NeaPolis Innovation

Review of previous sessions

Pad vs Line

- Lines are identifiers that convey both the Port and the Pad Values.

```
#define RED_LED_LINE PAL_LINE(GPIOA,8U)
palSetLine(RED_LED_LINE);
```

```
palSetLine(GPIOA,8U);
```

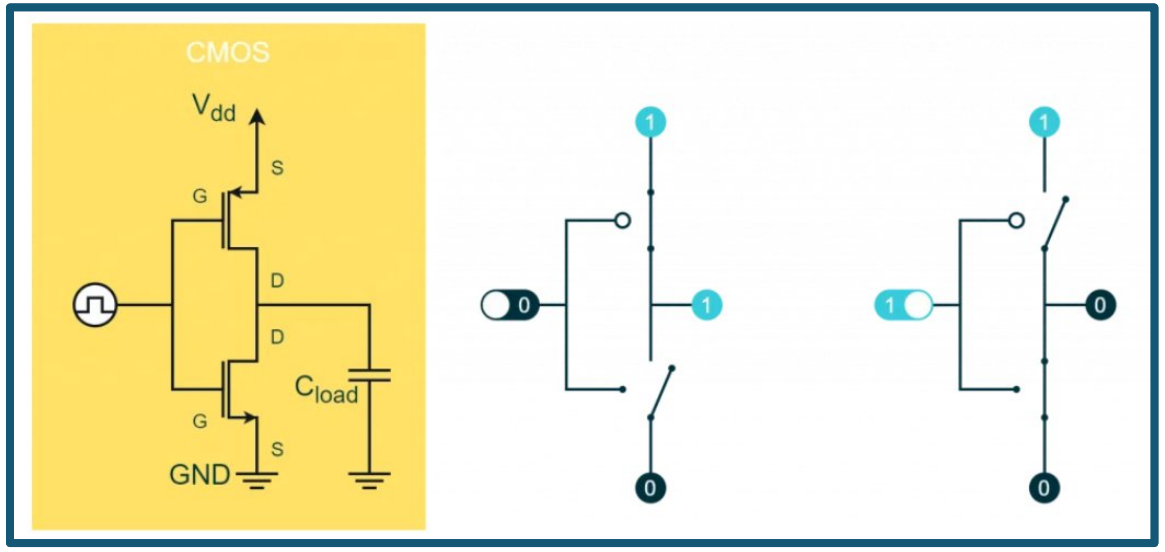
These are two different ways to change the output value of a GPIO to high.

- Some lines are defined in the board file, such as LINE_LED_GREEN.

```
192 #define LINE_LED                    PAL_LINE(GPIOA, 5U)
193 #define LINE_LED_GREEN              PAL_LINE(GPIOA, 5U)
194 #define LINE_SWDIO                  PAL_LINE(GPIOA, 13U)
```

Different Output Modes

- PAL_MODE_OUTPUT_PUSHPULL can drive the signal either high or low.
- When the GPIO output is high the load receives a high voltage, when the GPIO Output is low the load receives a low voltage.



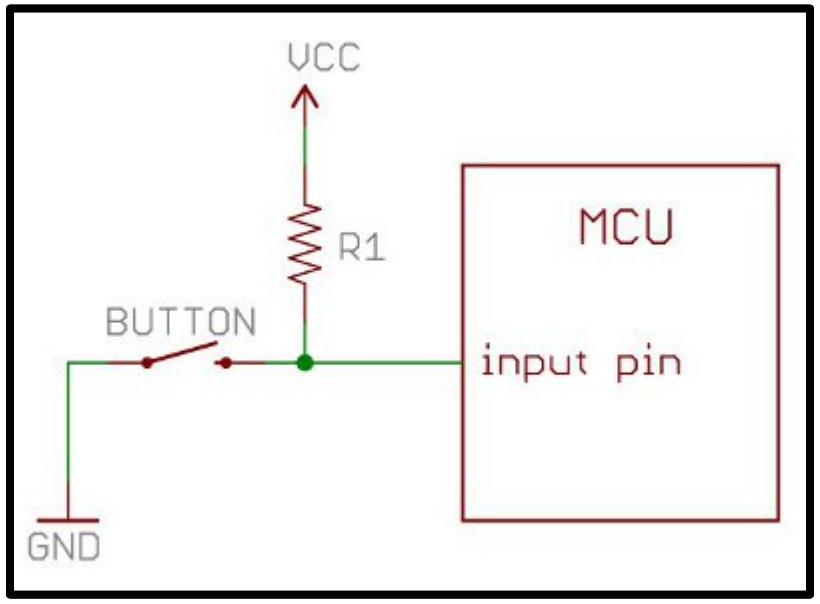
- PAL_MODE_OUTPUT_OPENDRAIN can only drive the signal low. When the GPIO output is high, the GPIO pin is in a high-impedance state.

