



DATA IN  
MOTION



# Internet of Things (IOT) applications with Mikrotik Devices

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# Agenda

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- All Examples and information are based on RouterOS 6.31
- Create your own weather station by using only Mikrotik Hardware and MCU with DHT Sensors

<https://freeboard.io/board/Kd6EPU>

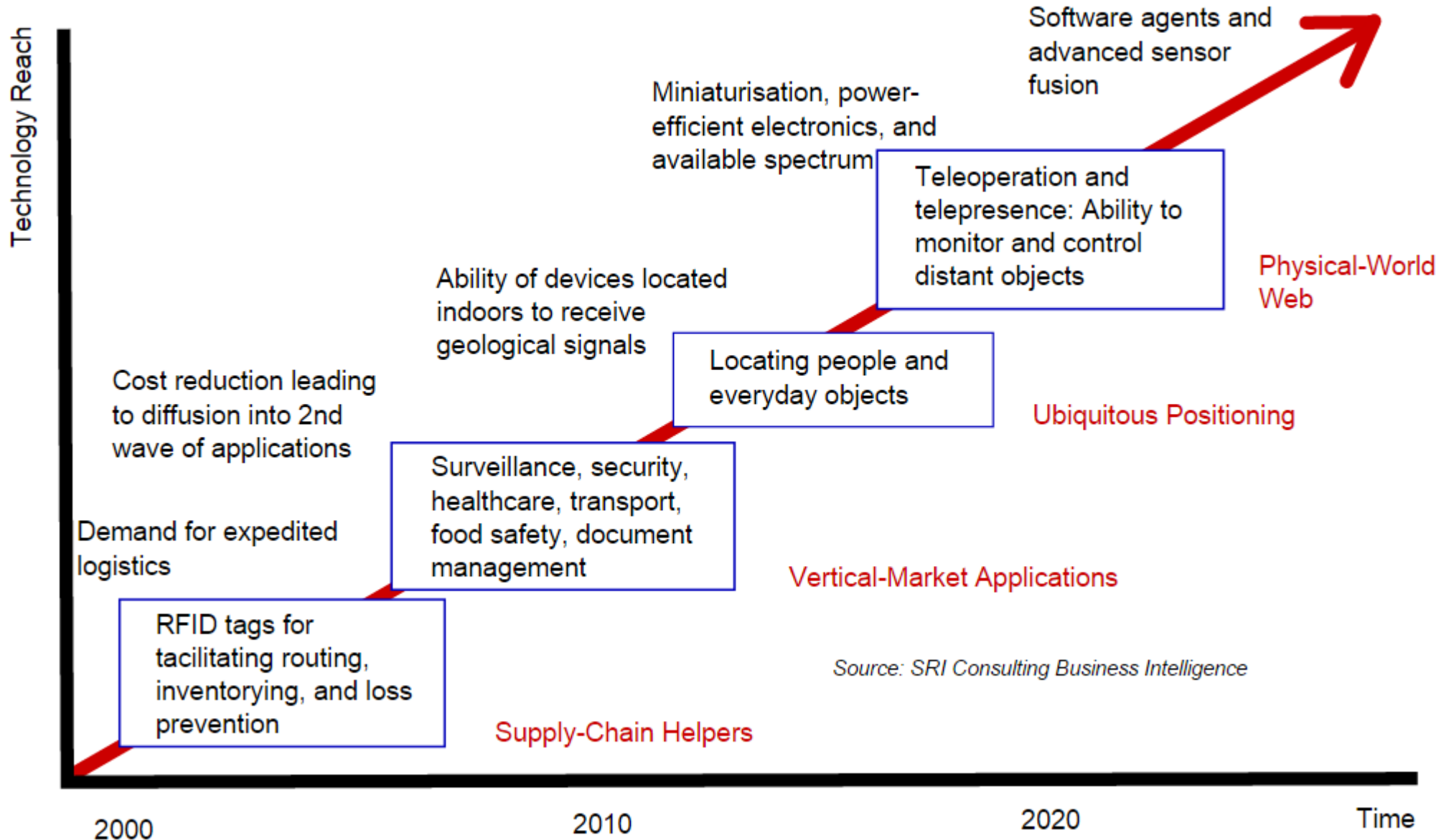


# Applications of IoT

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- **Environmental monitoring** - Weather Station, Soil Condition
- **Manufacturing** - Automatic process control, Predictive maintenance
- **Energy management** - Smart Grid, Thermal sensor
- **Medical and healthcare systems** - Pedometer, Wearable Heart rate monitors
- **Building and home automation** - Lighting System, Smart home
- **Transportation** - RFID electronic toll collection system, Easypass

