

RI53 Radio Networks , Spring 2022

Internet of Things (IoT) Adafruit LoRA board



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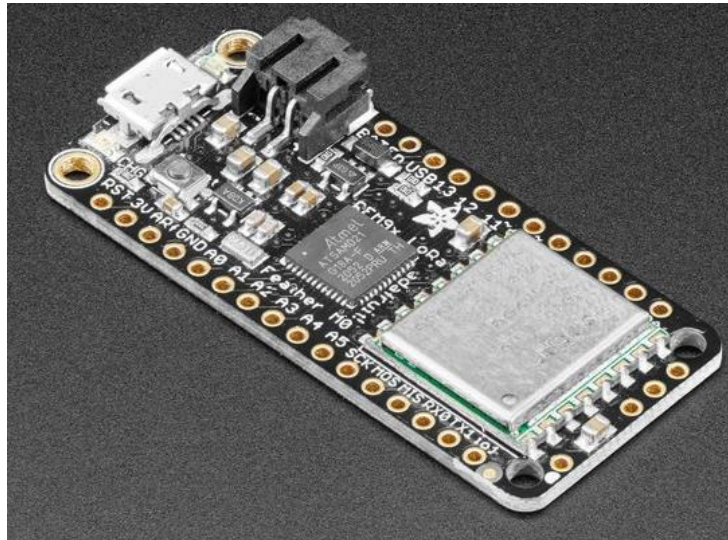
Belfort, 14-06-2022





The Adafruit Feather M0 RFM95 LoRa Radio (900MHz) has a microcontroller with a "[Long Range \(LoRa\)](#)" packet radio transceiver with built in USB and battery charging.

It's a great for making wireless networks that are more flexible than Bluetooth LE and without the high power requirements of WiFi.



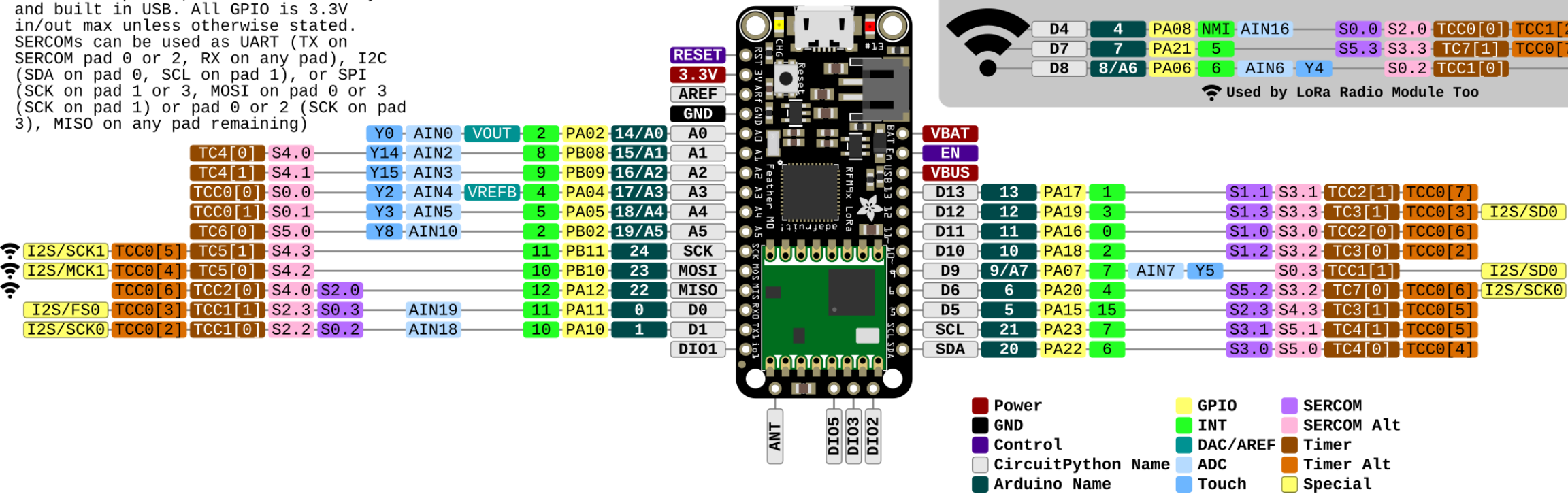


- ☐ ATmega32u4 @ 8MHz with 3.3V logic/power
- ☐ 3.3V regulator with 500mA peak current output
- ☐ USB native support, comes with USB bootloader and serial port debugging
- ☐ You also get tons of pins - 20 GPIO pins
- ☐ Hardware Serial, hardware I2C, hardware SPI support
- ☐ 7 x PWM pins
- ☐ 10 x analog inputs
- ☐ Built in 100mA lipoly charger with charging status indicator LED
- ☐ Pin #13 red LED for general purpose blinking
- ☐ Power/enable pin
- ☐ 4 mounting holes
- ☐ Reset button

