Temperature Component for Silverspoon.io

Matej PEREJDA
mat.per.vt@gmail.com

27. marec 2017

Vedúci: Mgr. Maroš **ANDREJKO** (UPJŠ)
Konzultant: Mgr. Štefan **BUNČIAK** (Red Hat Czech)

Obsah

I. Motivácia
II. Ciele
III. Výsledky a aktuálny stav

I. Motivácia

Kvôli komu a prečo?!

Internet of Things

Internet vecí - sieť fyzických objektov „vecí“ (zväčša) bezdrôtovo pripojených k internetu za účelom vzájomnej interakcie, zbierania, vymieňania dát a ovládania rôznych služieb.

Silverspoon.io

Jednotná, úplná, ľahko použiteľná vývojová platforma pre vytváranie komplexných IoT riešení.

Open source projekt spoločnosti Red Hat vybudovaný z komponentov integračného frameworku Apache Camel.

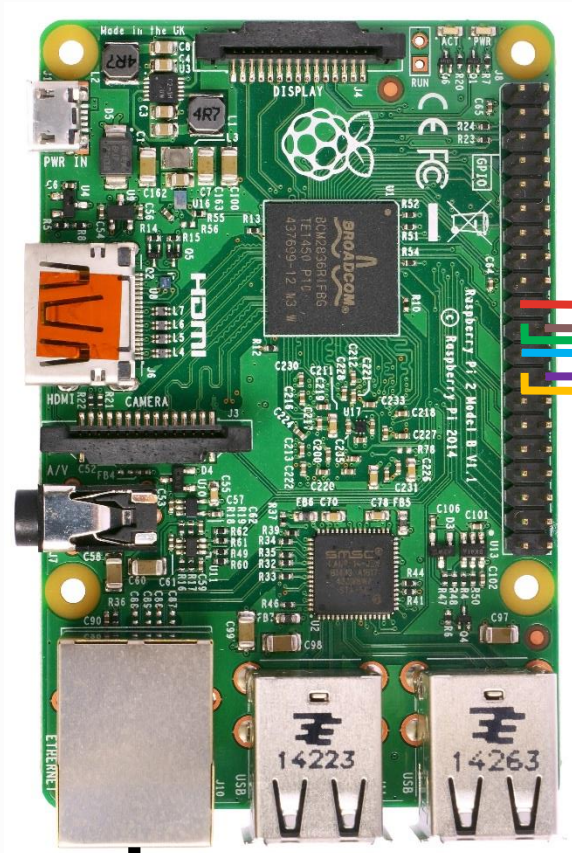
BULLDOG

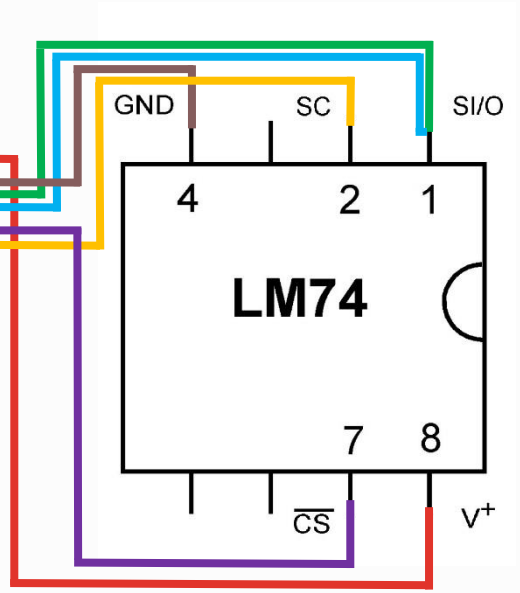
github.com/px3/bulldog

Bulldog

Java knižnica podporujúca jednoduchý prístup k perifériám ARM zariadení, ktorá okrem iného umožňuje komunikovať so zariadeniami pomocou zberníc a protokolov GPIO, SPI, I2C a UART.