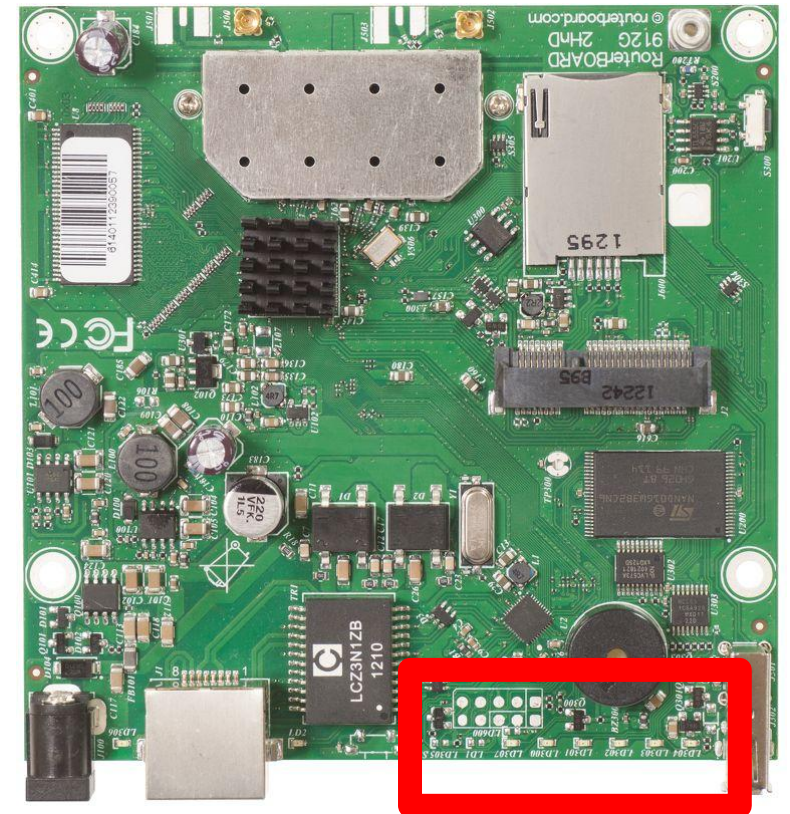
# Technology roadmap: The Internet of Things



# RouterBoard with built-in GPIO

These procedure required modification of the hardware that may void your warranty

[http://wiki.mikrotik.com/wiki/Manual/System/LEDS](http://wiki.mikrotik.com/wiki/Manual:System/LEDS)



**Built-in GPIO**

# RouterBoard and Power Source Of Things

## Power Over Ethernet Board (PoE Out)

- Max Current 500mA /1A Per Port \*\*
- Polarity - blue pair positive, brown pair negative
- Non 802.3af 8-30V
- Auto mode : Resistance is in range (3k $\Omega$  to 26.5k $\Omega$ )
- Use PoE power splitter for Things

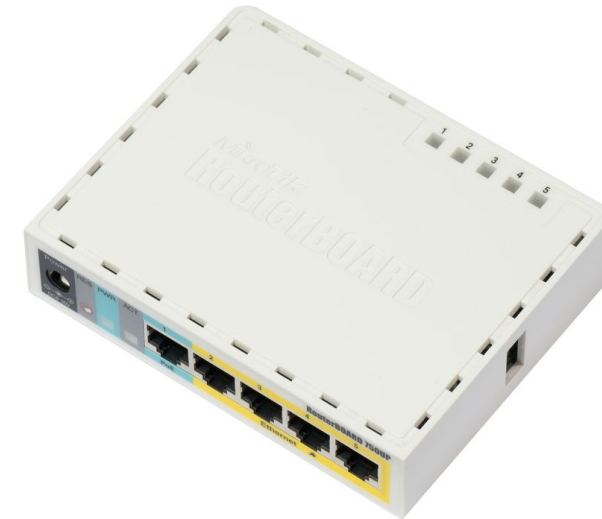
## USB power

- USB Type A / microUSB Type AB

\*\* Based on PoE controller firmware

<http://wiki.mikrotik.com/wiki/Manual:PoE-Out>

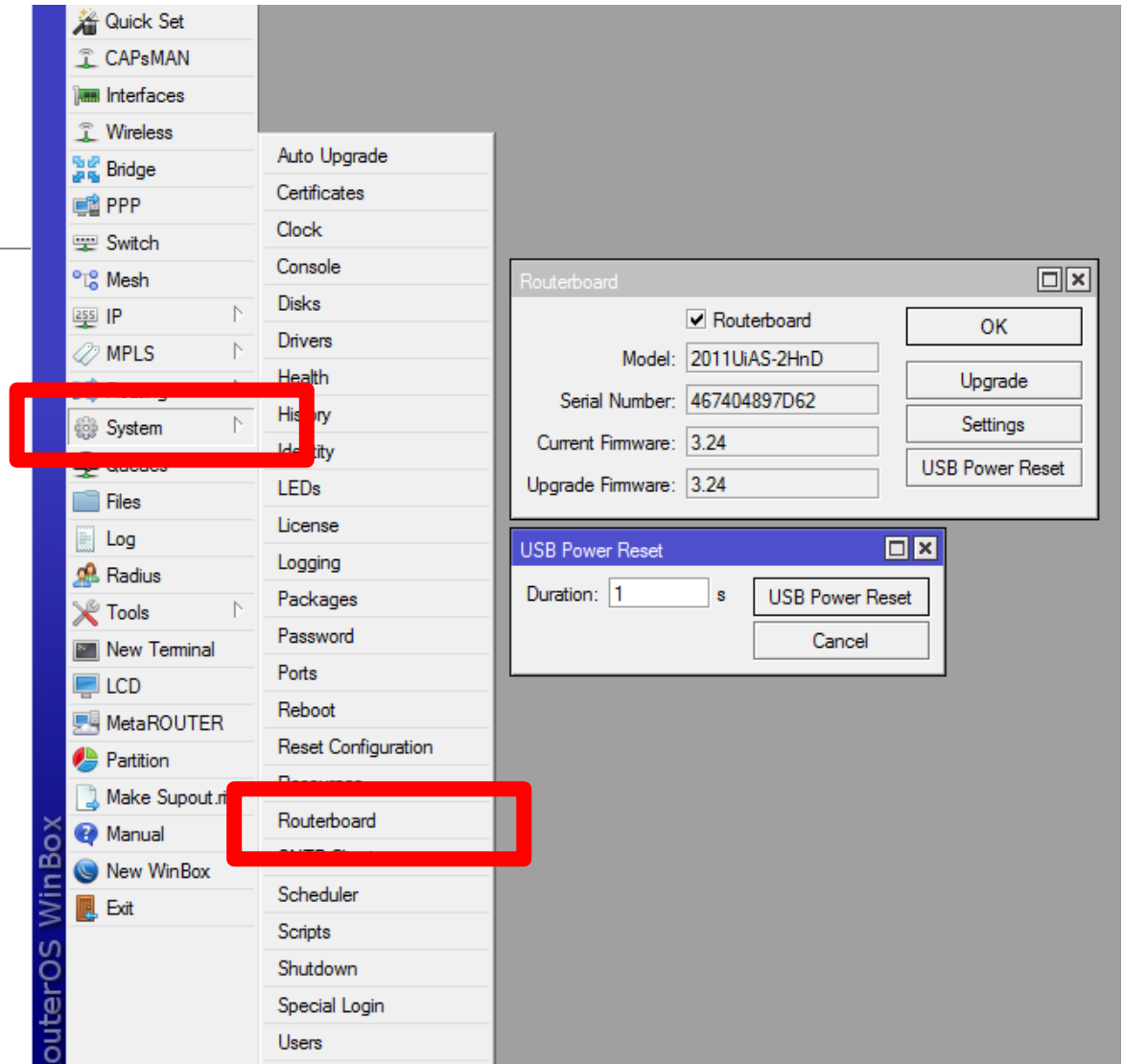
[http://wiki.mikrotik.com/wiki/Manual:USB\\_Features](http://wiki.mikrotik.com/wiki/Manual:USB_Features)