Adafruit Feather M0 RFM9x LoRa

<https://www.adafruit.com/products/3178>

The Microchip (nee Atmel) SAMD21 is an ARM Cortex-M0+ running at 48 MHz with 32kB on-chip SRAM, 256KB Flash memory and built in USB. All GPIO is 3.3V in/out max unless otherwise stated. SERCOMs can be used as UART (TX on SERCOM pad 0 or 2, RX on any pad), I2C (SDA on pad 0, SCL on pad 1), or SPI (SCK on pad 1 or 3, MOSI on pad 0 or 3 (SCK on pad 1) or pad 0 or 2 (SCK on pad 3), MISO on any pad remaining)





The open-source Arduino Software (IDE) makes it easy to write code, compile, and upload it to the board. This software can be used with any Arduino board.



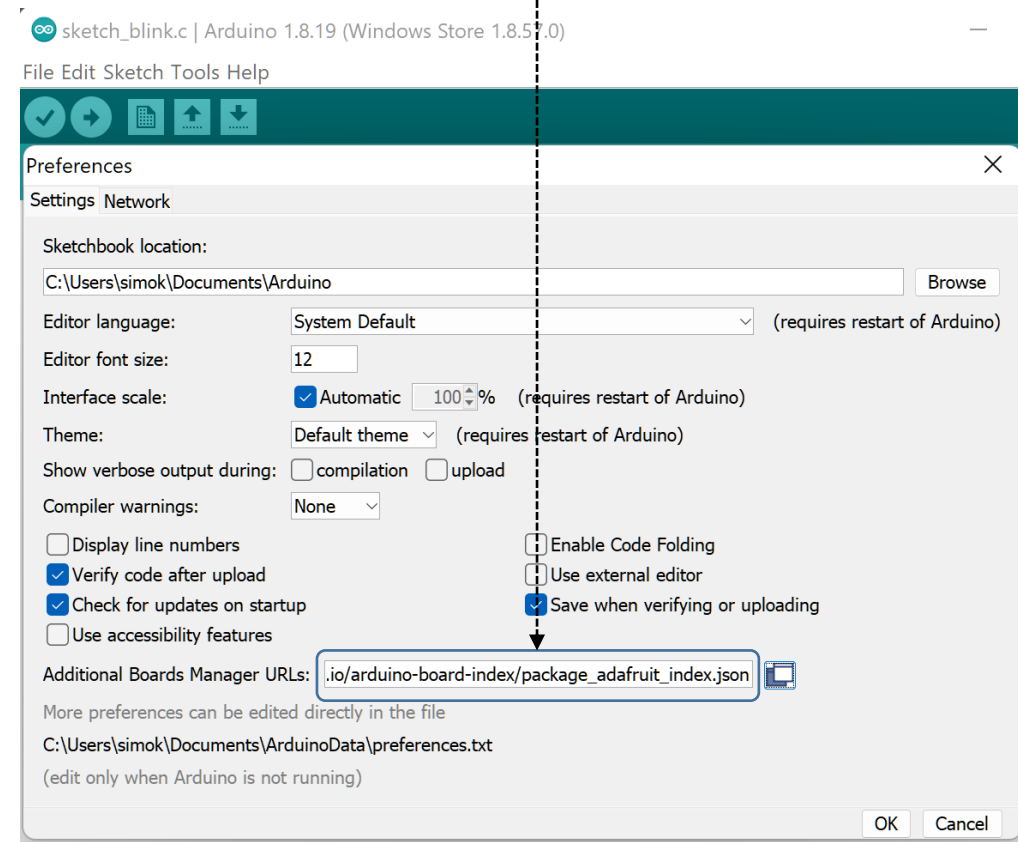
<https://www.arduino.cc/en/software>



The libraries for manipulating the Adafruit board are not installed in the Arduino IDE.

