



Internet of Things (IoT) applications with Mikrotik Devices

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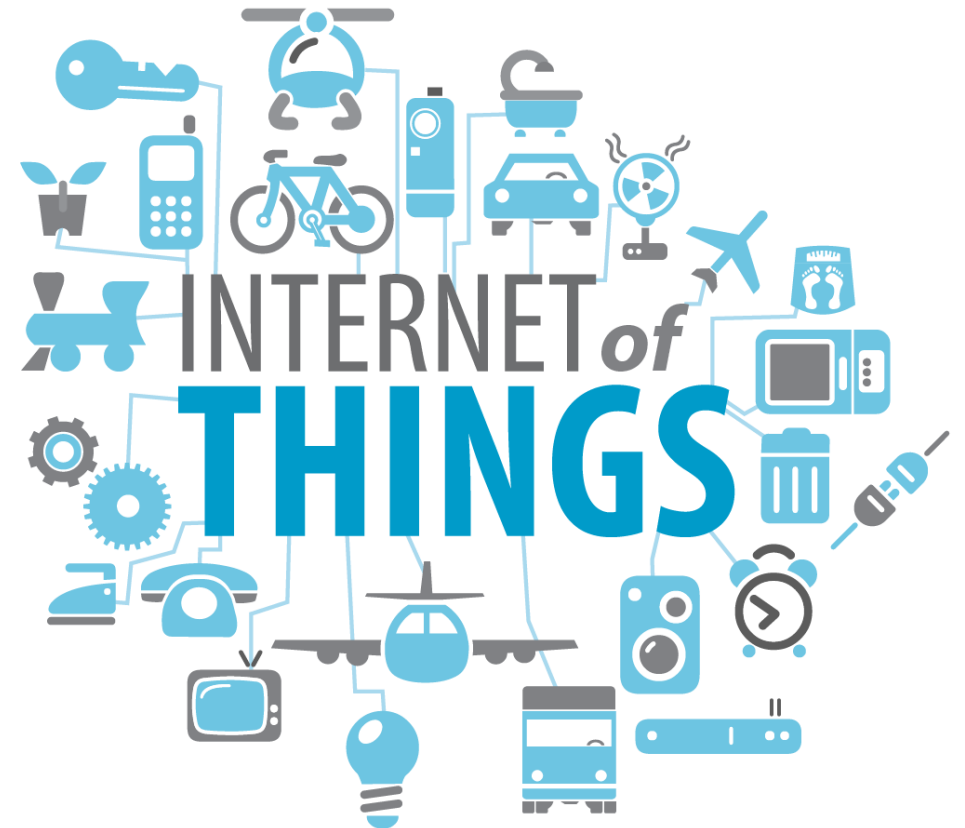
Agenda

- 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>

What is Internet of Things (IoT)?