# Power Reset Function

- Ability to schedule a power reset
- Supports both PoE and USB power out

\*Currently available on Routerboard devices only





# RouterOS UART interface

Using RouterBoard UART interface with Things

Application

- UART (USB to Serial and RS232)
  - ◆ USB to Serial
  - ◆ Full Size / RJ45 RS-232
- RouterBoard USB function
  - ◆ USB Power reset

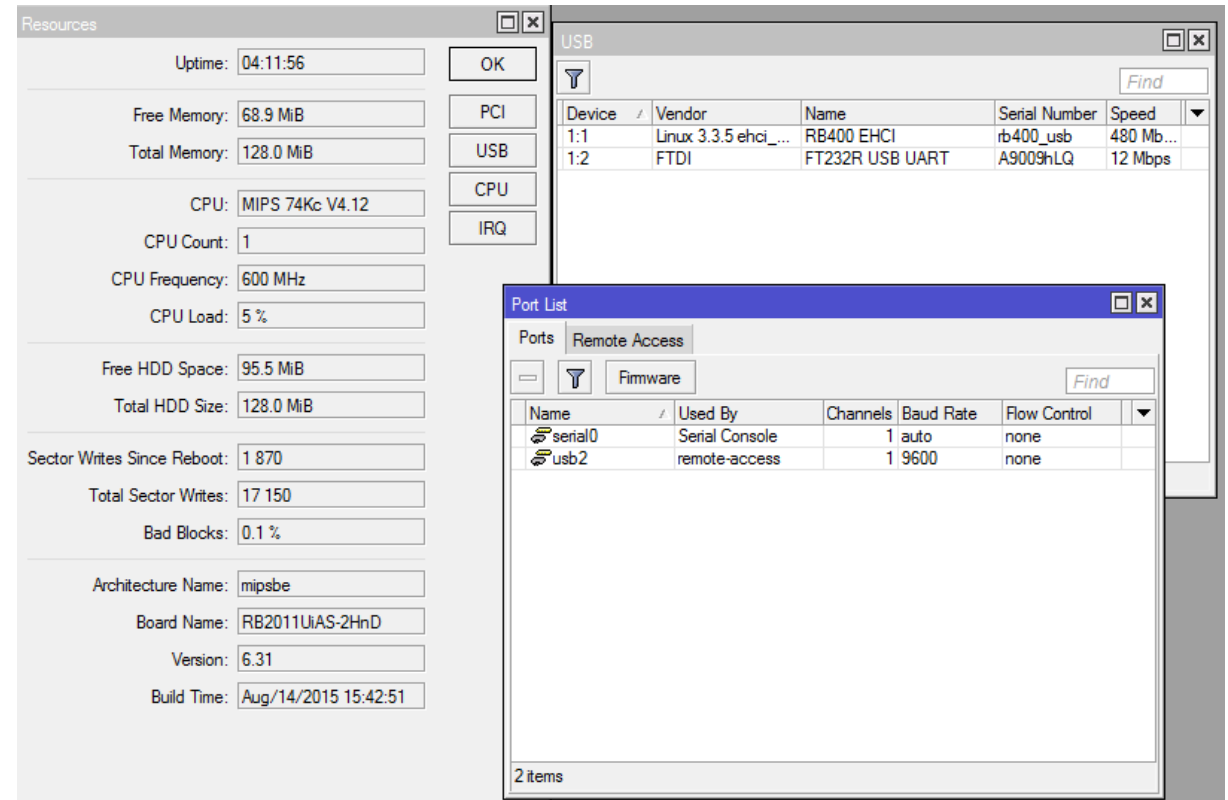


# RouterOS with UART

- RFC2217 (Serial to Ethernet)
- RouterOS Special Login

RoS doesn't provide commands to read/write the serial port directly.

