LORA / LORAWAN TUTORIAL 20

LoRa End Node Libraries

```
ostime_t calcAirTime (rps_t rps, u1_t plen) {
    u1_t bw = getBw(rps);
    u1_t sf = getSf(rps);
    if( sf == FSK ) {
        return (plen+/*preamble*/5+3+1+2) * 8
            * (s4_t)OSTICKS_PER_SEC / 50000;
    }
    u1_t sfx = 4*(sf+(7-SF7));
```

INTRO

- In this tutorial I will explain the origins of several LoRa end nodes libraries and where these libraries are used.

LORA END NODE LIBRARIES

- There are several important LoRa end node libraries.
  - Semtech LoRaMac-node library
  - IBM LMIC library (Note: LMIC stands for LoraMAC-in-C)
  - Arduino LMIC library
- Besides the above mentioned libraries, LoRa development board manufacturers also created their own libraries to be used on their hardware.

SEMTECH LORAMAC-NODE LIBRARY

- Semtech maintains a reference implementation of a LoRa end node.

- The code can be found at this location:
  https://github.com/Lora-net/LoRaMac-node

- API documentation can be found at:
  http://stackforce.github.io/LoRaMac-doc/

- This LoRa node library only supports the following platforms:
  NAMote72, NucleoLxx, SKiM880B, SKiM980A, SKiM881AXL and SAML21.

- A porting guide is available which provides guide lines on how to port the project to other platforms, see:
  http://stackforce.github.io/LoRaMac-doc/_p_o_r_t_i_n_g__g_u_i_d_e.html

IBM LMIC LIBRARY

- The IBM LMIC library was originally developed by the IBM Zurich Research Laboratory.
  IBM has ceased development on this library since version 1.6 (13th July 2015), however it is provided as open source under the BSD License.

- The code can be found at this location:
  https://www.zurich.ibm.com/pdf/lrsc/lmic-release-v1.6.zip or
  https://github.com/lmic-lib/lmic

- This library does not support Arduino platforms.

ARDUINO LMIC

- The IBM LMIC library is ported to Arduino platforms and is called Arduino LMIC.
- This library supports SX1272, SX1276 transceivers and compatible modules such as HopeRF RFM92/RFM95 modules.
- The code can be found at this location:
  https://github.com/matthijskooijman/arduino-lmic
  and are maintained by Matthijs Kooijman, Thomas Telkamp, and others.
- The Arduino LMIC library provides a fairly complete LoRaWAN Class A and Class B implementation, supporting the EU-868 and US-915 bands.
- The compiled size of this library is about 30kBytes.

ARDUINO LMIC FORK

- The Arduino LMIC library is forked many times but the fork made by MCCI Catena seems to be actively maintained.
  https://github.com/mcci-catena/arduino-lmic

- Among others, the MCCI Arduino LMIC has added regional support for Australia (921 MHz), Asia (923 MHz) and India (866 MHz).

ARDUINO LMIC USAGE

- The Arduino LMIC and the MCCI Arduino LMIC library are intended to be used with plain LoRa transceivers, connecting to them using SPI (Serial Peripheral Interface).

- This library contains a full LoRaWAN stack and is intended to drive these transceivers directly.