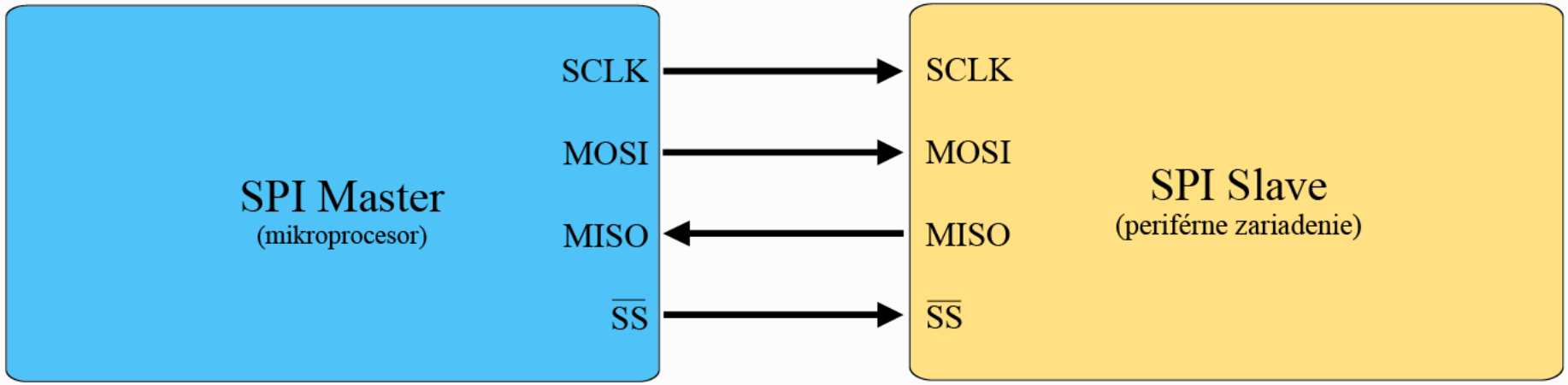
Silverspoon.io
Temperature Component
BULLDOG


