Lesson 2
GPIO

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Development Board

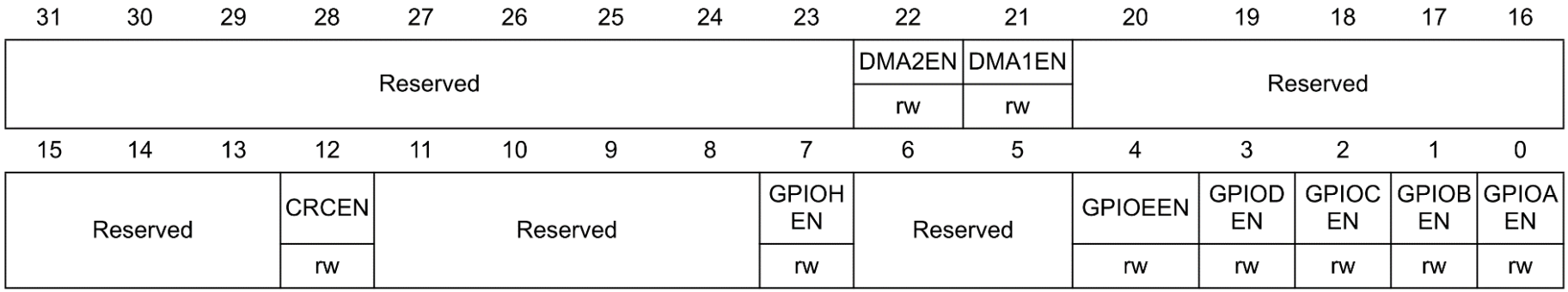
- STM32F0Discovery
  - User LD3: PC9
  - User LD4: PC8
  - B1 USER: PA0
- NucleoSTM32F401RE
  - B1 USER: PC13
  - User LD2: PA5

Reset and clock control (RCC)

- AHB1 peripheral clock enable register (RCC_AHB1ENR)

RCC_AHB1ENR

- Set and cleared by software.
  - 0: clock disable.
  - 1: clock enable.



General-purpose I/Os (GPIO)

- GPIO port mode register (GPIOx_MODER) (x =A..F)
- GPIO port input data register (GPIOx_IDR) (x = A..F)
- GPIO port output data register (GPIOx_ODR) (x = A..F)
- GPIO port bit set/reset register (GPIOx_BSRR) (x = A..F)

GPIOx_MODER

- MODERy[1:0]: Port x configuration bits (y = 0..15)
  - 00: Input mode (reset state)
  - 01: General purpose output mode
  - 10: Alternate function mode
  - 11: Analog mode

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
MODER15[1:0]		MODER14[1:0]		MODER13[1:0]		MODER12[1:0]		MODER11[1:0]		MODER10[1:0]		MODER9[1:0]		MODER8[1:0]	
rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
MODER7[1:0]		MODER6[1:0]		MODER5[1:0]		MODER4[1:0]		MODER3[1:0]		MODER2[1:0]		MODER1[1:0]		MODER0[1:0]	
rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw

GPIOx_IDR

- Bits 15:0 IDRy: Port input data bit (y = 0..15)
  - These bits are read-only. They contain the input value of the corresponding I/O port.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
IDR15	IDR14	IDR13	IDR12	IDR11	IDR10	IDR9	IDR8	IDR7	IDR6	IDR5	IDR4	IDR3	IDR2	IDR1	IDR0
r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r

GPIOx_ODR

- Bits 15:0 ODRy: Port output data bit (y = 0..15)
  - These bits can be read and written by software.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.	Res.
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
ODR15	ODR14	ODR13	ODR12	ODR11	ODR10	ODR9	ODR8	ODR7	ODR6	ODR5	ODR4	ODR3	ODR2	ODR1	ODR0
rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw	rw

GPIOx_BSRR

- Bits 31:16 BRy: Port x reset bit y (y = 0..15)
  - 1: Resets the corresponding ODRx bit
- Bits 15:0 BSy: Port x set bit y (y= 0..15)
  - 1: Sets the corresponding ODRx bit
- Writing 0 does nothing.

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
BR15	BR14	BR13	BR12	BR11	BR10	BR9	BR8	BR7	BR6	BR5	BR4	BR3	BR2	BR1	BR0
w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
BS15	BS14	BS13	BS12	BS11	BS10	BS9	BS8	BS7	BS6	BS5	BS4	BS3	BS2	BS1	BS0
w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w

CAUTION!!!

- When changing certain bits of register, all the other bits must be left unchanged.

Example 1

Configure PC13 as input

PC13 as input

- GPIOA_MODER:

  xxxx 00xx xxxx xxxx xxxx xxxx xxxx xxxx

- GPIOA_IDR:

  xxxx xxxx xxxx xxxx xx0x xxxx xxxx xxxx :B1 is released

  xxxx xxxx xxxx xxxx xx1x xxxx xxxx xxxx :B1 is pressed

Example 2

Configure PA5 as output

PA5 as output

- GPIOC_MODER:

  xxxx xxxx xxxx xxxx xxxx 01xx xxxx xxxx
- GPIOC_BSRR:

  xxxx xxxx xx1x xxxx xxxx xxxx xxxx xxxx :LD2 reset

  xxxx xxxx xxxx xxxx xxxx xxxx xx1x xxxx :LD2 set
- GPIOx_ODR: (option)

  xxxx xxxx xxxx xxxx xxxx xxxx xx0x xxxx :LD2 reset

  xxxx xxxx xxxx xxxx xxxx xxxx xx1x xxxx :LD2 set

Exercise

Main program

- If button pressed, LED on.
- If button released, LED off.
- Constantly scan.
- Use your GPIO driver.

GPIO Interface

Write the functions for GPIO pins

Functions

- Configure GPIO pins

  void GPIO_Set_Direction(GPIO_TypeDef* GPIOx, uint16_t inputMask, uint16_t outputMask);

- Read the input value

  uint8_t GPIO_ReadInputDataBit(GPIO_TypeDef* GPIOx, int Pin);

- Write value to a pin

  void GPIO_WriteBit(GPIO_TypeDef* GPIOx, int Pin, uint8_t BitVal);

Explain

- uint16_t inputMask = 0x0001 //Px0 as input
- uint16_t outputMask = 0x0300 //Px8, Px9 as output