



PYTHON AND ARDUINO: A TALE OF SNAKES AND KINGS

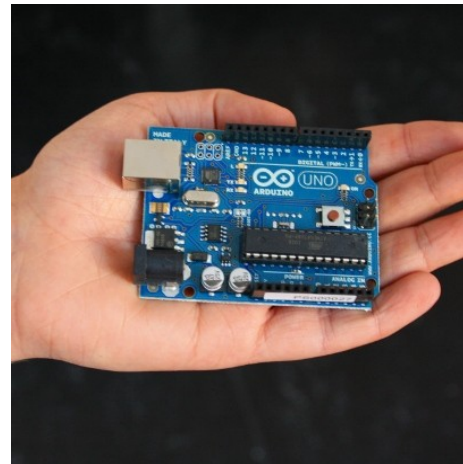
EuroPython 2012 - Florence

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Introduction

who
why
what



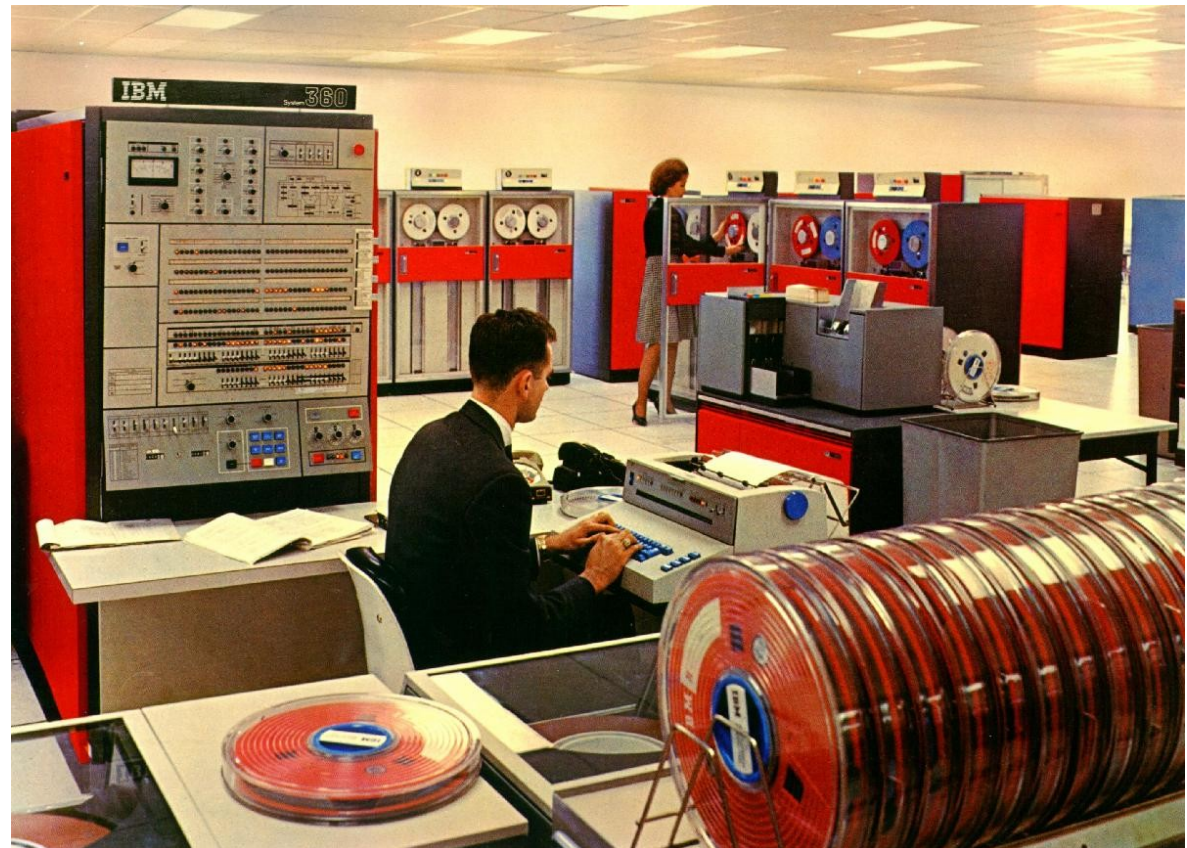
In the beginning

In the beginning was the abacus...
Technology started on real things
you could touch