[http://wiki.mikrotik.com/wiki/Serial\\_Port\\_Usage](http://wiki.mikrotik.com/wiki/Serial_Port_Usage)



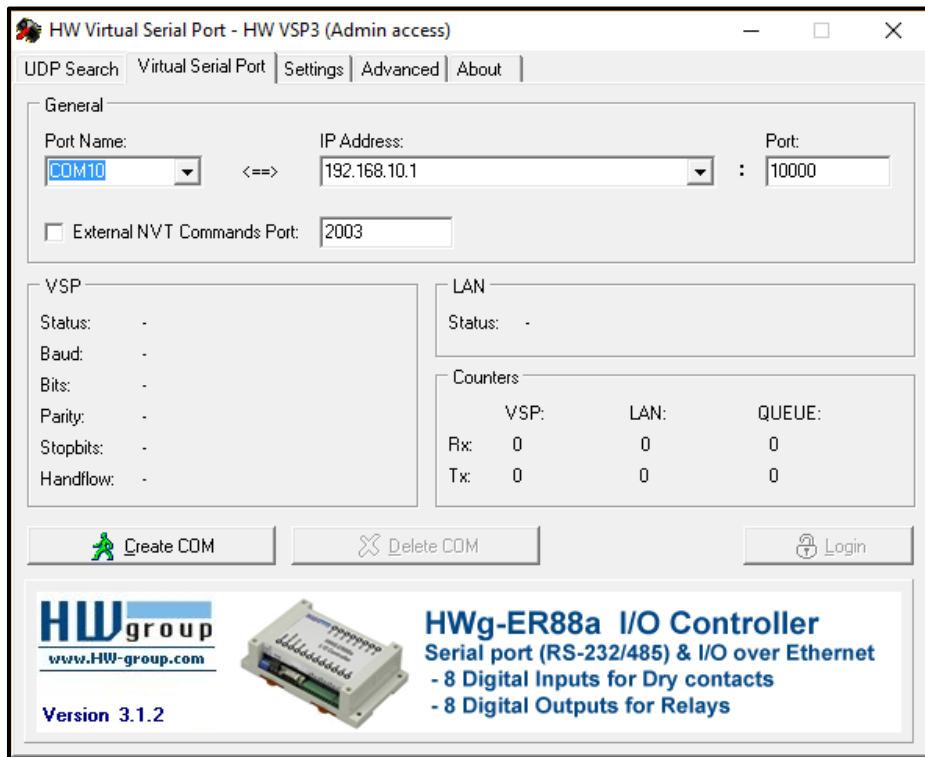
The screenshot shows the RouterOS interface with three windows open:

- Resources:** Displays system statistics such as Uptime (04:11:56), Free Memory (68.9 MiB), Total Memory (128.0 MiB), CPU (MIPS 74Kc V4.12), CPU Count (1), CPU Frequency (600 MHz), CPU Load (5%), Free HDD Space (95.5 MiB), Total HDD Size (128.0 MiB), Sector Writes Since Reboot (1 870), Total Sector Writes (17 150), Bad Blocks (0.1 %), Architecture Name (mipsbe), Board Name (RB2011UiAS-2HnD), Version (6.31), and Build Time (Aug/14/2015 15:42:51).
- USB:** A table listing USB devices:
 

Device	Vendor	Name	Serial Number	Speed
1:1	Linux 3.3.5 ehci_...	RB400 EHCI	rb400_usb	480 Mb...
1:2	FTDI	FT232R USB UART	A9009hLQ	12 Mbps
- Port List:** A table listing configured ports:
 

Name	Used By	Channels	Baud Rate	Flow Control
serial0	Serial Console	1	auto	none
usb2	remote-access	1	9600	none

# RFC2217 (Serial to Ethernet)



HW Virtual Serial Port - HW VSP3 (Admin access)