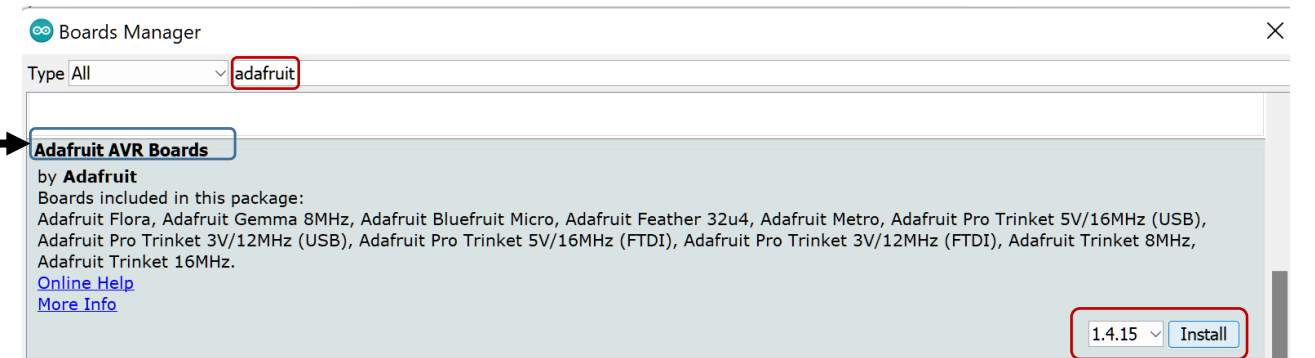
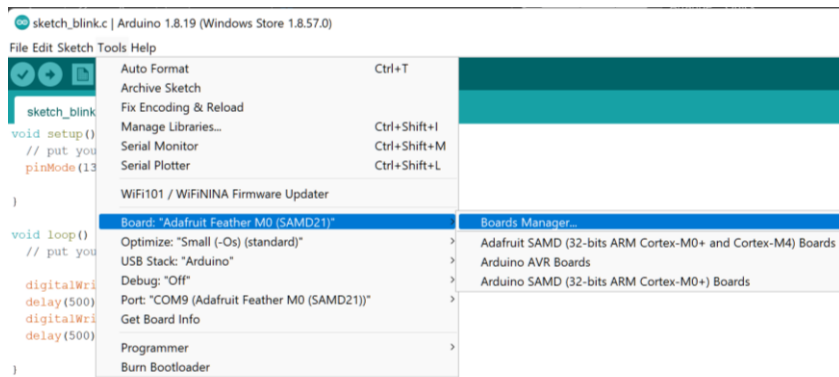
To do so, we need to add the link of the board manager of Adafruit