Different Input Modes

- In PAL_MODE_INPUT the GPIO behaves as a high impedence line.
- PAL_MODE_INPUT_PULLUP and PAL_MODE_INPUT_PULLDOWN enforce the status of the line when the external device is disconnected.

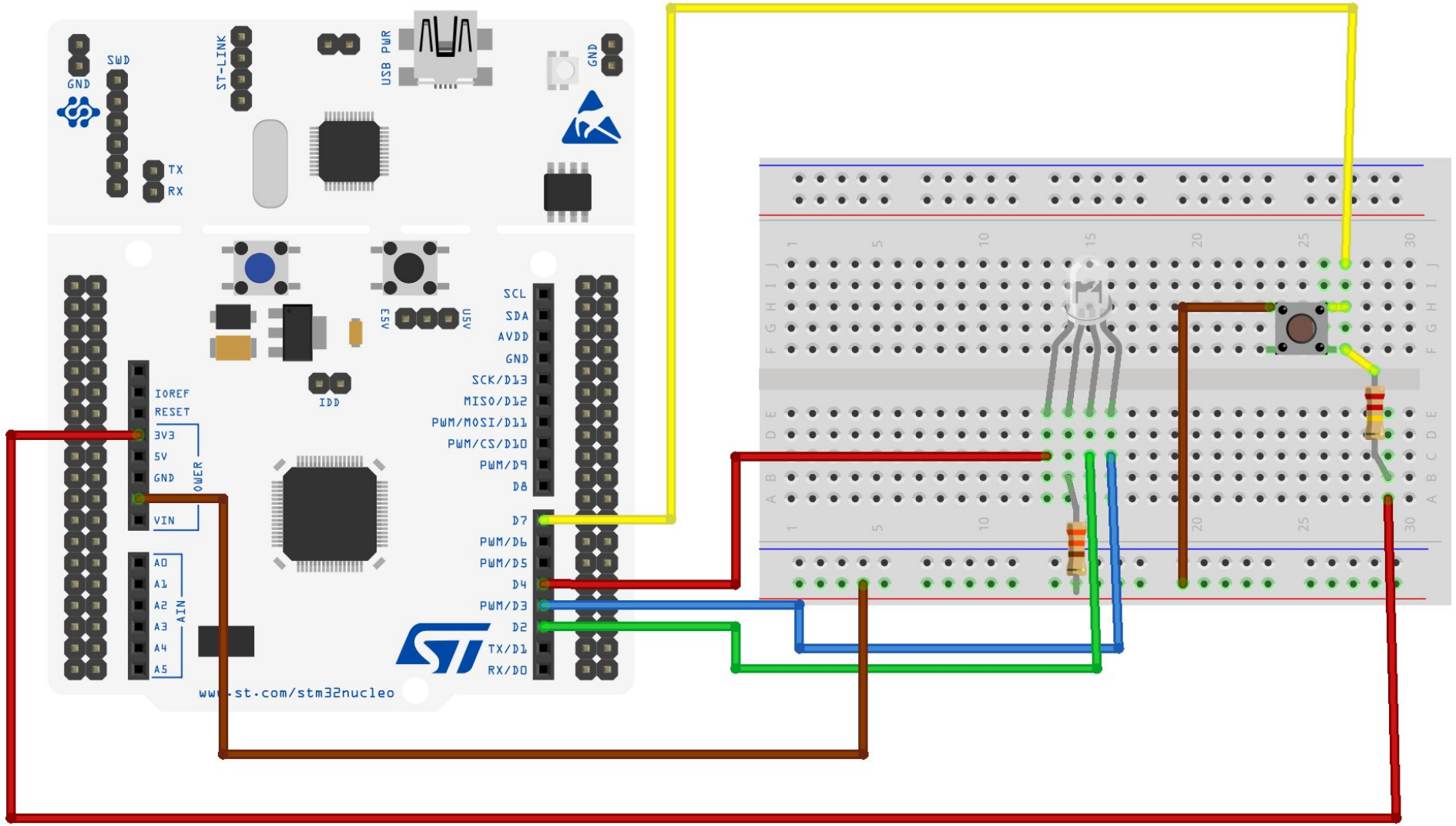
Using a button

- To use a button a pull-up circuit is needed in order to avoid an undefined behaviour when the button is not pressed.
- We can use an external pull-up circuit or set up the GPIO to use its internal pull-up resistor.