UDP Search Virtual Serial Port Settings Advanced About

General

Port Name: COM10 IP Address: 192.168.10.1 Port: 10000

External NVT Commands Port: 2003

VSP

Status: -

Baud: -

Bits: -

Parity: -

Stopbits: -

Handflow: -

LAN

Status: -

Counters

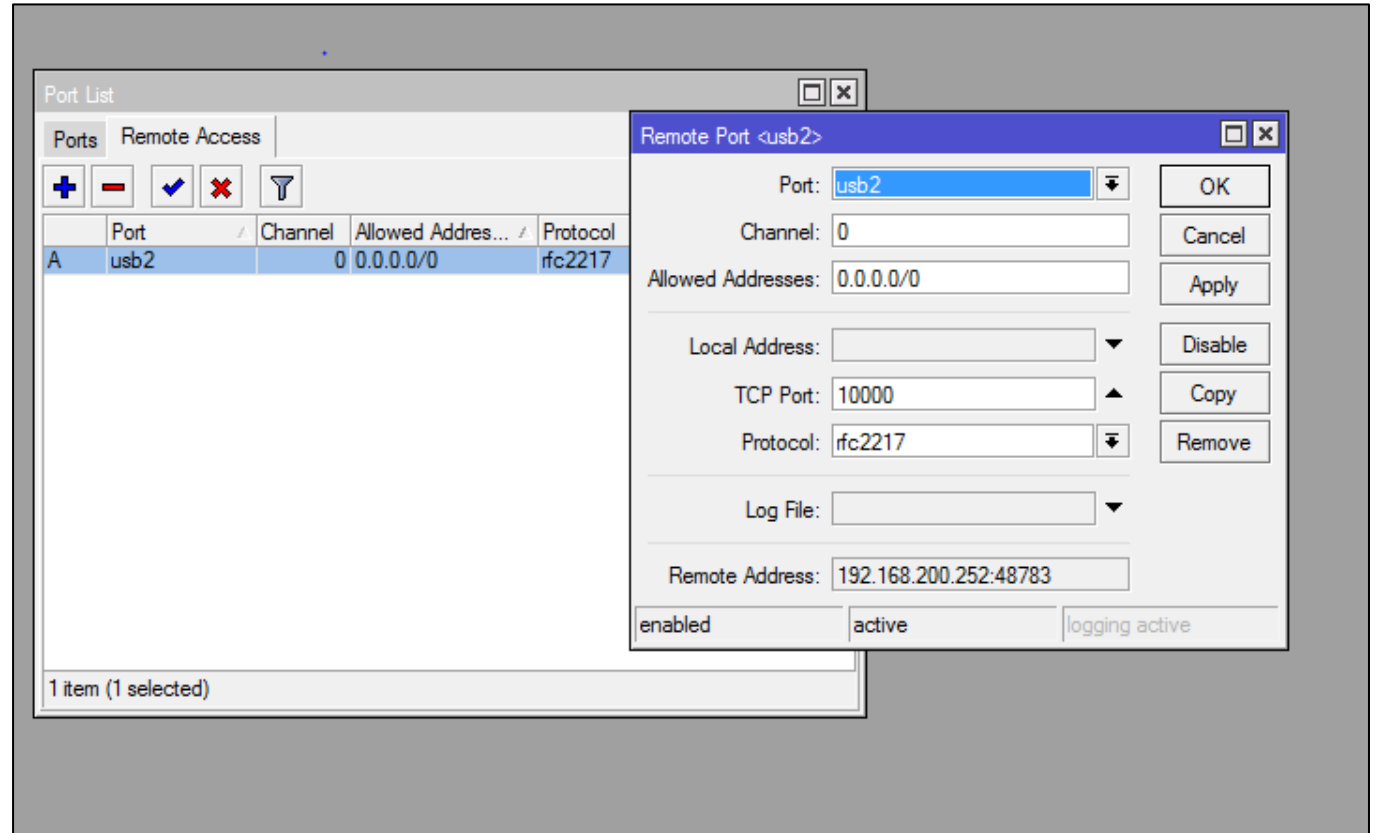
	VSP:	LAN:	QUEUE:
Rx:	0	0	0
Tx:	0	0	0

Create COM Delete COM Login

**HWgroup**  
www.hw-group.com

**HWg-ER88a I/O Controller**  
Serial port (RS-232/485) & I/O over Ethernet  
- 8 Digital Inputs for Dry contacts  
- 8 Digital Outputs for Relays

Version 3.1.2



Port List

Ports Remote Access

	Port	Channel	Allowed Address...	Protocol
A	usb2	0	0.0.0.0/0	rfc2217

Remote Port <usb2>

Port: usb2 OK

Channel: 0 Cancel

Allowed Addresses: 0.0.0.0/0 Apply

Local Address: Disable

TCP Port: 10000 Copy

Protocol: rfc2217 Remove

Log File:

Remote Address: 192.168.200.252:48783

enabled active logging active

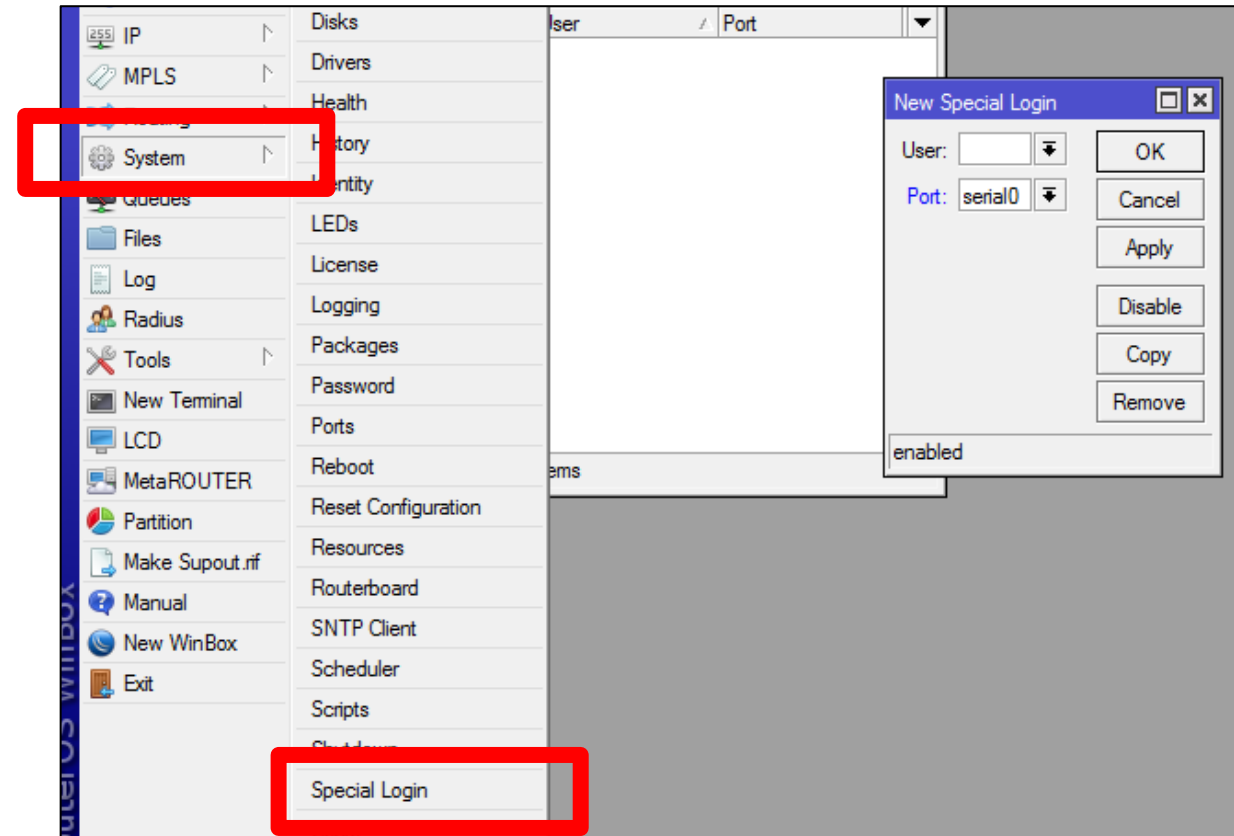
1 item (1 selected)