`https://adafruit.github.io/arduino-board-index/package_adafruit_index.json`



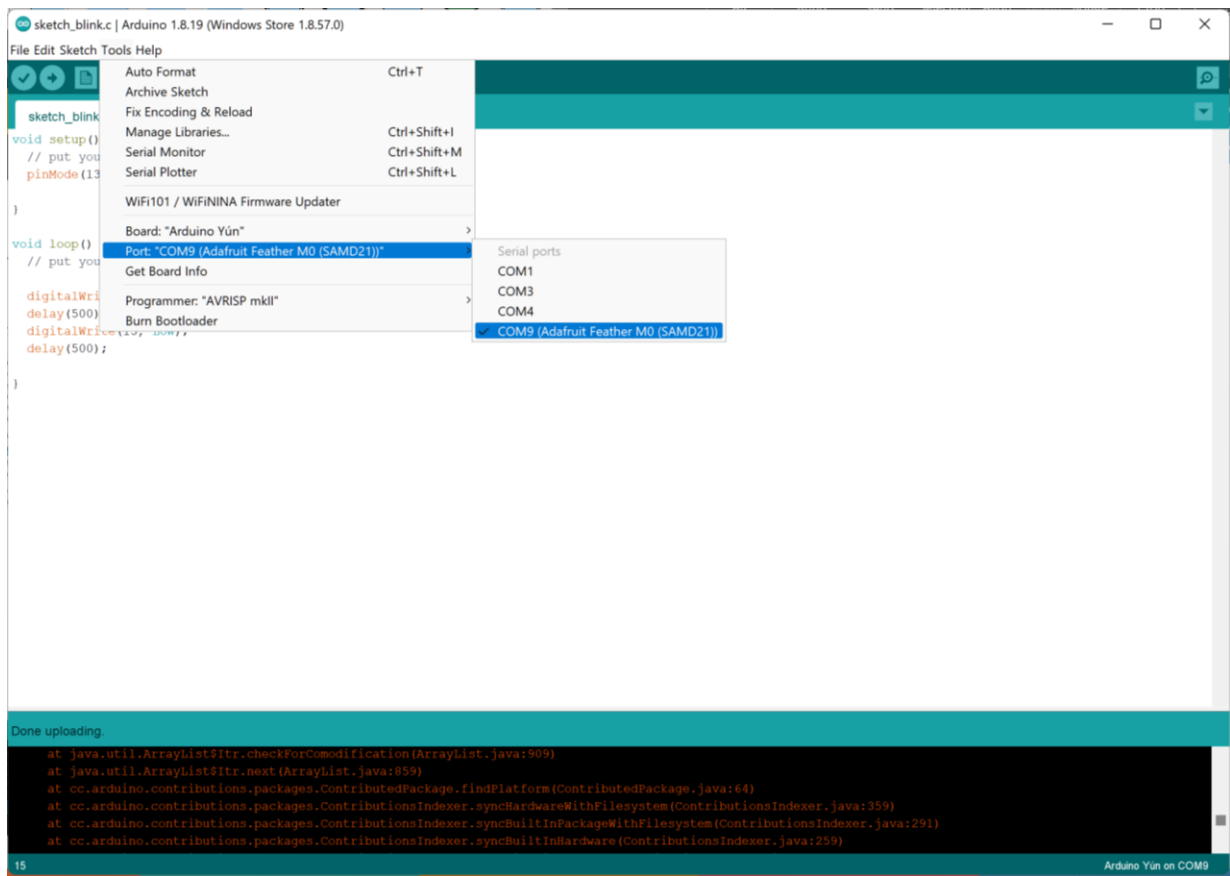
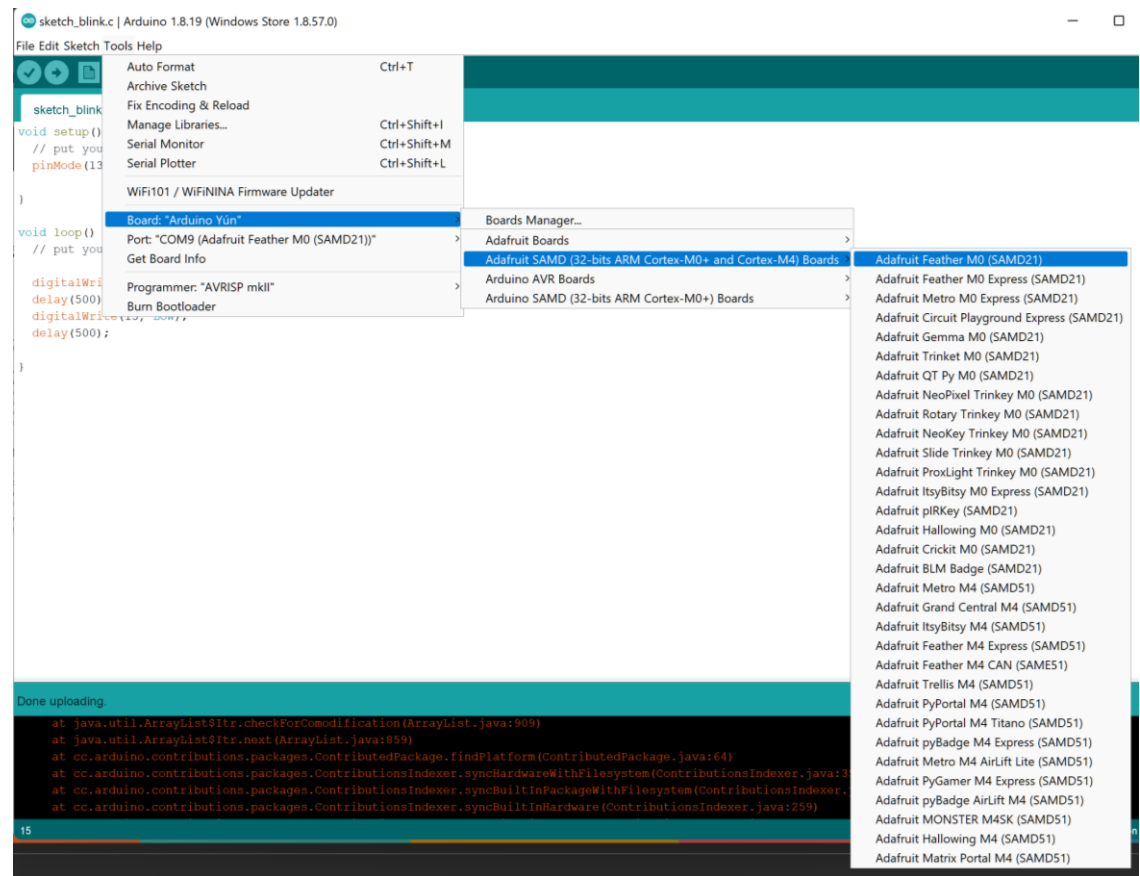


The next step is to install two Adafruit related boards manager from LM (Tools/Bords/ Libraries):



Adafruit Board

Now, we can select the Adafruit board as the target for deployment:



Done uploading.