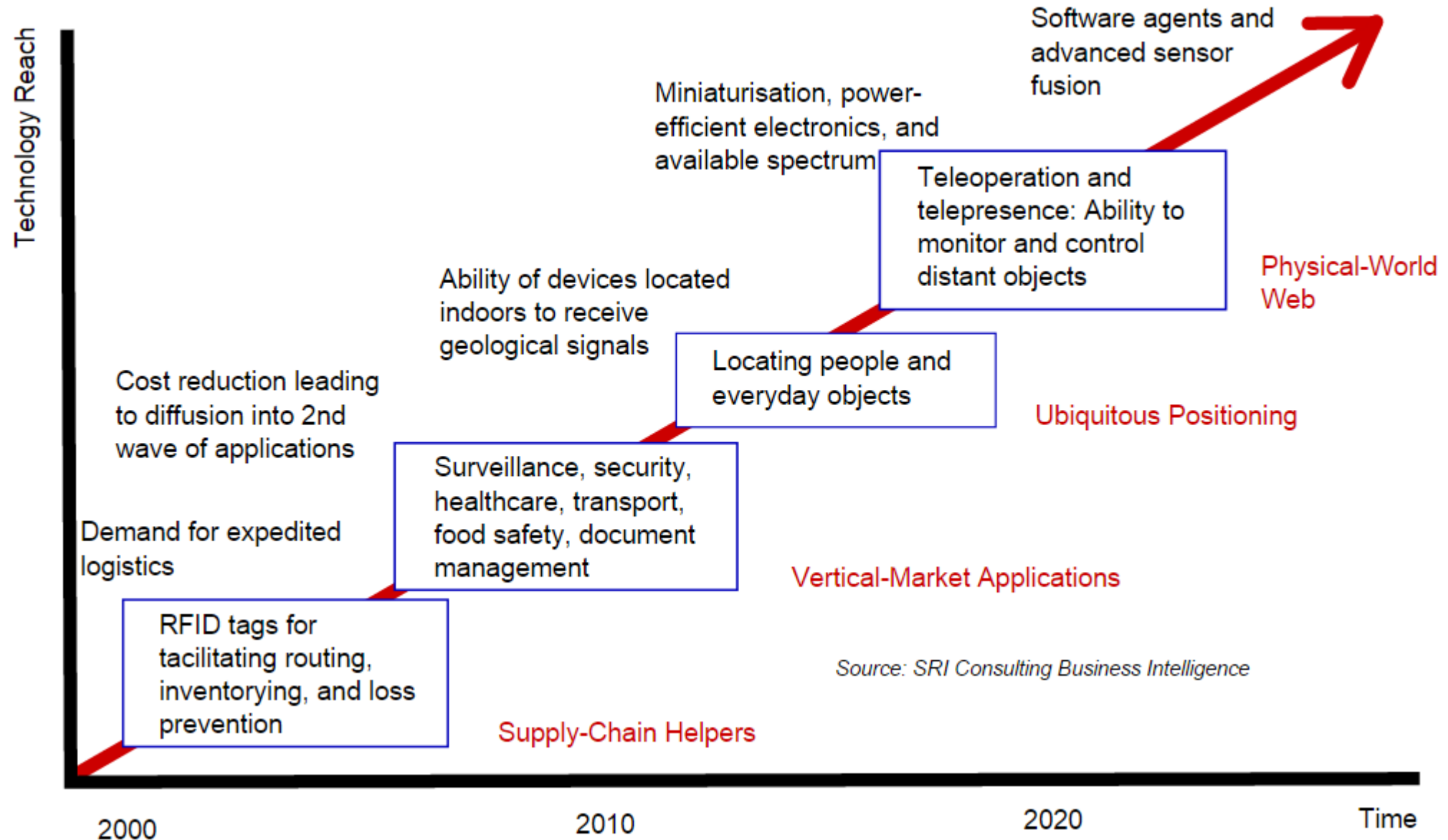
- Global Internet-based information architecture facilitating the exchange of goods and services
- The exchange of “things” in a secure and reliable manner to overcome the gap between objects in the physical world and their representation in information systems



Applications of IoT

- **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

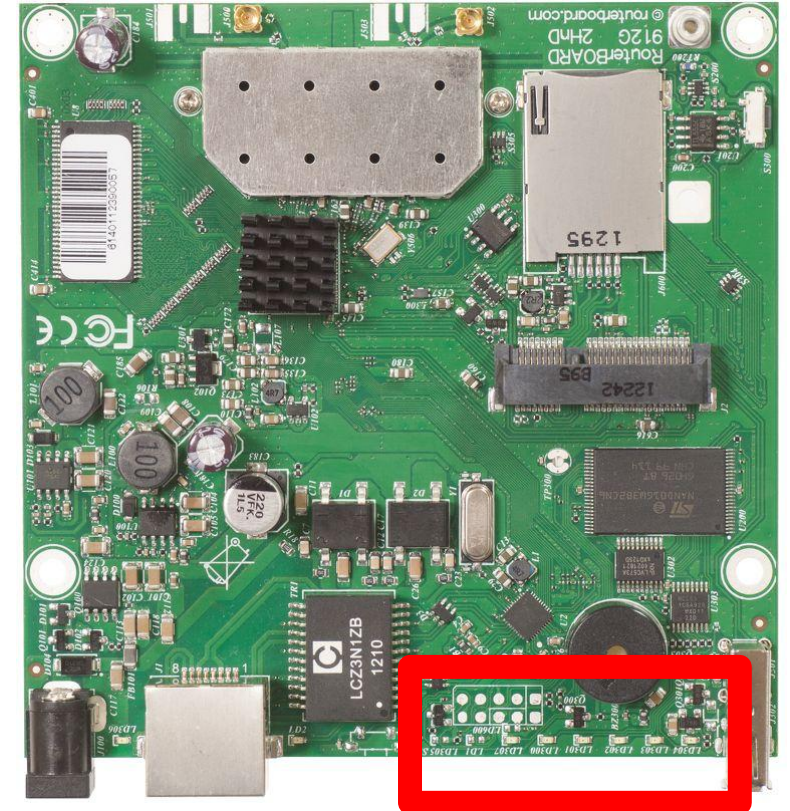
Technology roadmap: The Internet of Things



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>



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 Ω to 26.5k Ω)
- Use PoE power splitter for Things