DISPLAY
PWR IN
HDMI
CAMERA
14223
14263

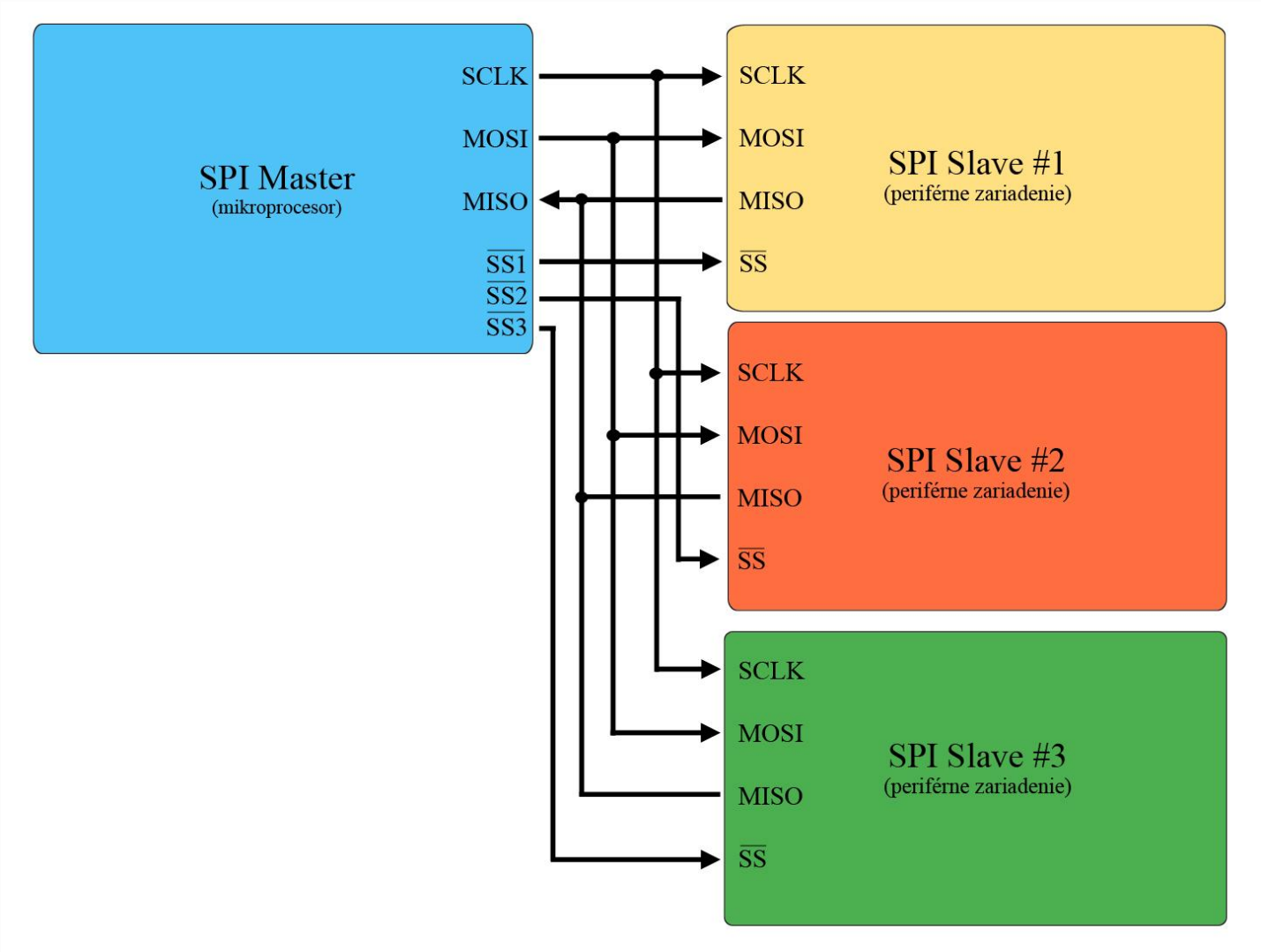

GND
SC
SI/O
4
2
1
LM74
7
8
CS
V+

- Komunikácia prostredníctvom zbernice SPI

  - sériová **komunikačná zbernica** navrhnutá spoločnosťou Motorola
  - **full-duplex**ový mód
  - **štyri signály**:
    - SCLK (clock)
    - MOSI (master output slave input)
    - MISO (master input slave output)
    - $\overline{SS}$ (slave select)



- Komunikácia prostredníctvom zbernice SPI



- Komunikácia prostredníctvom zbernice SPI

Výhody:

- full-duplexový mód
- nižšie energetické nároky
- menší počet použitých vodičov

Nevýhody:

- podpora zapojenia iba jedného master zariadenia
- žiadne HW potvrdenie od slave zariadenia pri začatí komunikácie
- žiaden mechanizmus kontroly chýb

II. Ciele

Ciele

- Navrhnúť, implementovať a otestovať nový komponent integračného frameworku Apache Camel pre prácu s teplotou
- Analyzovať dostupné platformy pre komplexnú prácu s Internet of Things
- Analyzovať existujúce knižnice pre prácu s periférіami (senzormi, aktuátormi,...)