# RouterOS Special Login

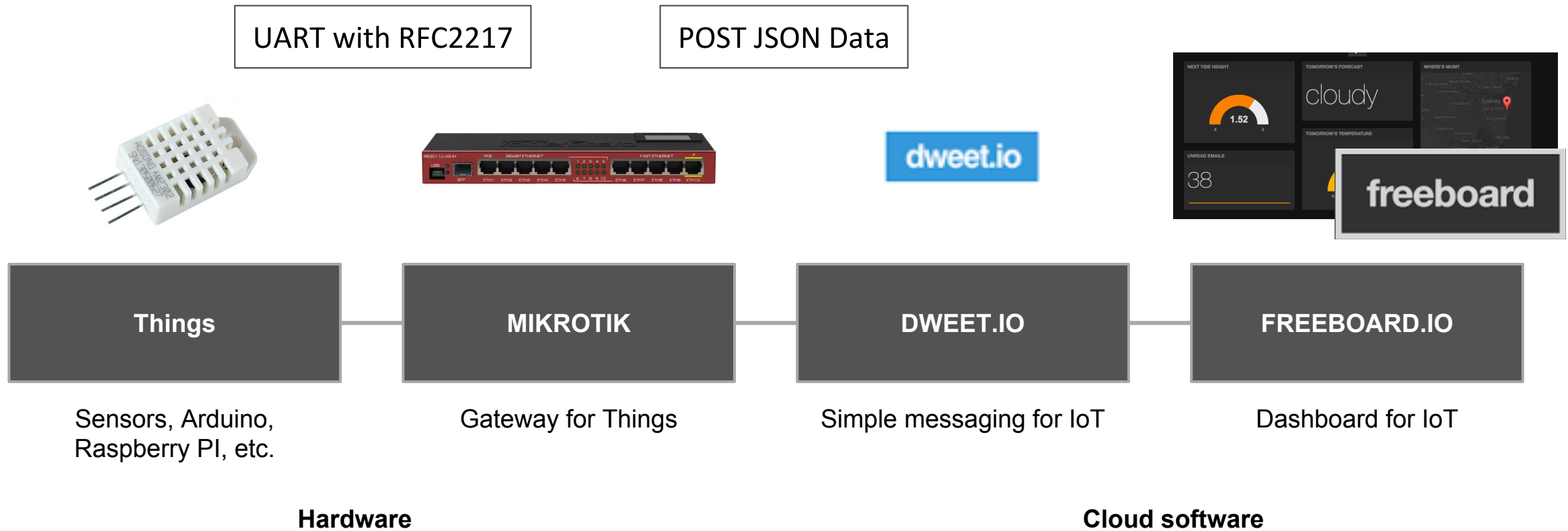
Interface Things with Terminal

Application

- Telnet
- SSH Secure Shell

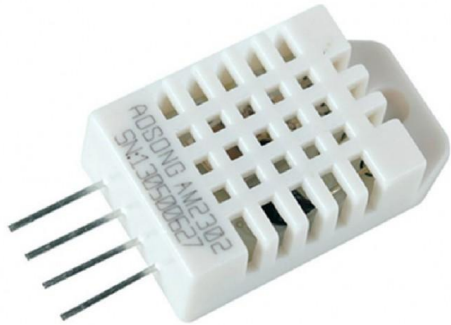


# Weather Station example with RB Hardware



# Weather Station (Hardware) Cont.

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## DHT22

Humidity Sensor  
Temperature Sensor



## Arduino Board

Microcontroller

# Weather Station (Hardware) Cont.

## RB2011UiAs-IN

- RS232 full handshaking
- USB with 5V power output
- USB serial (Based on RouterOS 6.31)
  - Support FT232RL/Prolific PL and USB U209-000-R
- USB Power Reset Function