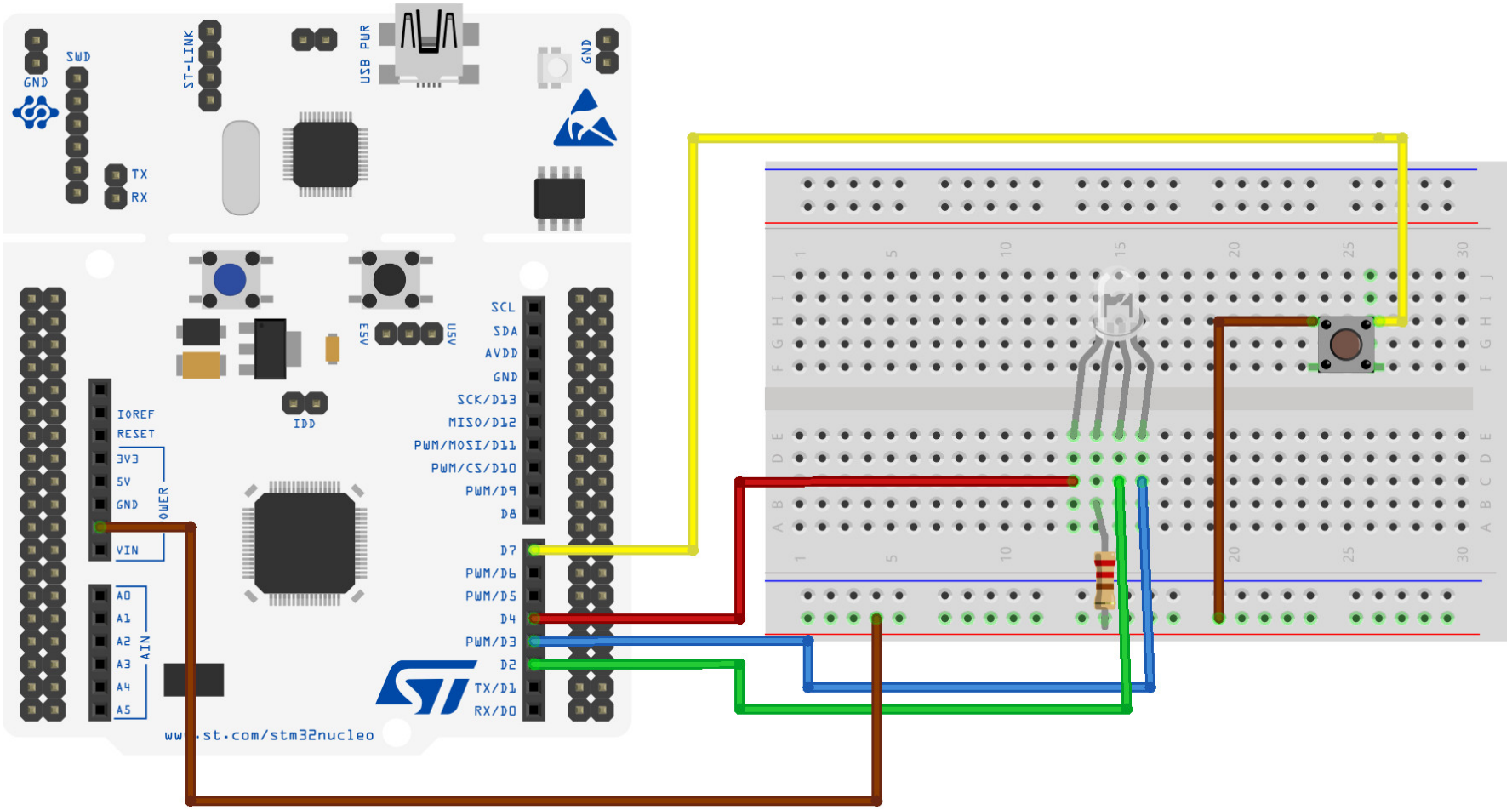


- When the button is not pressed the input pin detects a high voltage since there is approximately no current flow and no voltage drop on the resistor.
- When the button is pressed the GPIO detects a low voltage since it is shorted to GND.

External pull-up circuit

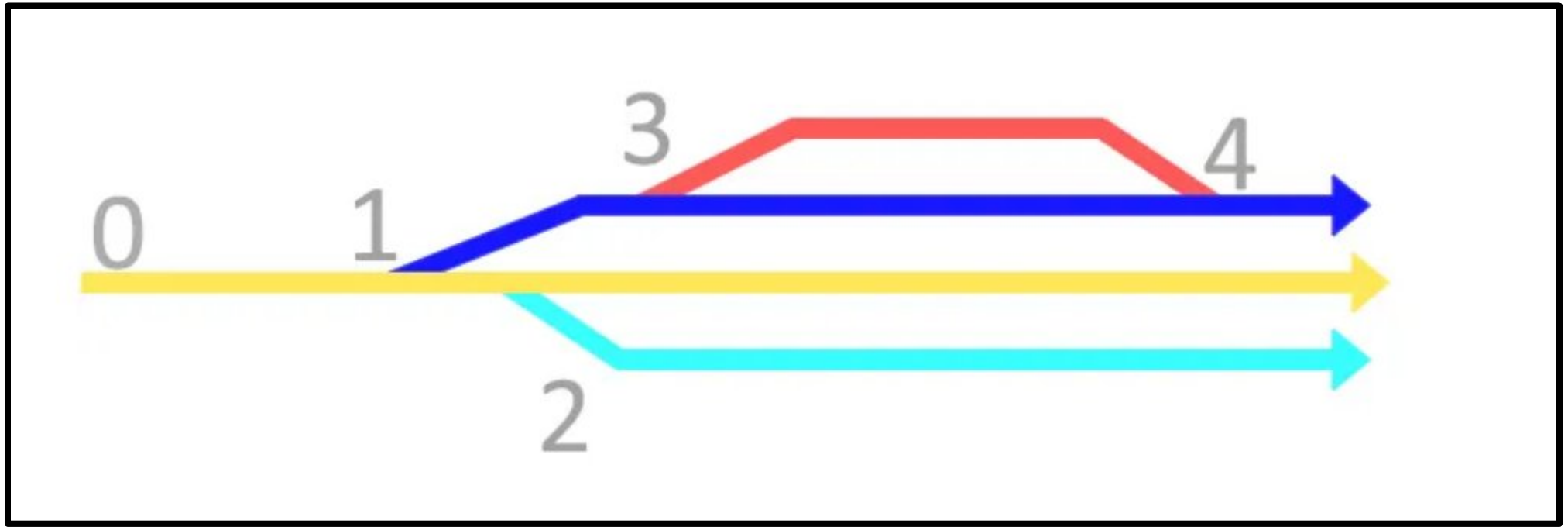


Internal pull-up circuit



Multithreading

- A single thread application could be imagined like a straight line.
- In a multithreaded application, the code execution can split in more than a branch: this mean that our line could fork and execution proceeds long two or more separate branches.



Multithreading

- The OS assigns the resources alternately to each line, according to established rules, pushing each line forward. The operation of pausing a line saving its state and resuming an another is called context switch.

- Among all the threads ready for execution, the one with the highest priority is the one being executed, no exceptions to this rule.

Using a joystick