III. Výsledky a aktuálny stav

Ilustrácia prepojenia zariadenia Raspberry Pi so senzorom TI LM74

3-wire SPI

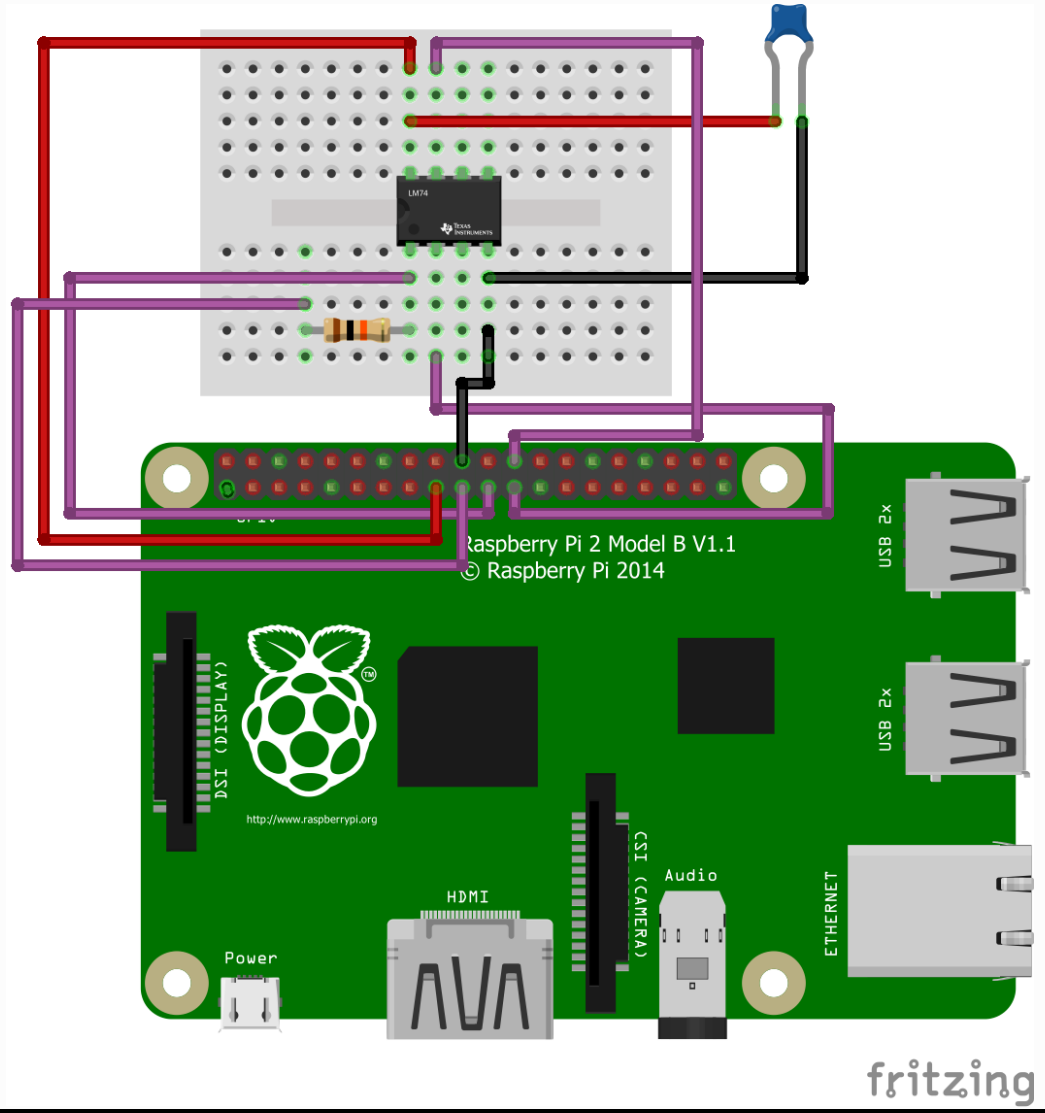
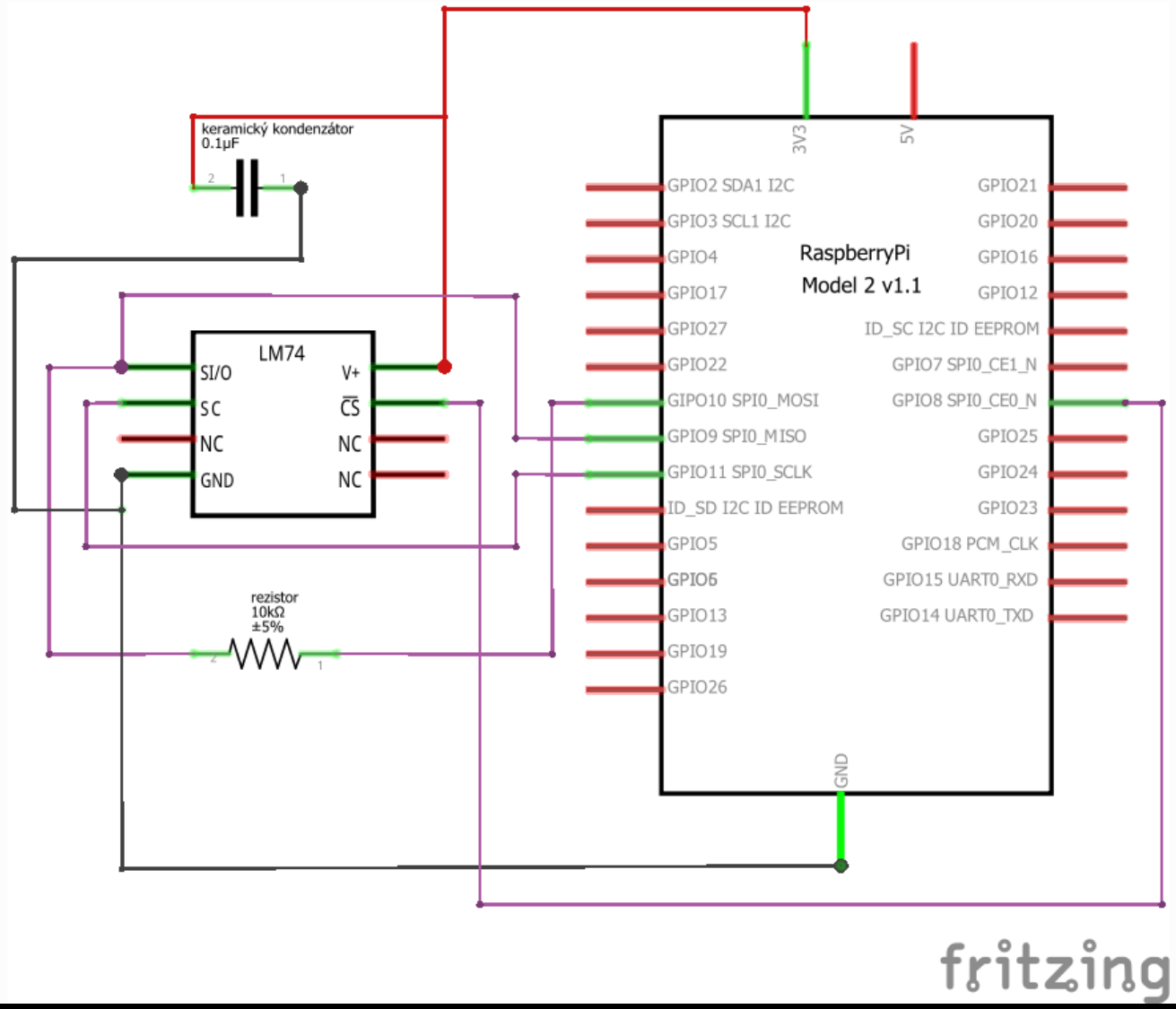