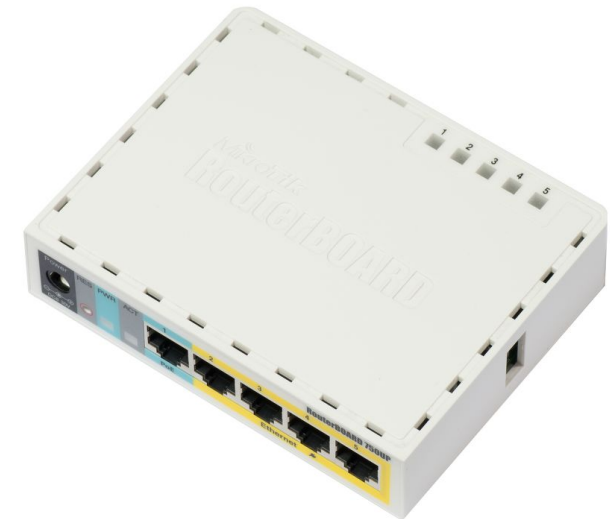
USB power

- USB Type A / microUSB Type AB

** Based on PoE controller firmware

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

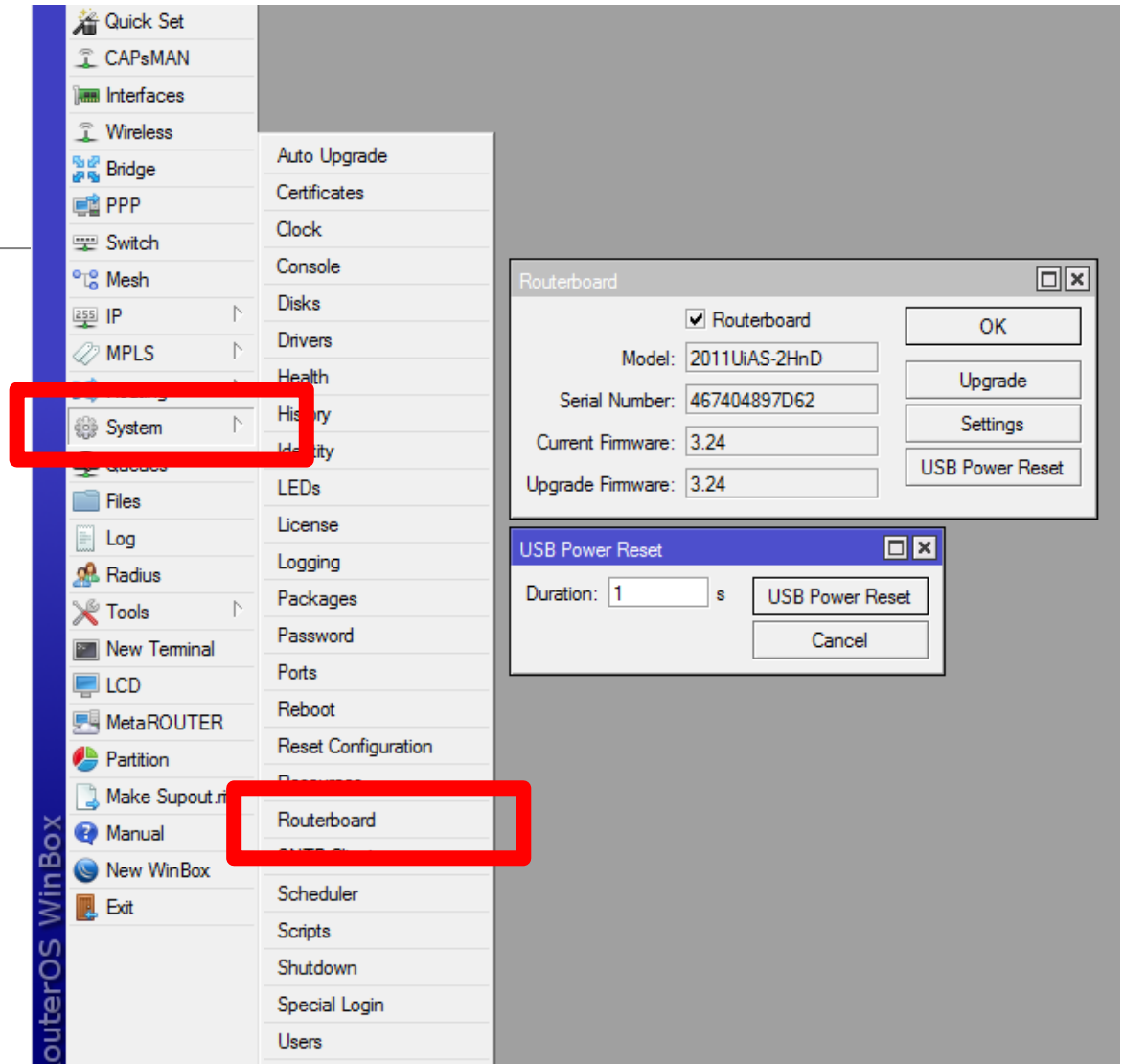
http://wiki.mikrotik.com/wiki/Manual:USB_Features



