordingly when one of these events occurs.

The MMA is a collection of wisdom and experience for handling a wide array of special situations.

Case: Configuration and Status of the modem is required by upstream applications. Real-time control of the modem state is required.
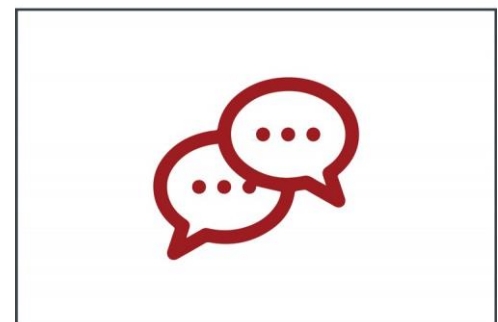
MMA: The MMA uses the commonly known "ini" style configuration file, as well as a key-value status file to configure and view the status of the modem in real-time. For consumption by any system application, it exports IMEI, SIM ID, registration status, access technology, signal quality, operator, and IP information.

The MMA talks to the cell module and manages the appropriate processes and responses.