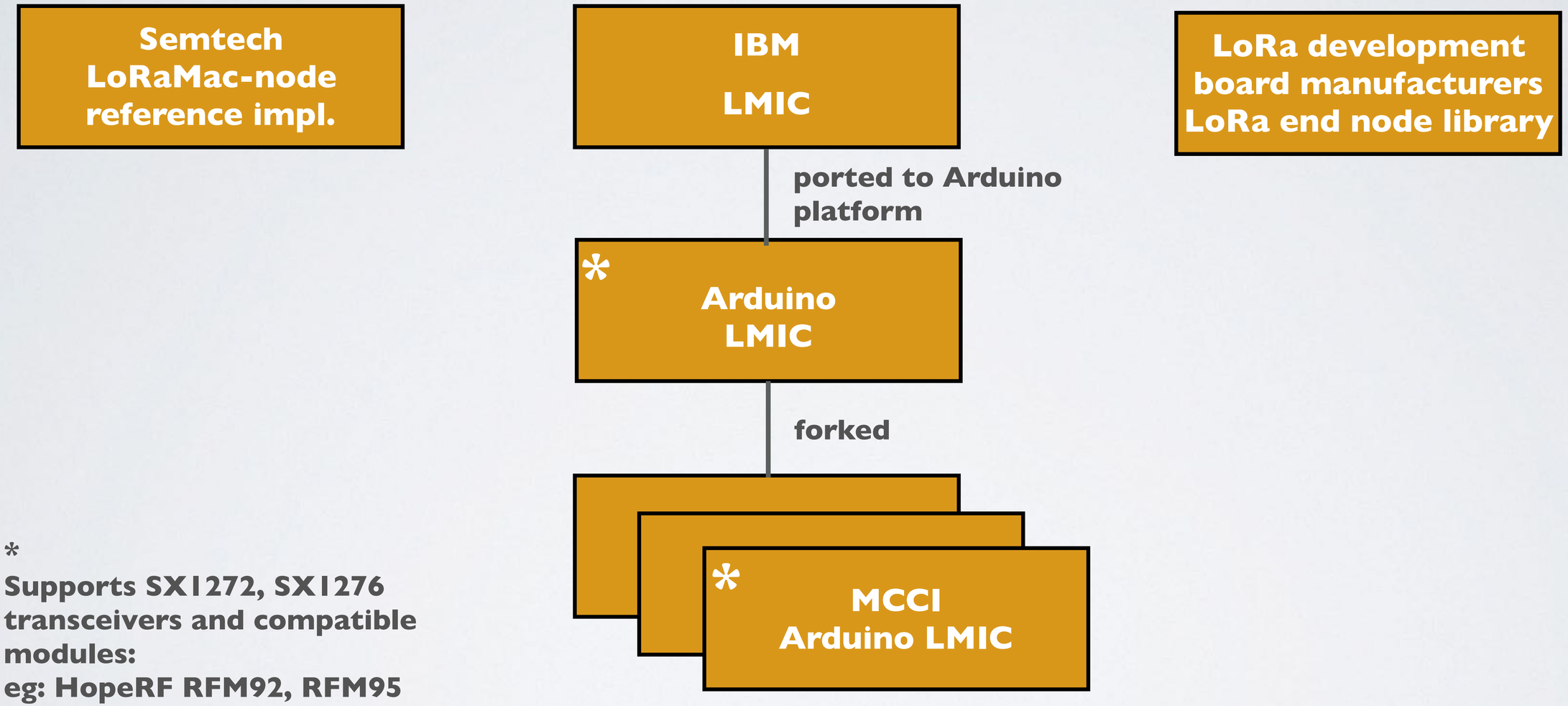
- The library has only been tested with LoRaWAN 1.0.2 networks.

- The library can not be used with full-stack devices like the Microchip RN2483. These modules contains a transceiver and microcontroller that implements the LoRaWAN stack and exposes a high-level serial interface instead of a low-level SPI transceiver interface.

ARDUINO LMIC DOCUMENTATION

- To understand how the Arduino LMIC library works:
  - IBM LoRaWAN in C Technical Specification
    https://github.com/matthijskooijman/arduino-lmic/blob/master/doc/LMiC-v1.5.pdf
  - Semtech SX1272/73 Datasheet
    https://www.semtech.com/uploads/documents/sx1272.pdf
  - Semtech SX1276-7-8-9 Datasheet
    https://www.semtech.com/uploads/documents/DS_SX1276-7-8-9_W_APP_V5.pdf

LORA END NODE LIBRARIES OVERVIEW



*
Supports SX1272, SX1276 transceivers and compatible modules:
eg: HopeRF RFM92, RFM95

OTHER ARDUINO LORA END NODE LIBRARIES

- Other Arduino LoRa end node libraries can be found at:
  https://www.arduinolibraries.info/libraries

- Please note:
  There are libraries available to setup direct communication between two LoRa radio's.
  These libraries have nothing to do with the LoRaWAN protocol.