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

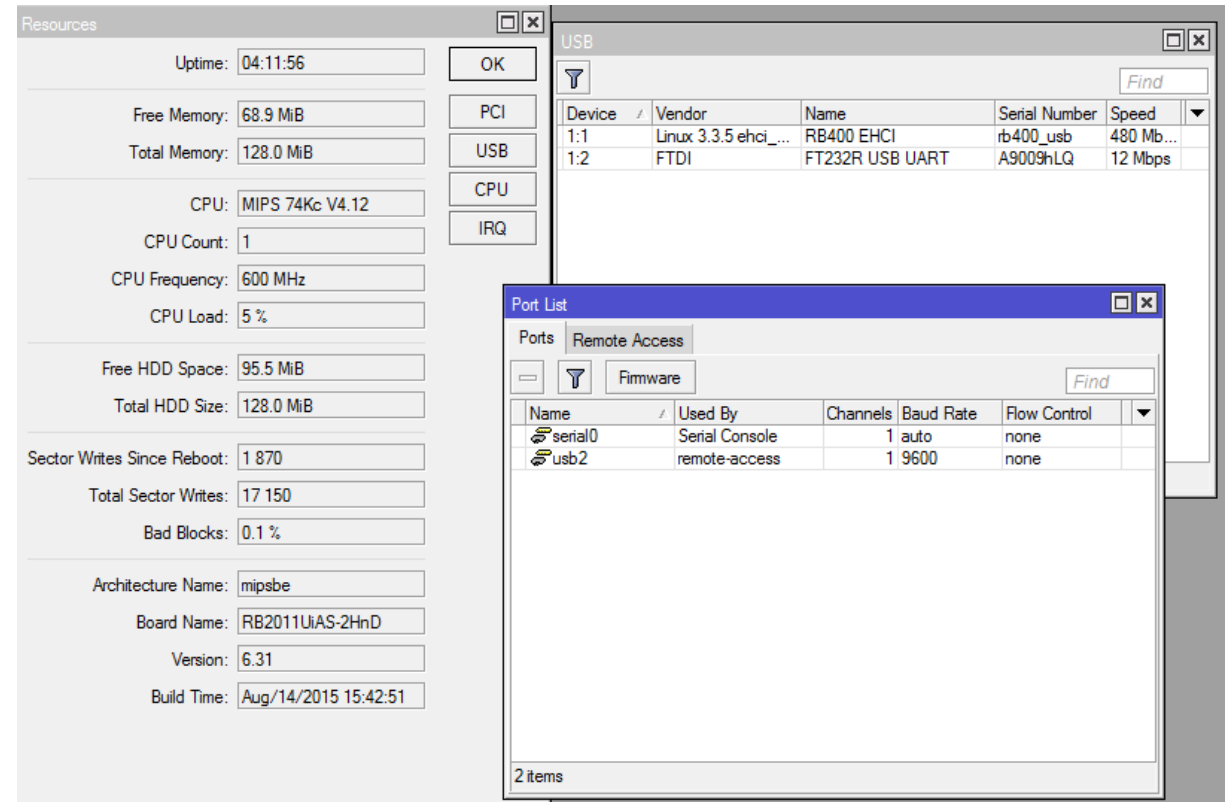


RouterOS with UART