# Weather Station (Hardware) Cont.



```
DHT22.ino

#include "DHT.h"
#define DHTPIN 2 // what pin we're connected to
#define DHTTYPE DHT22 // DHT 22 (AM2302)

DHT dht(DHTPIN, DHTTYPE);

void setup() {
  pinMode(13, OUTPUT);
  Serial.println("DHT Begin ... !!!");
  digitalWrite(13, HIGH);
  Serial.begin(9600);
  dht.begin();
  delay(1000);
  digitalWrite(13, LOW);
}

void loop() {
  String content = "";
  char character;
  while(Serial.available()) {
    character = Serial.read();
    content.concat(character);
  }
  if (content == "R") {
    // Serial.println(content);
    digitalWrite(13, HIGH);
    readDHT();
    delay(100);
    digitalWrite(13, LOW);
  }
  else if (content != "") {
    // Serial.println(content);
    Serial.flush();
  }
}

void readDHT() {
  float h = dht.readHumidity();
  // Read temperature as Celsius (the default)
  float t = dht.readTemperature();
  // Read temperature as Fahrenheit (isFahrenheit = true)
  float f = dht.readTemperature(true);
  // Check if any reads failed and exit early (to try again).
  if (isnan(h) || isnan(t) || isnan(f)) {
    Serial.println("Failed to read from DHT sensor!");
    return;
  }

  // Compute heat index in Fahrenheit (the default)
  float hif = dht.computeHeatIndex(f, h);
  // Compute heat index in Celsius (isFahrenheit = false)
  float hic = dht.computeHeatIndex(t, h, false);

  Serial.print("Humidity %: ");
  Serial.println(h);
  Serial.print("Temperature *C: ");
  Serial.println(t);
  Serial.print("Temperature *F: ");
  Serial.println(f);
  Serial.print("Heat index *C: ");
  Serial.println(hic);
  Serial.print("Heat index *F: ");
  Serial.println(hif);
}

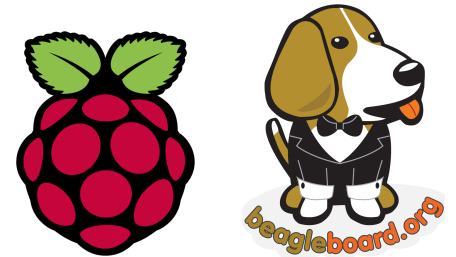
```



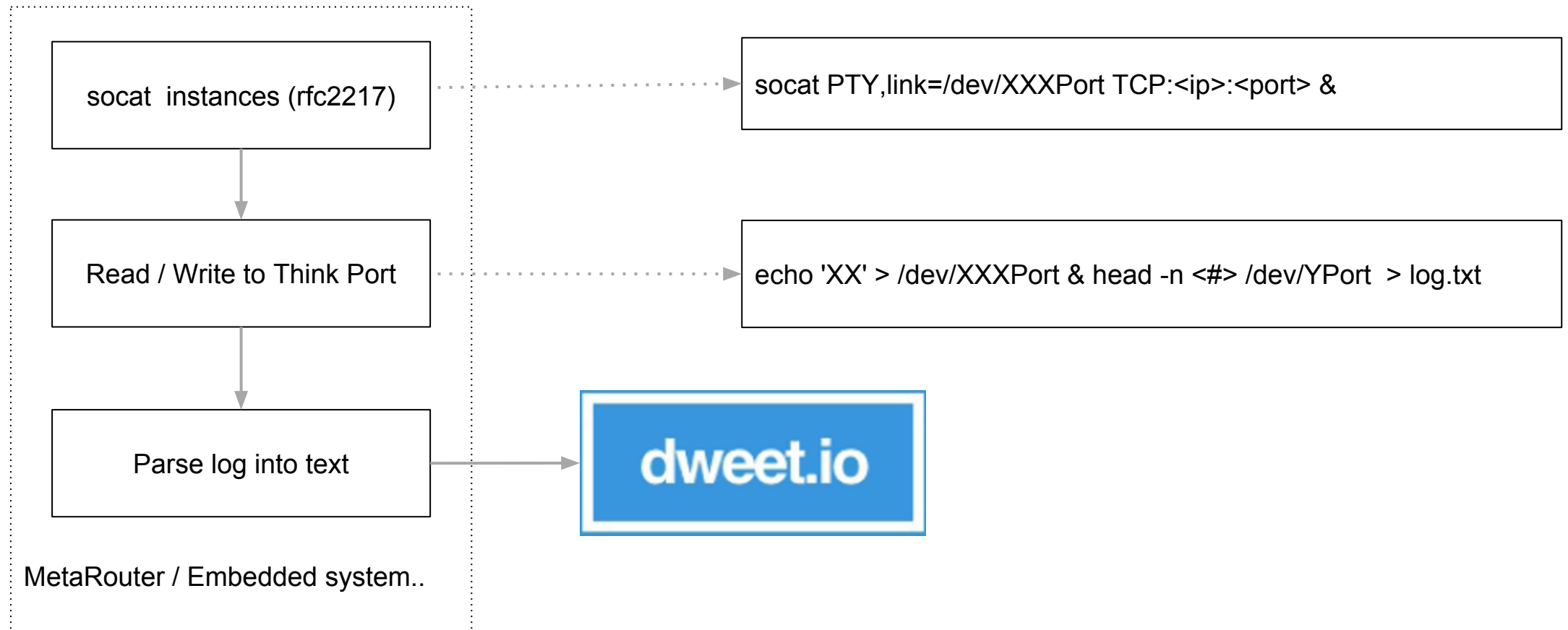
# Think and TCP/IP Stack

RoS doesn't provide commands to read/write the serial port directly.

