USB Temp Probe

CS572 - Project 2

By Freddy Carl, Wil Cooley
& Akbar Saidov

Architecture

- Based on original Wirebird project, used in production 3 Thankgivings in a row
- Device is USB interrupt endpoint
- Teensy provides USB HID interface to thermistor probes (adding support for thermocouple probes trivial)
  - Includes both probe enumeration & data-collection
- Driver provides simplified user-space interface to USB HID device

Firmware

- Based on Sean Bruno's lighty code
- Started out as USB-serial, but switched to HID due to driver complexity
- Required thermistor-to-Celsius conversion from PJRC
- Return only int data to kernel, so we multiply by 100 to preserve two points of precision.
  - int-restriction turns out not to be relevant, since data is returned as ASCII
- const struct probe_input_record probe_inputs[] = {

```
    /* Pin    Name     (Input number is index) */
    { 9,     basic_thermistor_1 },
    { 5,     basic_thermistor_2 },
    { 0,    null_probe },
};
```

Driver & User program

Based also on lighty and usb-skeleton.c driver
Implements probe enum & read commands via ioctl, read system calls

- Read after ioctl-read-all command returns probe data
- Read after ioctl-enum command returns probe enumeration

ENUM command

0 basic_thermistor

1 null_probe

RDALL command

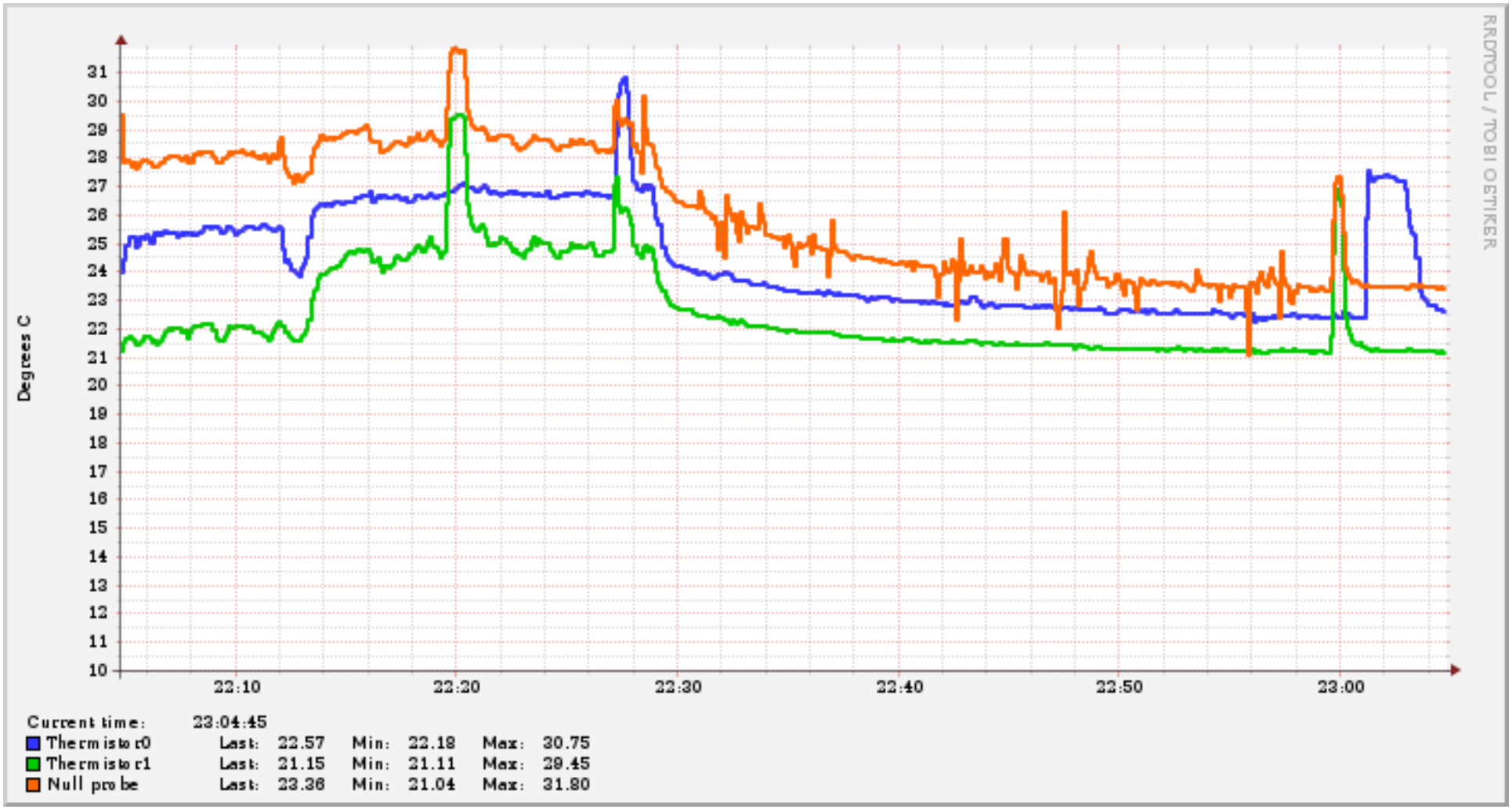
2021<tab>9829

User program acquires temperature data by polling

RRDtool is used to collect and graph the data:

- rrdcreate.sh - Creates RRD database
- rrdupdate.sh - Aquires data via user program & stores in RRD
- rrdgraph.sh - Generates graph
- Web server adds headers for automatic refresh

Demo


Degrees C
31
30
29
28
27
26
25
24
23
22
21
20
19
18
17
16
15
14
13
12
11
10
22:10
22:20
22:30
22:40
22:50
23:00
RRDTOOL / TOBI OETIKER
Current time: 23:04:45
Thermistor0 Last: 22.57 Min: 22.18 Max: 30.75
Thermistor1 Last: 21.15 Min: 21.11 Max: 29.45
Null probe Last: 23.36 Min: 21.04 Max: 31.80