- 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

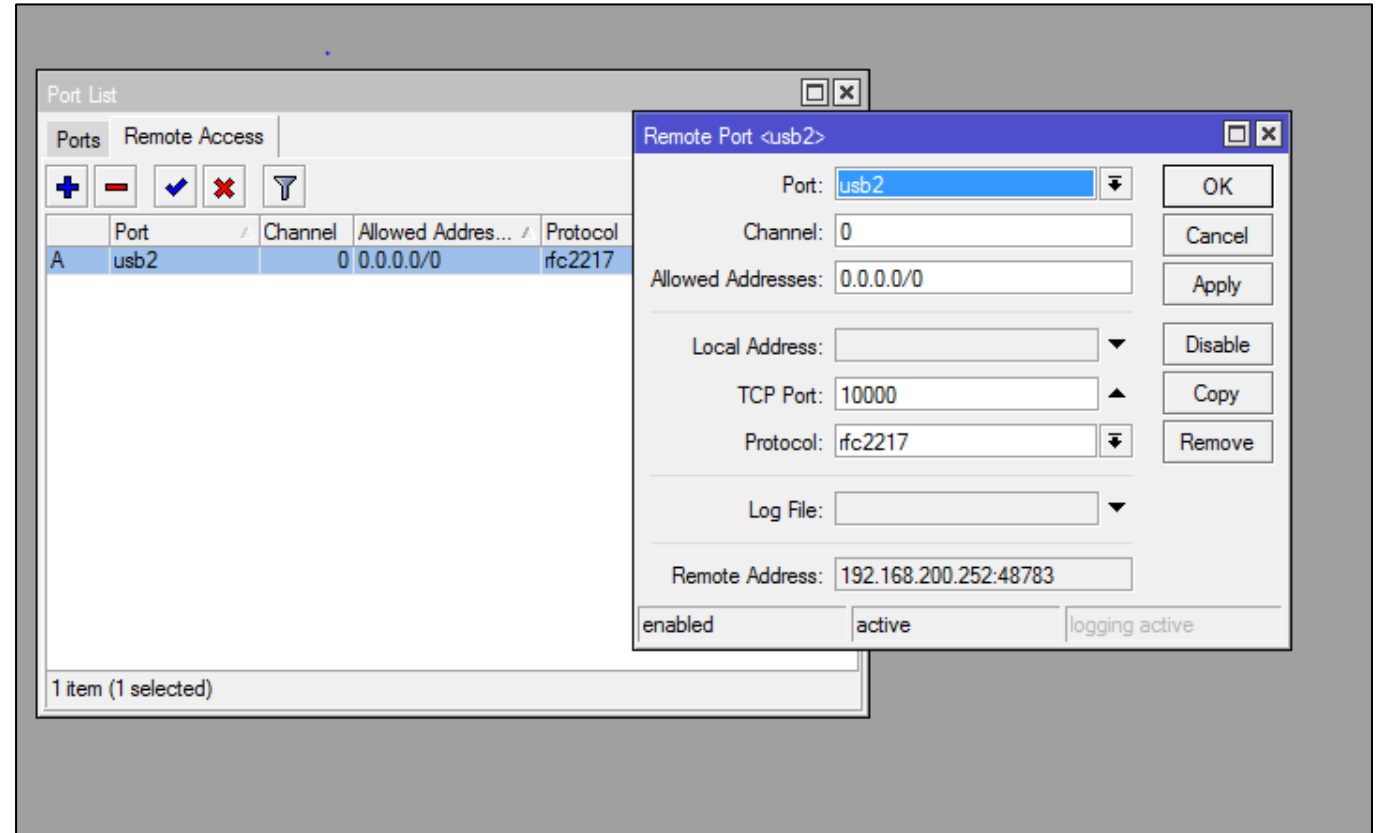
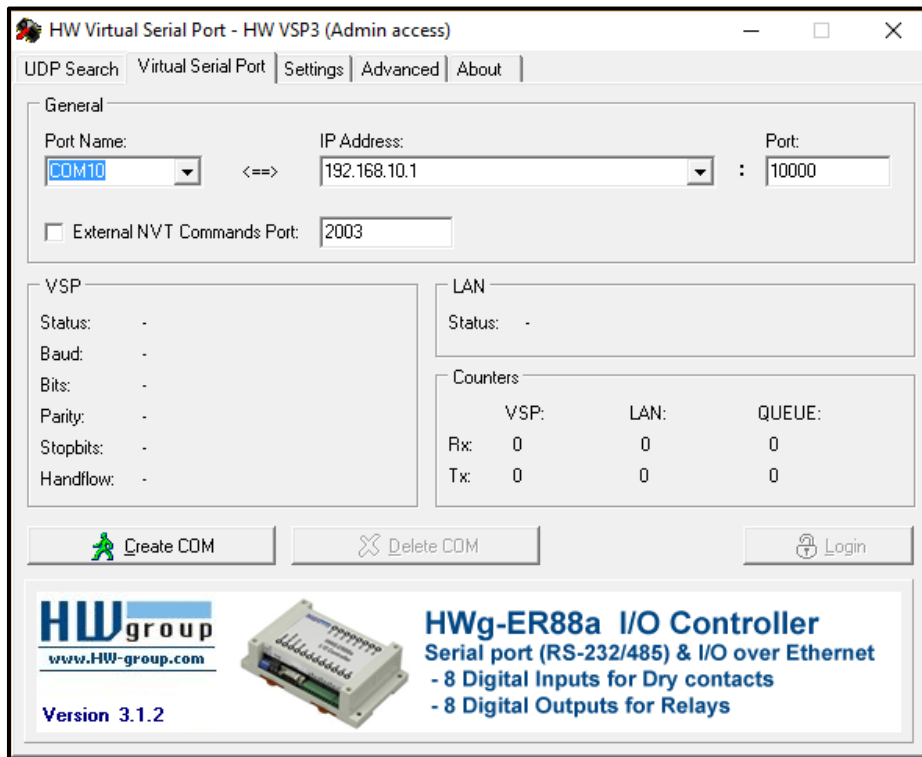