at java.util.ArrayList\$Itr.checkForComodification(ArrayList.java:909)
at java.util.ArrayList\$Itr.next(ArrayList.java:859)
at cc.arduino.contributions.packages.ContributedPackage.findPlatform(ContributedPackage.java:64)
at cc.arduino.contributions.packages.ContributionsIndexer.syncHardwareWithFilesystem(ContributionsIndexer.java:359)
at cc.arduino.contributions.packages.ContributionsIndexer.syncBuiltInPackageWithFilesystem(ContributionsIndexer.java:291)
at cc.arduino.contributions.packages.ContributionsIndexer.syncBuiltInHardware(ContributionsIndexer.java:259)

15

Arduino Yun on COM9

Adafruit Feather M0 (SAMD21), Small (-Os) (standard), Arduino, Off on COM9

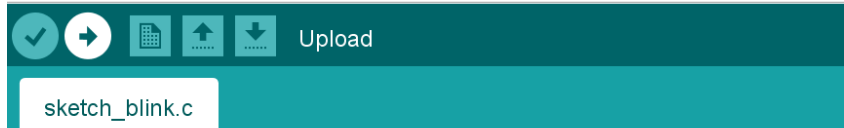


To check the setup, we will run a blinking program on the Built-in LED (PIN13):

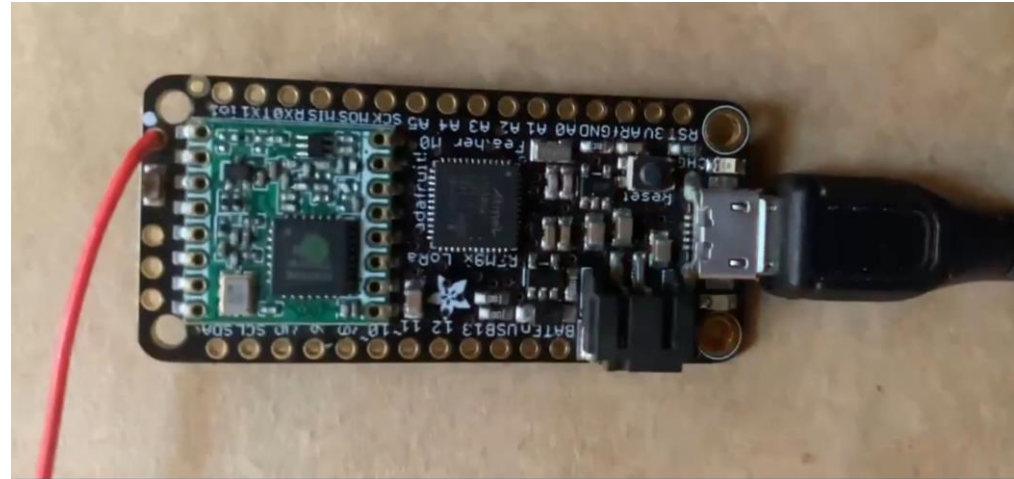
<https://filesender.renater.fr/?s=download&token=6aa16673-c73d-4265-b6a1-beaab17efbc1>

sketch_blink.c | Arduino 1.8.19 (Windows Store 1.8.57.0)