Schéma prepojenia zariadenia Raspberry Pi so senzorom TI LM74



Kódovanie celých čísel v dvojkovej sústave

Číslo	Priamy kód (sign bit)	Inverzný kód (1's complement)	Doplnkový kód (2's complement)
3	0011	0011	0011
2	0010	0010	0010
1	0001	0001	0001
0	0000	0000	0000
-0	1000	1111	N/A
-1	1001	1110	1111
-2	1010	1101	1110
-3	1011	1100	1101

Dvojkový doplnok (Two's complement)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	1	1	0	0	1	0	0	0	0	1	1	1

$= 3\ 207_{TC}$

1's complement (negácia)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	1	1	1	0	0	1	1	0	1	1	1	1	0	0	0

pripočítanie 0001_2

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	1	1	1	0	0	1	1	0	1	1	1	1	0	0	1

$= -3\ 207_{TC}$

TC = Two's complement

Dvojkový doplnok (Two‘s complement)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	1	1	1	0	0	1	1	0	1	1	1	1	0	0	1

$= -3\ 207_{TC}$

odčítanie 0001_2

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	1	1	1	0	0	1	1	0	1	1	1	1	0	0	0

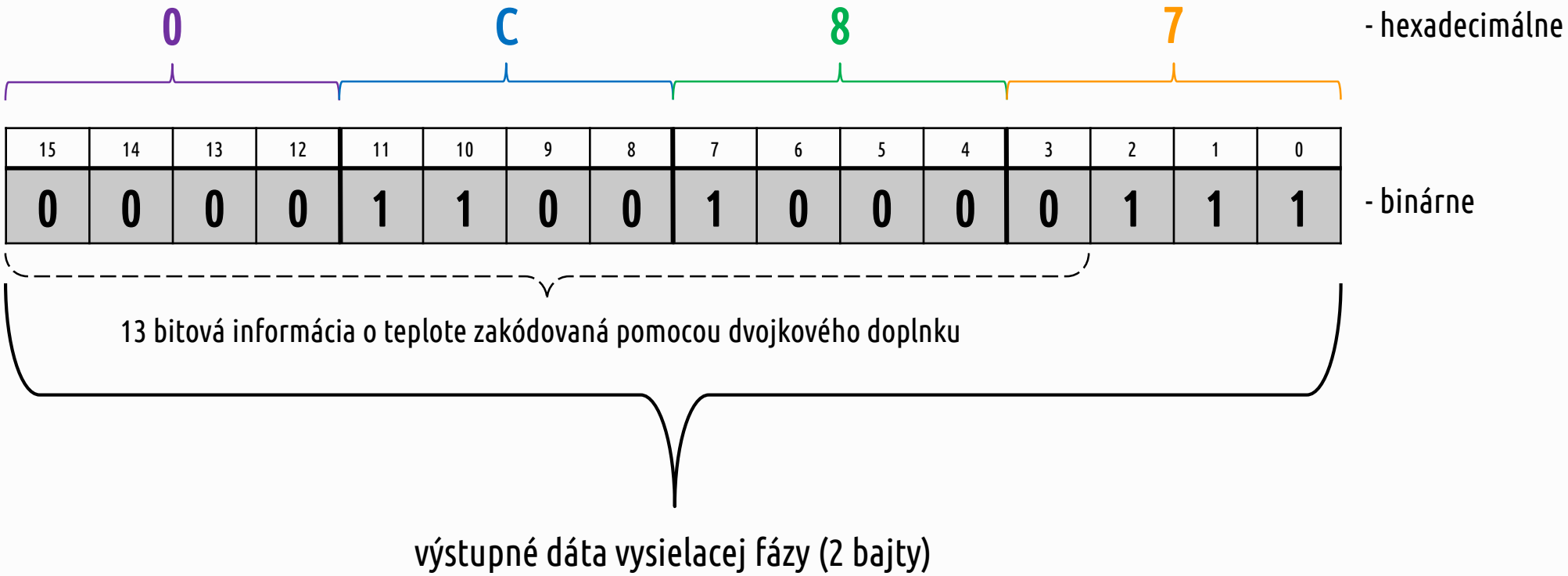
1‘s complement (negácia)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	1	1	0	0	1	0	0	0	0	1	1	1