The screenshot displays the RouterOS WinBox interface. The 'Resources' window shows system statistics: Uptime: 04:11:56, Free Memory: 68.9 MiB, Total Memory: 128.0 MiB, CPU: MIPS 74Kc V4.12, CPU Count: 1, CPU Frequency: 600 MHz, CPU Load: 5 %, Free HDD Space: 95.5 MiB, Total HDD Size: 128.0 MiB, Sector 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. The 'USB' window lists two devices: 1:1 Linux 3.3.5 ehci_... RB400 EHCI 480 Mb... and 1:2 FTDI FT232R USB UART A9009hLQ 12 Mbps. The 'Port List' window shows two ports: serial0 (Used By: Serial Console, Channels: 1 auto, Flow Control: none) and usb2 (Used By: remote-access, Channels: 1 9600, Flow Control: none).

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

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

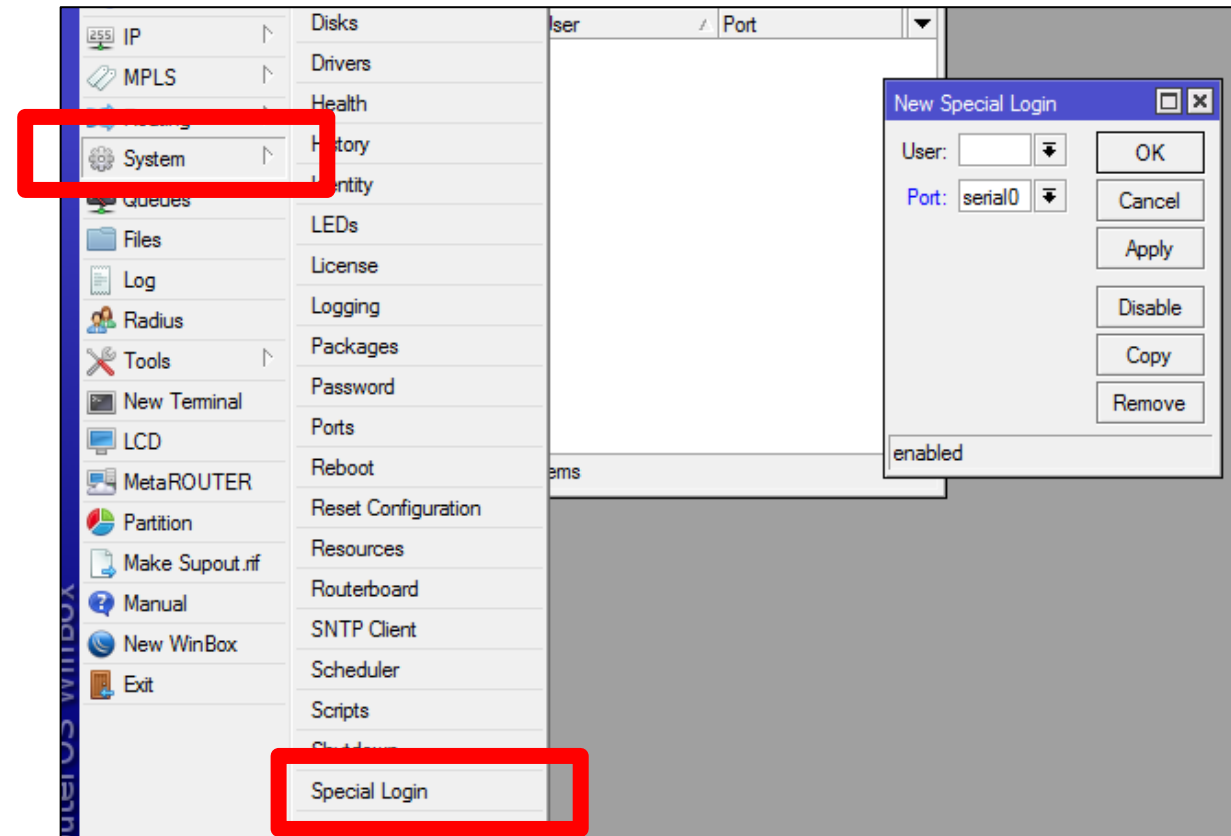
RFC2217 (Serial to Ethernet)