Being digital

From Big-Blue to Micro-Soft



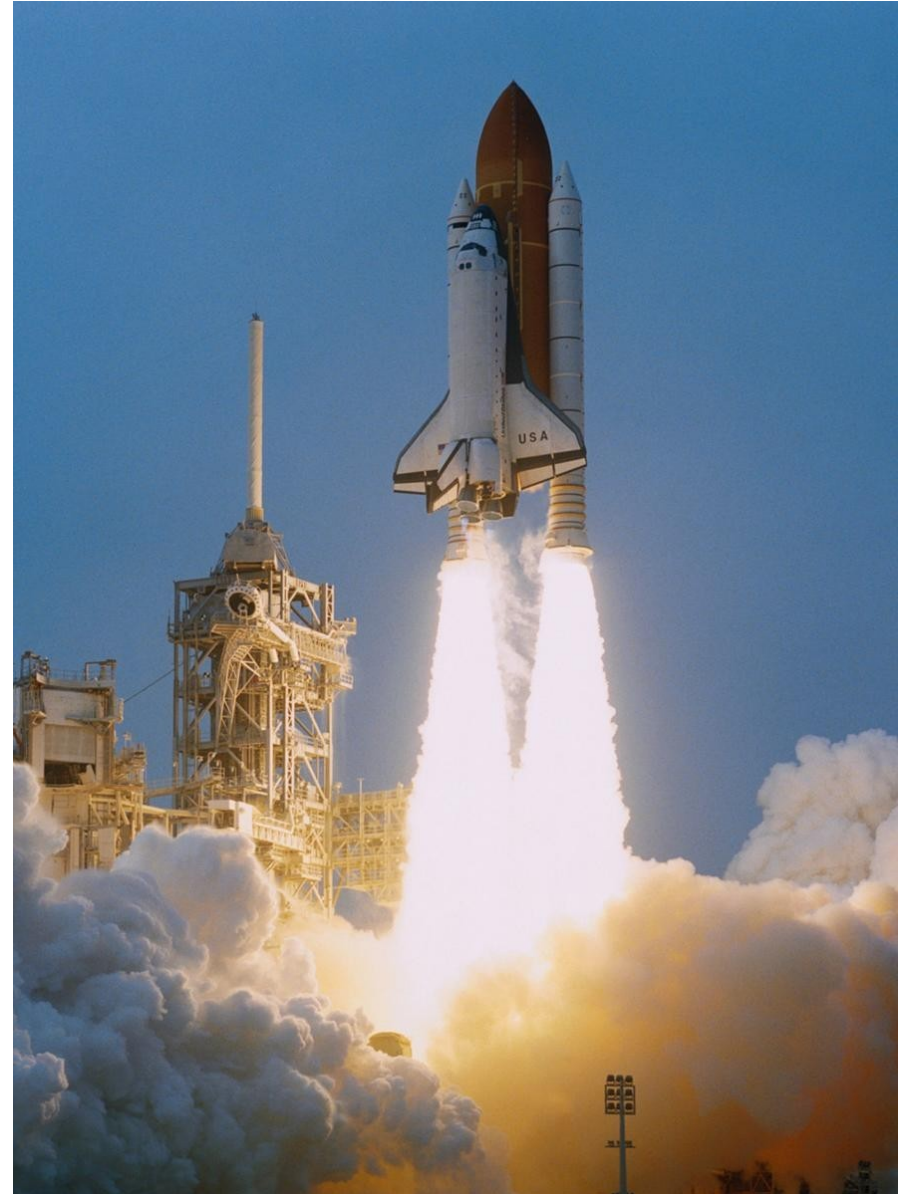
Touching the Sky

Alice in Metaphorsland:
desktops, trash-bins and wizards