$= 3\ 207_{TC}$

TC = Two‘s complement

Prijatie zakódovanej informácie o teplote zo senzora



Spracovanie prijatých dát - kladné hodnoty

0				C				8				7			
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	1	1	0	0	1	0	0	0	0	1	1	1

bitový posun doprava o 3 bity

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0

prevod do desiatkovej sústavy

400

vynásobenie hodnotou teplotného rozlíšenia 0,0625

25°C

Spracovanie prijatých dát - záporné hodnoty

F 3 8 7

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	1	1	1	0	0	1	1	1	0	0	0	0	1	1	1

určuje zápornú teplotu

odčítanie 0001_2

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	1	1	1	0	0	1	1	1	0	0	0	0	1	1	0

1‘s complement (negácia)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	1	1	0	0	0	1	1	1	1	0	0	1

bitový posun doprava o 3 bity

Spracovanie prijatých dát - záporné hodnoty

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1

prevod do desiatkovej sústavy

399

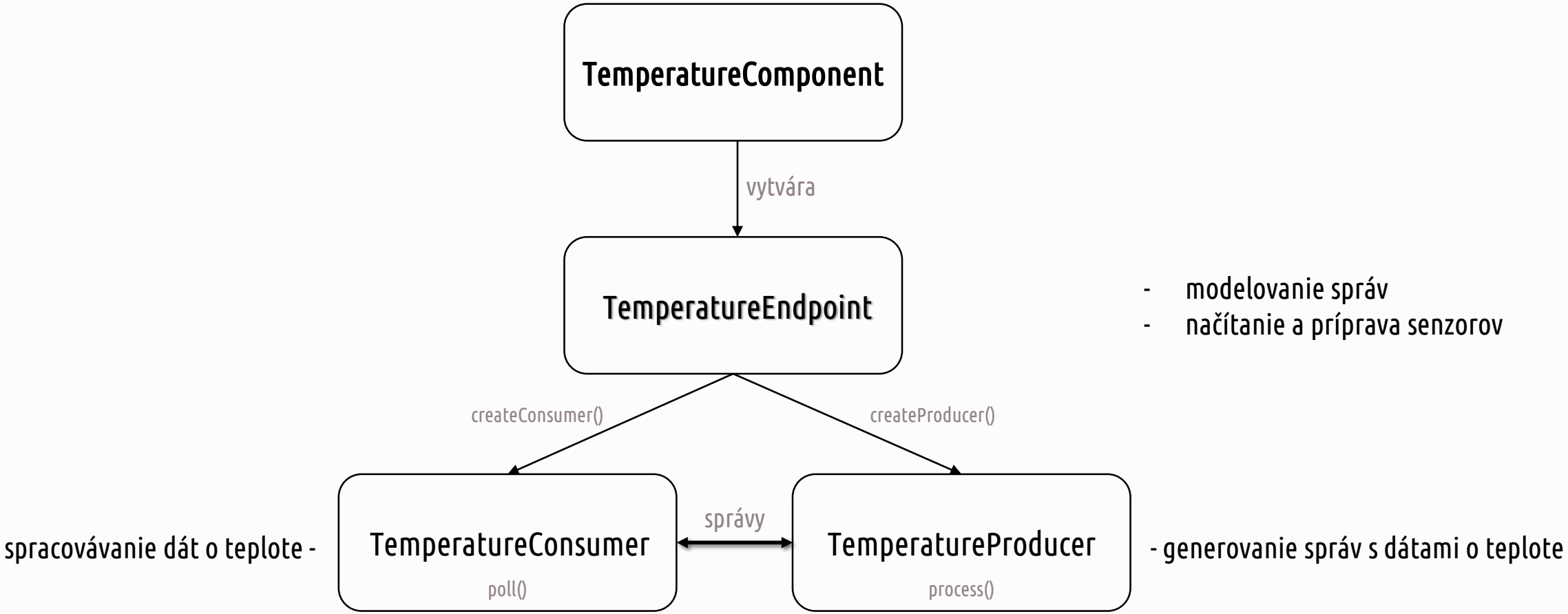
vynásobenie zápornou hodnotou teplotného rozlíšenia 0,0625