File Edit Sketch Tools Help



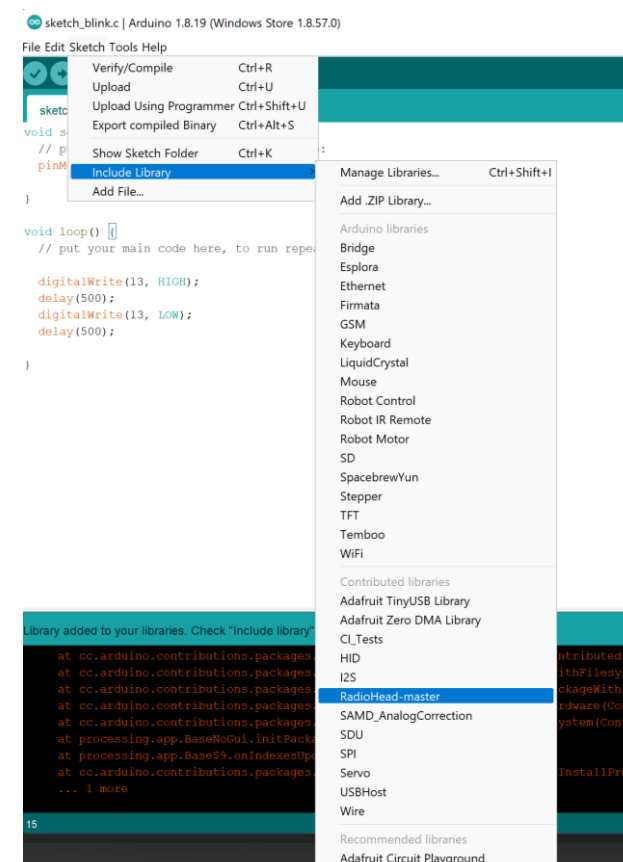
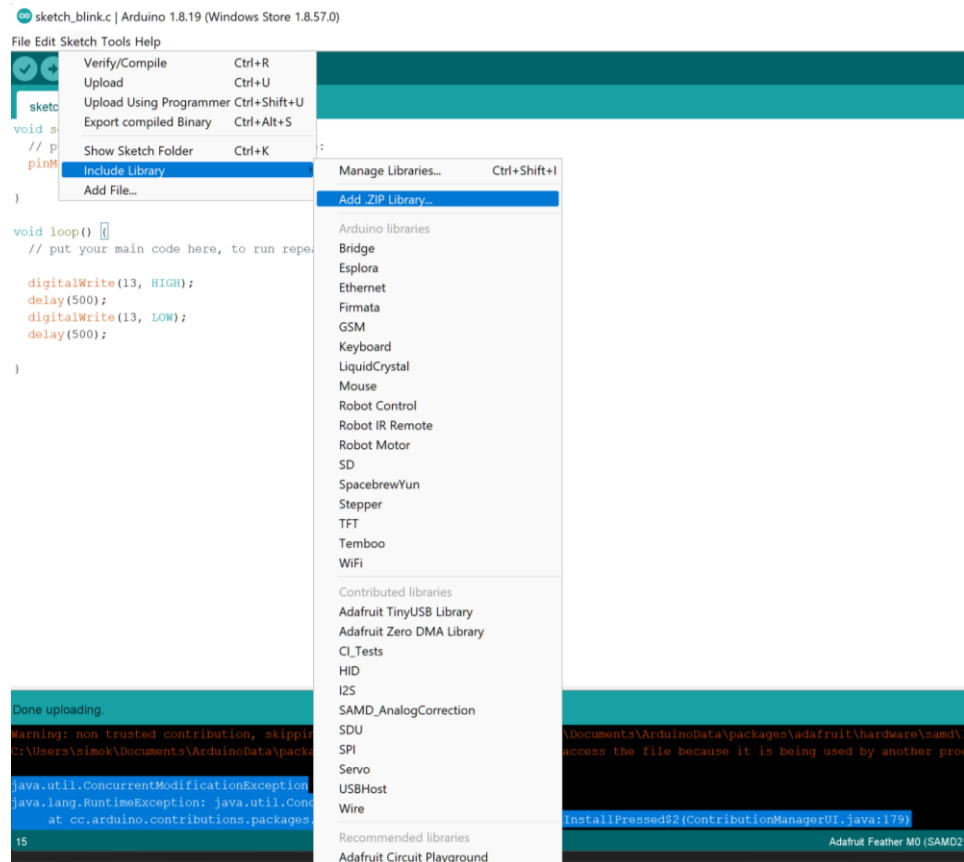
```
void setup() {  
  // put your setup code here, to run once:  
  pinMode(13, OUTPUT);  
}  
  
void loop() {  
  // put your main code here, to run repeatedly:  
  
  digitalWrite(13, HIGH);  
  delay(500);  
  digitalWrite(13, LOW);  
  delay(500);  
}
```





To handle all the LoRA-based communications, we need to include the *RadioHead* that provides functions and methods to do so.

Arduino IDE allows the installation of custom libraries :





LoRA Client Server Com

We will establish a client server communication using LoRA network:



Download both sketches and change the messages to send.
A group will upload the sender file, another group will use the server side

```

Server | Arduino 1.8.19 (Windows Store 1.8.57.0)
File Edit Sketch Tools Help

Server

// The default transmitter power is 13dBm, using PA_BOOST.
// If you are using RFM95/96/97/98 modules which uses the PA_BOOST transmitter pin, then
// you can set transmitter powers from 5 to 23 dBm:
rf95.setTxPower(23, false);

void loop()
{
  if (rf95.available())
  {
    // Should be a message for us now
    uint8_t buf[RH_RF95_MAX_MESSAGE_LEN];
    uint8_t len = sizeof(buf);

    if (rf95.recv(buf, &len))
    {
      RH_RF95::printBuffer("Received: ", buf, len);
      Serial.print("Got: ");
      Serial.println((char*)buf);
      Serial.print("RSSI: ");
      Serial.println(rf95.lastRssi(), DEC);
    }
  }
  else
  {
    Serial.println("Receive failed");
  }
}