Leaving Earth

Abstraction can be addictive



Unusable interfaces

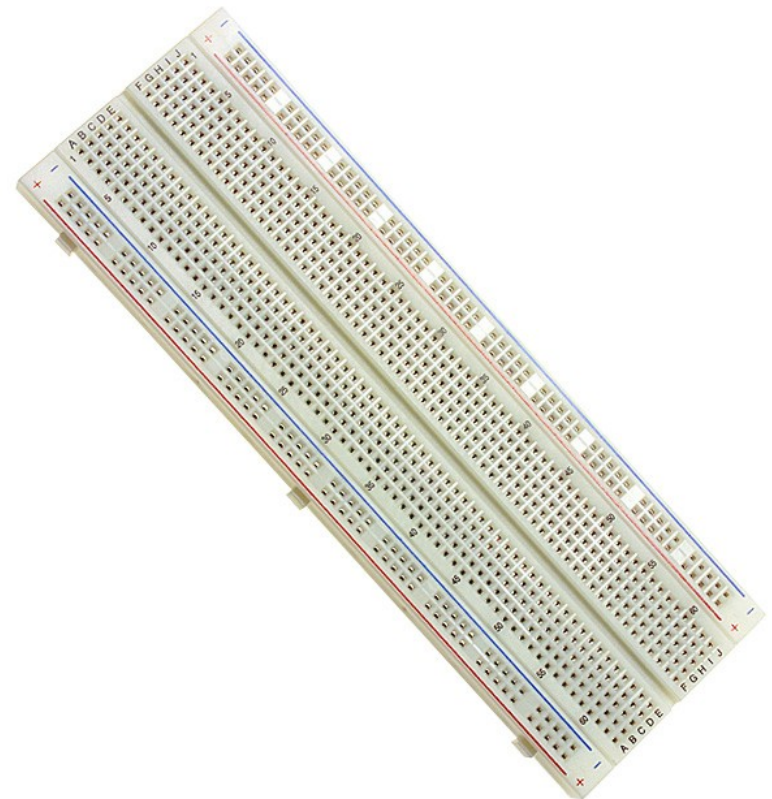
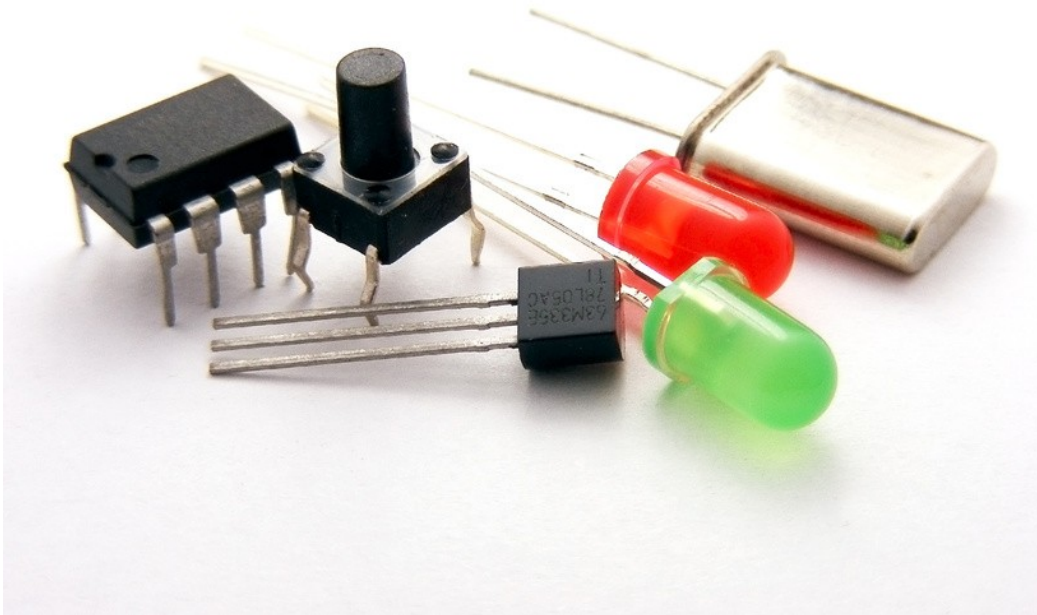