-24.9375°C ≈ **-25°C**

Úspešná komunikácia so senzorom a načítanie dát o teplote

```
pi@raspberrypi ~/Desktop/bulldog-examples $ sudo mvn exec:java -Dexec.mainClass="org.bulldog
.examples.LM74Example"
[INFO] Scanning for projects...
[INFO]
[INFO] ------------------------------------------------------------------------
[INFO] Building bulldog-examples 0.2.1-SNAPSHOT
[INFO] ------------------------------------------------------------------------
[INFO]
[INFO] --- exec-maven-plugin:1.4.0:java (default-cli) @ bulldog-examples ---
Temperature: 28.5625
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time: 10.016s
[INFO] Finished at: Fri Nov 06 01:22:05 CET 2015
[INFO] Final Memory: 10M/24M
[INFO] ------------------------------------------------------------------------
```

- Apache Camel komponent pre prácu s teplotou



- Analýza existujúcich knižníc pre prácu s periférami

LibsensorPy

bcm2835

BULLDOG

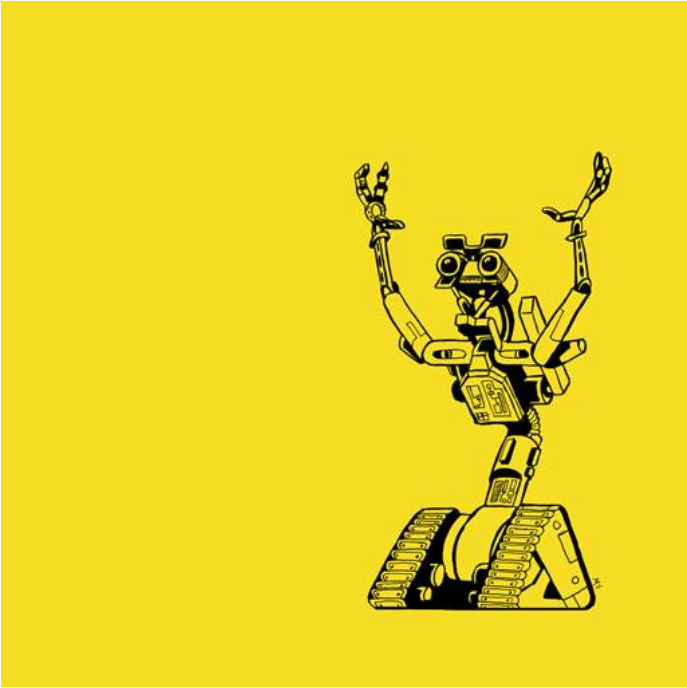
RaspberryPi.Net

Pigpio

Raspberry# IO

Raspi.js

PiLowLib



WiringPi

Framboos

RaspberryGPIOManager

Súhrnný prehľad vlastností analyzovaných knižníc

Č.	Názov	Jazyk	GPIO I/O	SPI	I2C	PWM	UART
1	Bcm2835	C, C++	✓	✓	✓	✓	✓
2	Bulldog	C, Java	✓	✓	✓	✓	✓
3	Framboos	Java, Scala	✓	×	×	×	✓
4	Johnny-Five	JavaScript	✓	✓	✓*	✓	✓*
5	Libmraa	C, C++	✓	✓	✓	✓	✓
6	LibsensorPy	Python	✓	✓	✓	×	×
7	Pi4J	C, Java	✓	✓	✓	✓	✓
8	Pigpio	C	✓	✓	✓	✓	✓
9	PiLowLib	Python	✓	✓	×	✓	×
10	RaspberryGPIOManager	C#	✓	×	×	×	×
11	RaspberryPi.Net	C#	✓	✓	?	✓	?
12	Raspberry# IO	C#	✓	✓	✓	×	×
13	Raspi.js	C++, JavaScript, Python	✓	×	✓	✓	✓
14	WiringPi	C,C++	✓	✓	✓	✓	✓

- Analýza dostupných IoT platform

A gap analysis of Internet-of-Things platforms

Julien Mineraud[a,*], Oleksiy Mazhelis[b], Xiang Su[c], Sasu Tarkoma[a]

[a] *Department of Computer Science, University of Helsinki, Finland*
[b] *Department of Computer Science and Information Systems, University of Jyväskylä, Finland*
[c] *Department of Computer Science and Engineering, University of Oulu, Finland*

Abstract

We are experiencing an abundance of Internet-of-Things (IoT) middleware solutions that provide connectivity for sensors and actuators to the Internet. To gain a widespread adoption, these middleware solutions, referred to as platforms, have to meet the expectations of different players in the IoT ecosystem, including device providers, application developers, and end-users, among others.

In this article, we evaluate a representative sample of these platforms, both proprietary and open-source, on the basis of their ability to meet the expectations of the IoT. The evaluation is completed by a gap analysis of the current IoT landscape with respect to (i) the support of heterogeneous hardware, (ii) the capabilities of the platform for data management, (iii) the support of application developers, (iv) the extensibility of the different platforms for the formation of ecosystems, as well as (v) the availability of dedicated marketplaces to the IoT. The gap analysis aims to highlight the deficiencies of today's solutions to improve their integration to tomorrow's ecosystem. In order to strengthen the finding of our analysis, we conducted a survey amongst the partners of the Finnish Internet of Things program, counting over 350 experts, to evaluate the most critical issues for the development of future IoT platforms. Based on the results of our analysis and our survey, we conclude this article with a list of recommendations for extending these IoT platforms in order to fill in the gaps.

Keywords: Internet of Things, IoT platforms, IoT marketplace, gap analysis, IoT ecosystem.

01181v2 [cs.CY] 25 Nov 2015

1. Introduction

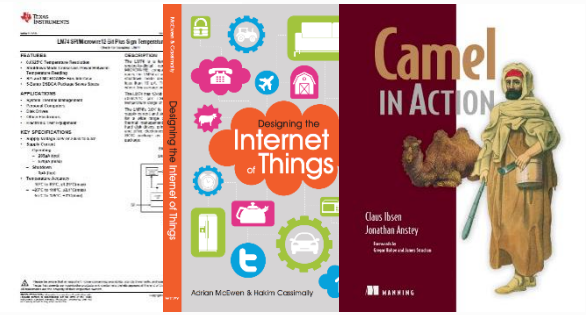
The Internet of Things (IoT) paradigm foresees the development of our current environment towards new enriched spaces, such as smart cities, smart homes, smart grid, enhanced medical support and automated environ-

as the middleware and the infrastructure that enables the end-users to interact with smart objects, as depicted in Figure 1. We frame our study as a gap analysis of these platforms with regard to their capacities in meeting the challenges emerging from the current development of the IoT technologies. In order to evaluate the limitations of

A gap analysis of Internet-of-Things platforms
Julien Mineraud
Oleksiy Mazhelis
Xiang Su
Sasu Tarkoma

Zdroje a literatúra

- IBSEN, Claus; ANSTEY, Jonathan. Camel in Action. Manning Publications Co., 2011
- MCEWEN, Adrian; CASSIMALLY, Hakim. Designing the IoT. John Wiley & Sons, 2013
- LM74 | Digital Output | Local Temperature Sensors | Technical documents [online]



Ďakujem za pozornosť...

...otázky?