- External Embedded System
  - Raspberry PI, BeagleBone, etc. (RJ45)
  - MCU with built-in TCP/IP stack i.e. NodeMCU (Wi-Fi)
  - Other Think Gateway.
- Hardware Server
- Cloud Computing
- MetaRouter with OpenWrt



# Weather Station (Software)



# dweet.io

Sending Data to dweet.io

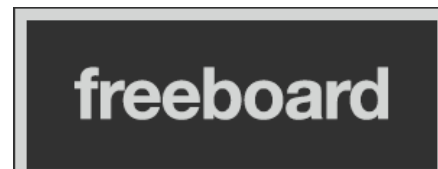
<https://dweet.io/follow/mum15th>

Use freeboard as Dashboard

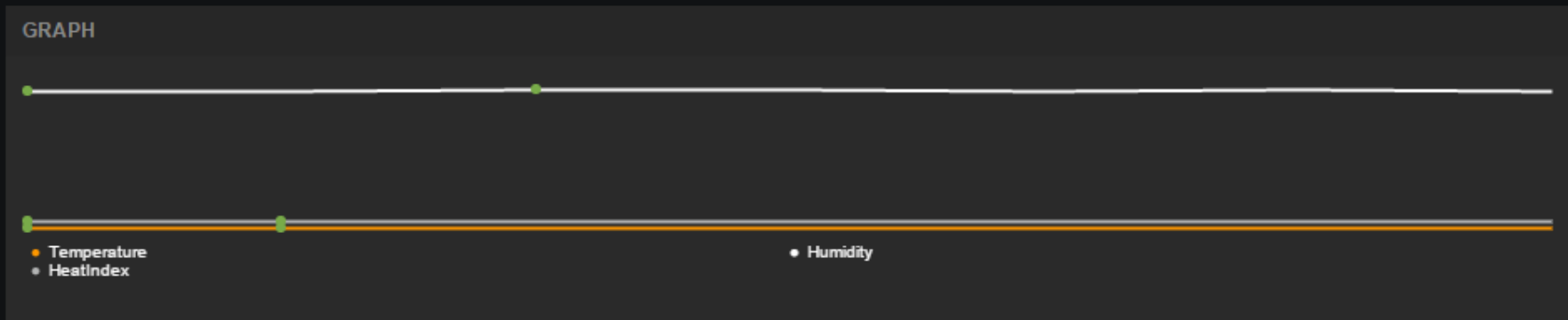
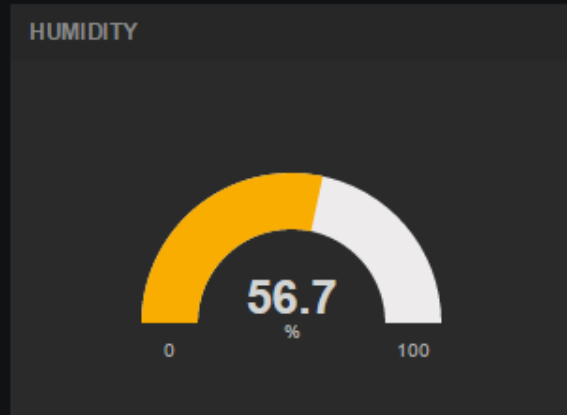
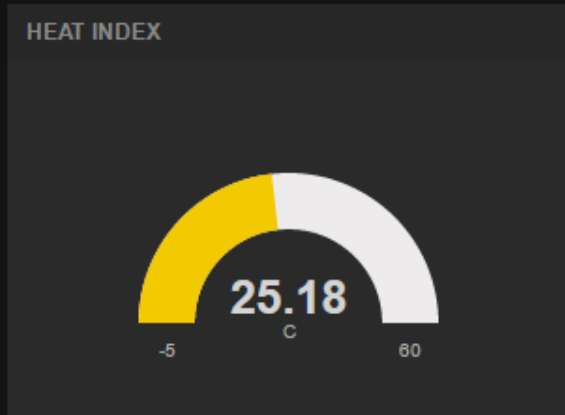
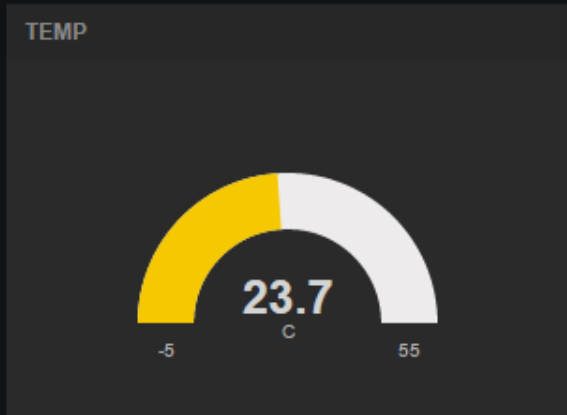
<https://freeboard.io/board/Kd6EPU>

more info.

<http://buglabs.net/>



```
{
  "this": "succeeded",
  "by": "dweeting",
  "the": "dweet",
  "with": {
    "thing": "mum15th",
    "created": "2015-08-28T09:22:27.757Z",
    "content": {
      "Humidity %": 56.7,
      "Temperature *C": 23.8,
      "Temperature *F": 74.84,
      "Heat index *C": 25.23,
      "Heat index *F": 77.41,
      "last_update": "Fri Aug 28 09:22:27 UTC 2015"
    }
  }
}
{
  "this": "succeeded",
  "by": "dweeting",
  "the": "dweet",
  "with": {
    "thing": "mum15th",
    "created": "2015-08-28T09:23:03.522Z",
    "content": {
      "Humidity %": 56.7,
      "Temperature *C": 23.7,
      "Temperature *F": 74.66,
      "Heat index *C": 25.18,
      "Heat index *F": 77.32,
      "last_update": "Fri Aug 28 09:23:03 UTC 2015"
    }
  }
}
```



LAST UPDATE

LastUpdate  
Fri Aug 28 09:24:03 UTC 2015

# Q & A

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