It's all about Interactivity



Being real

Physical computing: low cost MCU's and electronic components



Here comes the King

Arduino's revolution

minimal

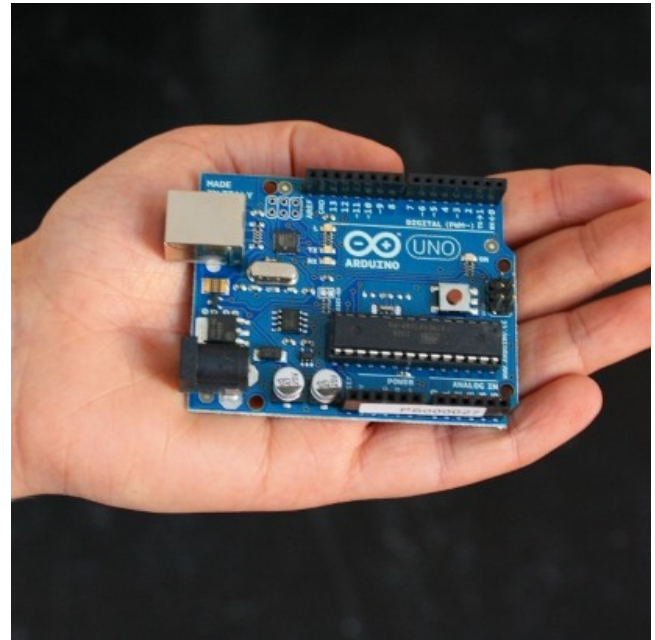
easy to use

cheap

from artists

Made in Italy

open hardware



What's inside?