```

COM9

```

16:25:00.709 -> Received:
16:25:00.709 -> 48 65 6C 6C 6F 20 57 6F 72 6C 64 20 23 31 20 66
16:25:00.709 -> 72 6F 6D 20 42 0
16:25:00.744 -> Got: Hello World #1 from B
16:25:00.744 -> RSSI: -21
16:25:09.525 -> Received:
16:25:09.525 -> 48 65 6C 6C 6F 20 57 6F 72 6C 64 20 23 35 20 66
16:25:09.525 -> 72 6F 6D 20 43 0
16:25:09.525 -> Got: Hello World #5 from C
16:25:09.525 -> RSSI: -23
16:25:10.805 -> Received:
16:25:10.805 -> 48 65 6C 6C 6F 20 57 6F 72 6C 64 20 23 32 20 66
16:25:10.805 -> 72 6F 6D 20 42 0
16:25:10.805 -> Got: Hello World #2 from B
16:25:10.805 -> RSSI: -22

```

Autoscroll Show timestamp Newline 9600 baud Clear output

Done uploading.

```

Sketch: Server.ino
Sketch size: 10.5KB (619/619 pages)
Sketch is 1.183 seconds
Verify 39592 bytes of flash
Verify successful
Done in 0.660 seconds

```

Adafruit Feather M0 (SAMD21), Small (-Os) (standard), Arduino, Off on COM9

```

Sender | Arduino 1.8.19 (Windows Store 1.8.57.0)
File Edit Sketch Tools Help

Sender

digitalWrite(RFM95_RST, HIGH);
delay(10);

while (!rf95.init()) {
  Serial.println("LoRa radio init failed");
  while (1);
}
Serial.println("LoRa radio init OK!");

// Defaults after init are 434.0MHz, modulation GFSK_FSK, 125kHz, 100mW
if (!rf95.setFrequency(RF95_FREQ)) {
  Serial.println("setFrequency failed");
  while (1);
}
Serial.print("Set Freq to: "); Serial.println(RF95_FREQ);

// The default transmitter power is 13dBm, using PA_BOOST.
// If you are using RFM95/96/97/98 modules which uses the PA_BOOST transmitter pin, then
// you can set transmitter powers from 5 to 23 dBm:
rf95.setTxPower(23, false);

int16_t packetnum = 0; // packet counter,

void loop()
{
  Serial.println("Sending to rf95_server");

```

COM12

```

16:25:50.134 -> Sending to rf95_server
16:25:50.134 -> Sending Hello World #9 from C
16:25:50.168 -> Waiting for packet to complete...
16:26:00.219 -> Sending to rf95_server
16:26:00.219 -> Sending Hello World #10 from C
16:26:00.219 -> Waiting for packet to complete...

```

Autoscroll Show timestamp Newline 9600 baud Clear output

```

Sketch: Sender.ino
Sketch size: 10.5KB (627/627 pages)
Sketch is 1.206 seconds
Verify 40112 bytes of flash
Verify successful
Done in 0.680 seconds

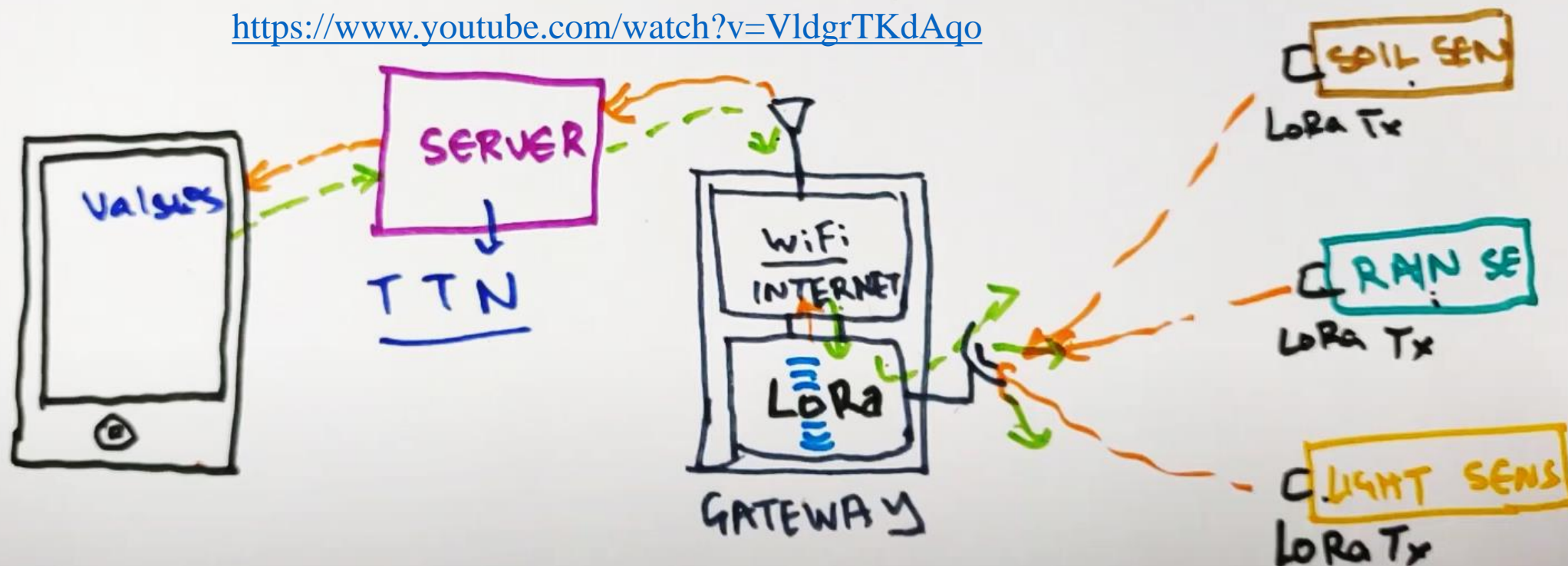
```