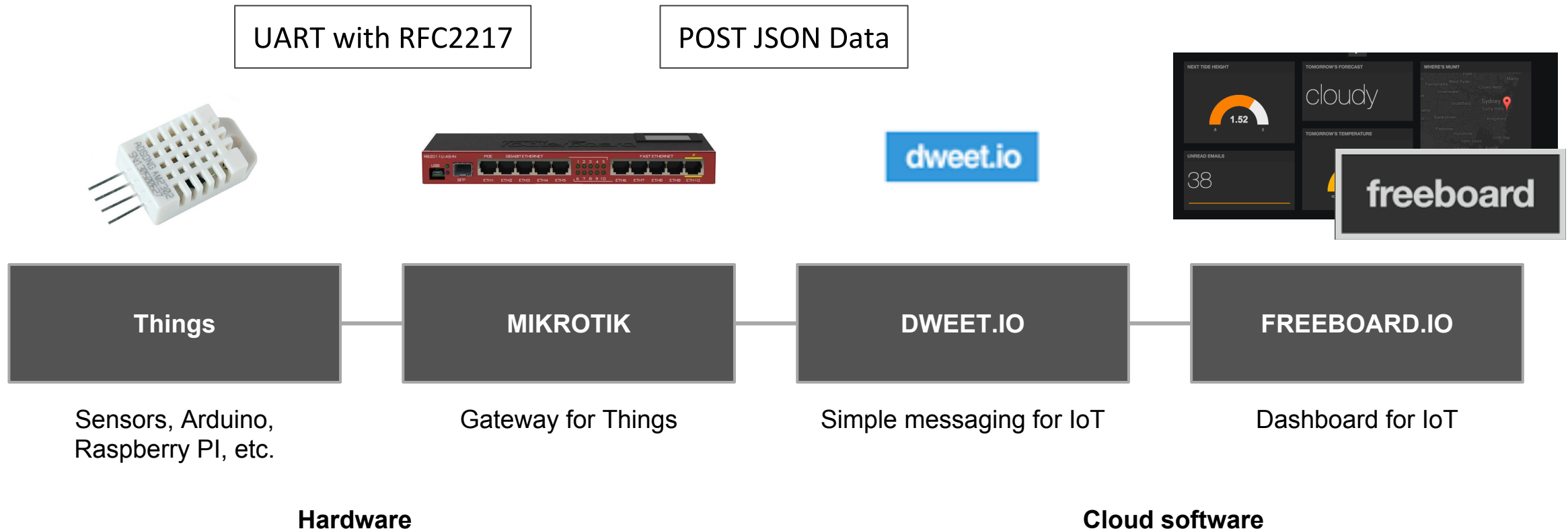
RouterOS Special Login

Interface Things with Terminal
Application

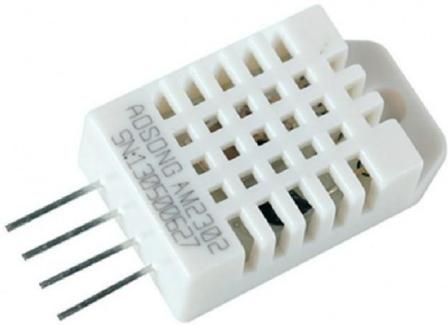
- Telnet
- SSH Secure Shell



Weather Station example with RB Hardware



Weather Station (Hardware) Cont.



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;
  }

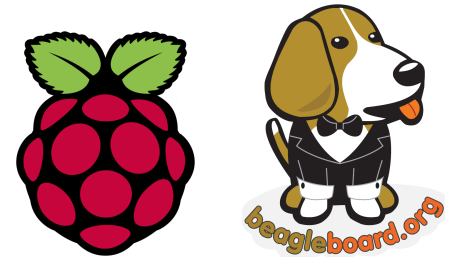
  // Compute heat index in Fahrenheit (the default)
  float hif = dht.computeHeatIndex(f, h);
  // Compute heat index in Celsius (isFahrenheit = false)
  float hic = dht.computeHeatIndex(t, h, false);