Adafruit Feather M0 (SAMD21), Small (-Os) (standard), Arduino, Off on COM12



- ❑ LG01-N is an open source single channel LoRa Gateway. It lets us bridge LoRa wireless network to an IP network via WiFi, Ethernet, Or 3G/4G cellular via optional LTE module.
- ❑ LoRa wireless allows users to send data and reach extremely long ranges at low data-rates. It provides ultra-long range spread spectrum communication and high interference immunity.

<https://www.youtube.com/watch?v=VldgrTKdAqo>





The Dragino GateWay should be configured to establish the communication to the backbone

dragino-1ad45c

Invalid username and/or password! Please try again.

Authorization Required

Please enter your username and password.

Username

Password



Login



Reset

DRAGINO TECHNOLOGY CO., LIMITED

dragino-1ad45c

Status Sensor System Network Logout

AUTO REFRESH ON

Status

System

Hostname	dragino-1ad45c
Router Model	dragino
Firmware Version	IoT-4.3.4
Build Time	Mon May 7 14:24:11 CST 2018
Kernel Version	3.18.45
Local Time	Sun Jan 1 00:34:21 2012
Uptime	0h 34m 50s
Load Average	0.10, 0.07, 0.04

Memory

Total Available	38484 kB / 61116 kB (62%)
Free	14008 kB / 61116 kB (22%)
Cached	16984 kB / 61116 kB (27%)
Buffered	7492 kB / 61116 kB (12%)

Network

IPv4 WAN Status

Type: static
Address: 10.130.1.1
Netmask: 255.255.255.0
Gateway: 255.255.255.255
DNS 1: 8.8.8.8
Connected: 0h 34m 12s



Small Enterprise-Campus Network

WAN Port

- Disable
- WAN Port
- WiFi Client
- Mesh WiFi
- USB Modem
- USB Ethernet Modem

Continuously Check Net Connection

AUTO REFRESH ON

Free	13728 kB / 61116 kB (22%)
Cached	17364 kB / 61116 kB (28%)
Buffered	7492 kB / 61116 kB (12%)

IPv4 WAN Status

```

Type: dhcp
Address: 192.168.0.27
Netmask: 255.255.255.0
Gateway: 192.168.0.1
DNS 1: 89.2.0.1
DNS 2: 89.2.0.2
Expires: 23h 57m 57s
Connected: 0h 2m 3s

```

IPv6 WAN Status  Not connected

Active Connections 67 / 16384 (0%)

Hostname	IPv4-Address	MAC-Address	Leasetime remaining
DESKTOP-AEACCA6	10.130.1.205	e4:b9:7a:f3:87:fd	<i>expired</i>



On the backbone side, we need to register our GateWay

THE THINGS NETWORK

THE THINGS STACK
Community Edition

Overview

Applications

Gateways

Organizations

EU1 Community
Fair use policy applies ?

Mohamed KAS

Welcome to the Console!

Get started right away by creating an application or registering a gateway.

Need help? Have a look at our [Documentation](#) or [Get support](#).

Create an application

Register a gateway

1

2

3

LoRA Dragino GateWay

RI53: IoT



dragino-1d96c4 - Wireless - LuCI x The Things Network Console x +

console.thethingsnetwork.org/gateways/register

THE THINGS NETWORK CONSOLE COMMUNITY EDITION

Applications Gateways Support DraginoDemo

Gateways

GATEWAYS [register gateway](#)

You do not have any gateways

[Get started by registering one!](#)

<https://www.youtube.com/watch?v=VldgrTKdAqo>

<https://console.thethingsnetwork.org/gateways/register>

[QUESTIONS]

[ANSWERS]

DARIUS FOROUX