  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);
}
```

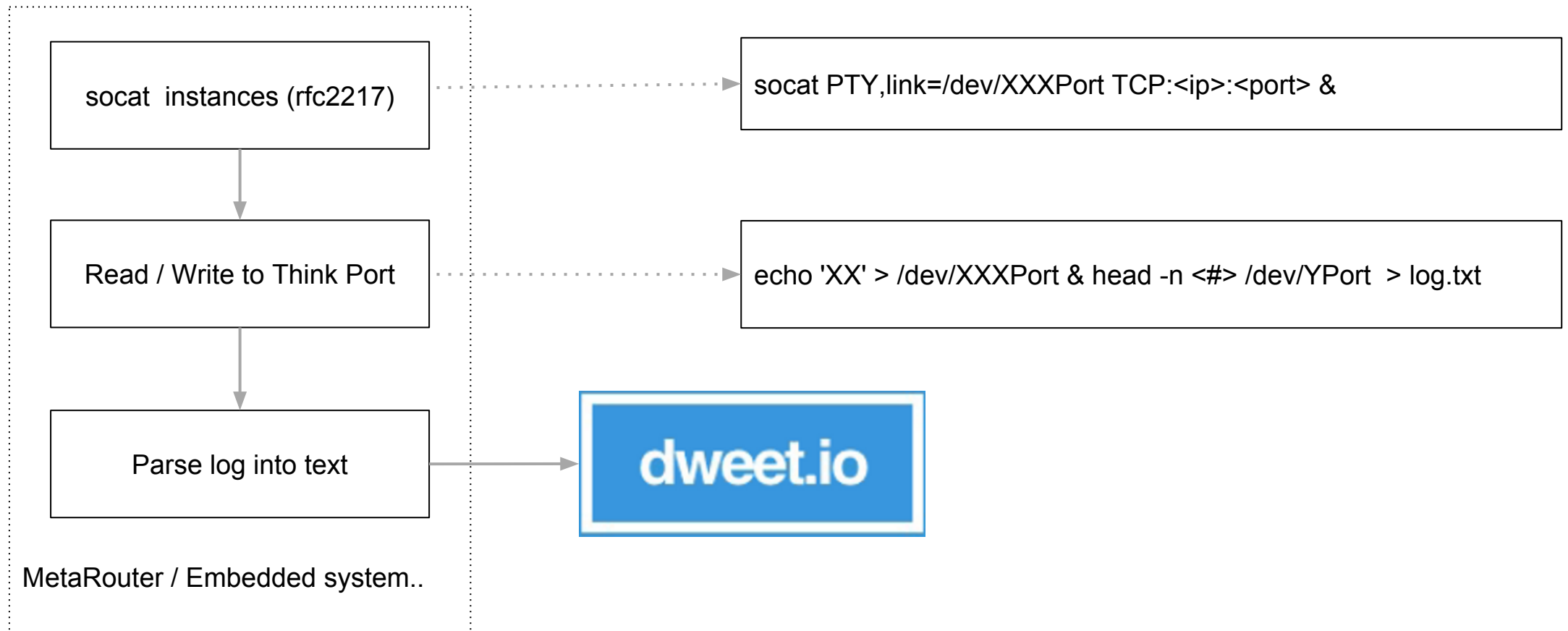

Think and TCP/IP Stack

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

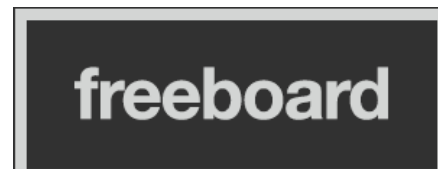
<https://dweet.io/follow/mum15th>

Use freeboard as Dashboard

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

more info.

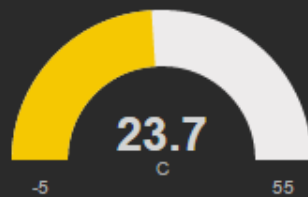
<http://buglabs.net/>



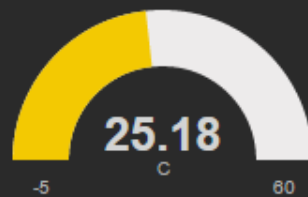
```
{
  "this": "succeeded",
  "by": "dweeting",
  "the": "dweet",
  "with": {
    "thing": "mum15th",
    "created": "2015-08-28T09:22:27.757Z",
    "content": {
      "Humidity %": 56.7,
      "Temperature *C": 23.8,
      "Temperature *F": 74.84,
      "Heat index *C": 25.23,
      "Heat index *F": 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"
    }
  }
}
```

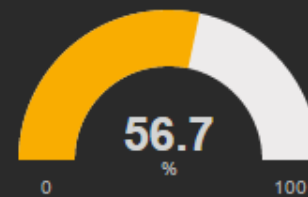
TEMP



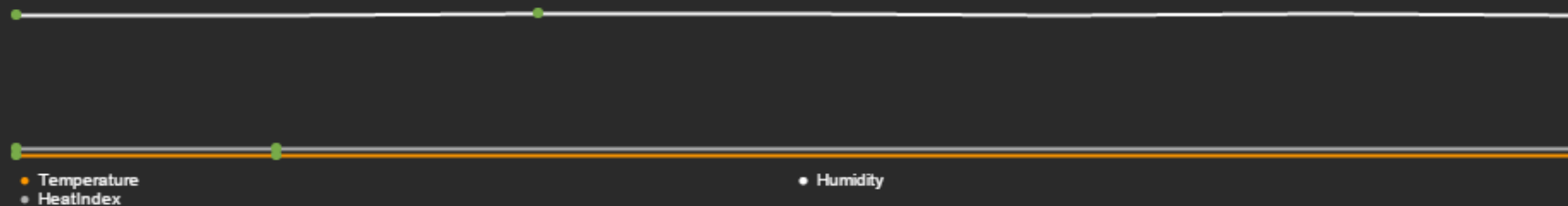
HEAT INDEX



HUMIDITY



GRAPH



LAST UPDATE

LastUpdate

Fri Aug 28 09:24:03 UTC 2015

Q & A