hw: device: electronic prototyping board

sw: bootloader

sw: libraries

sw: IDE

community

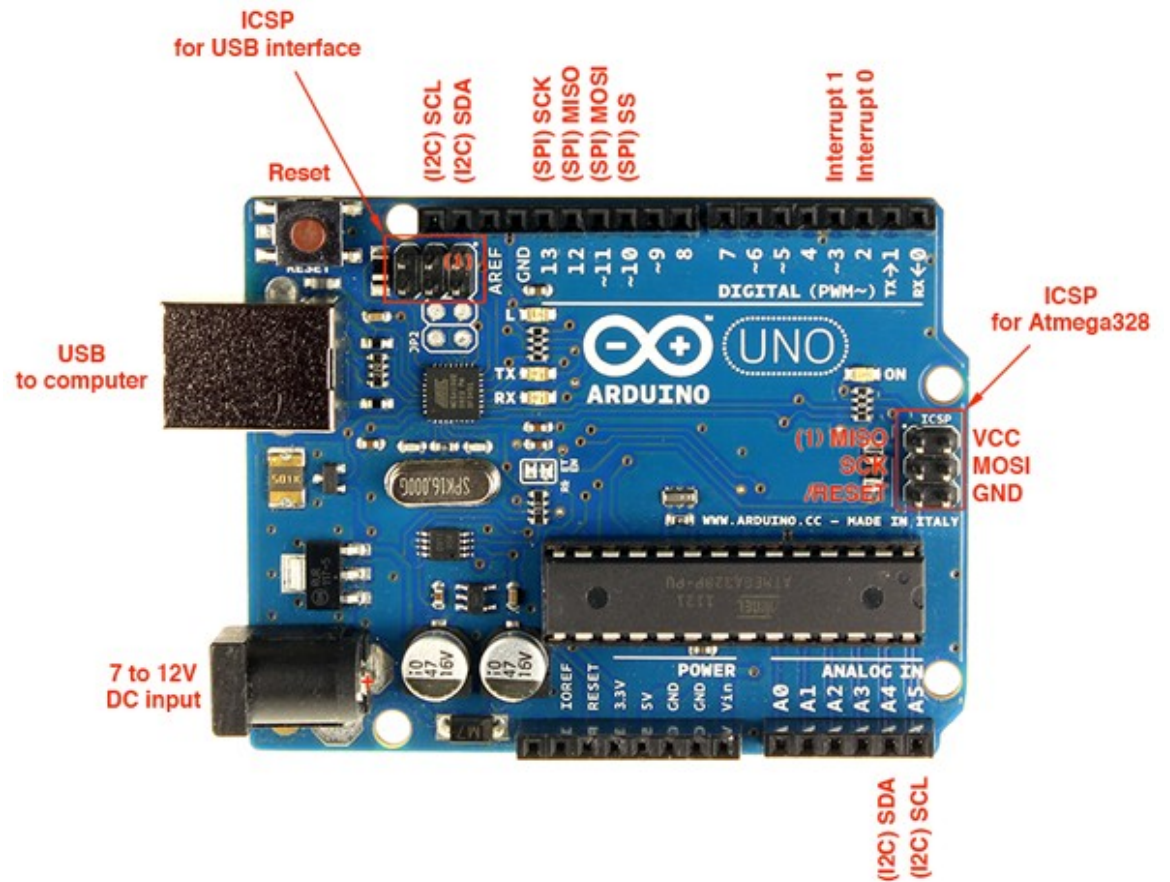
lot of manuals

lot of examples



The board

Arduino UNO



MCU

Atmega 328

RAM 2 KB

ROM 32 KB

EEPROM 1 KB

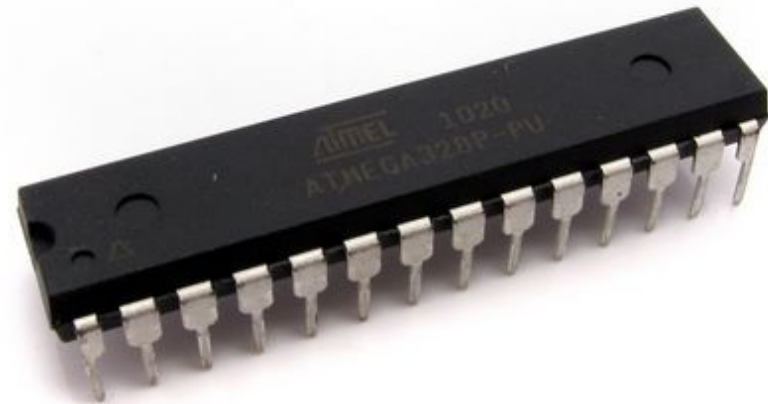
14 digital pins

6 PWM capable

6 analog inputs

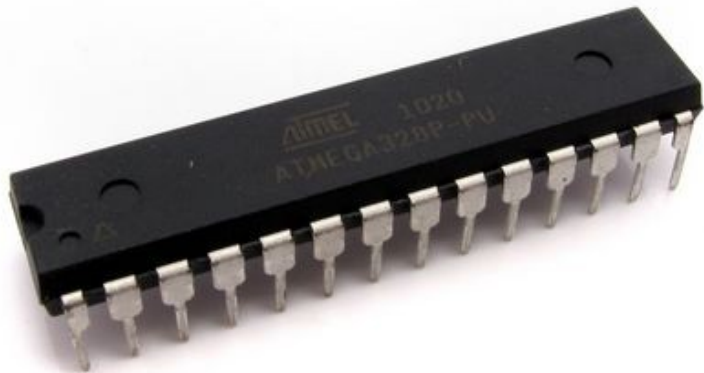
Up to 16 MHz

avr-gcc



Power to the people!

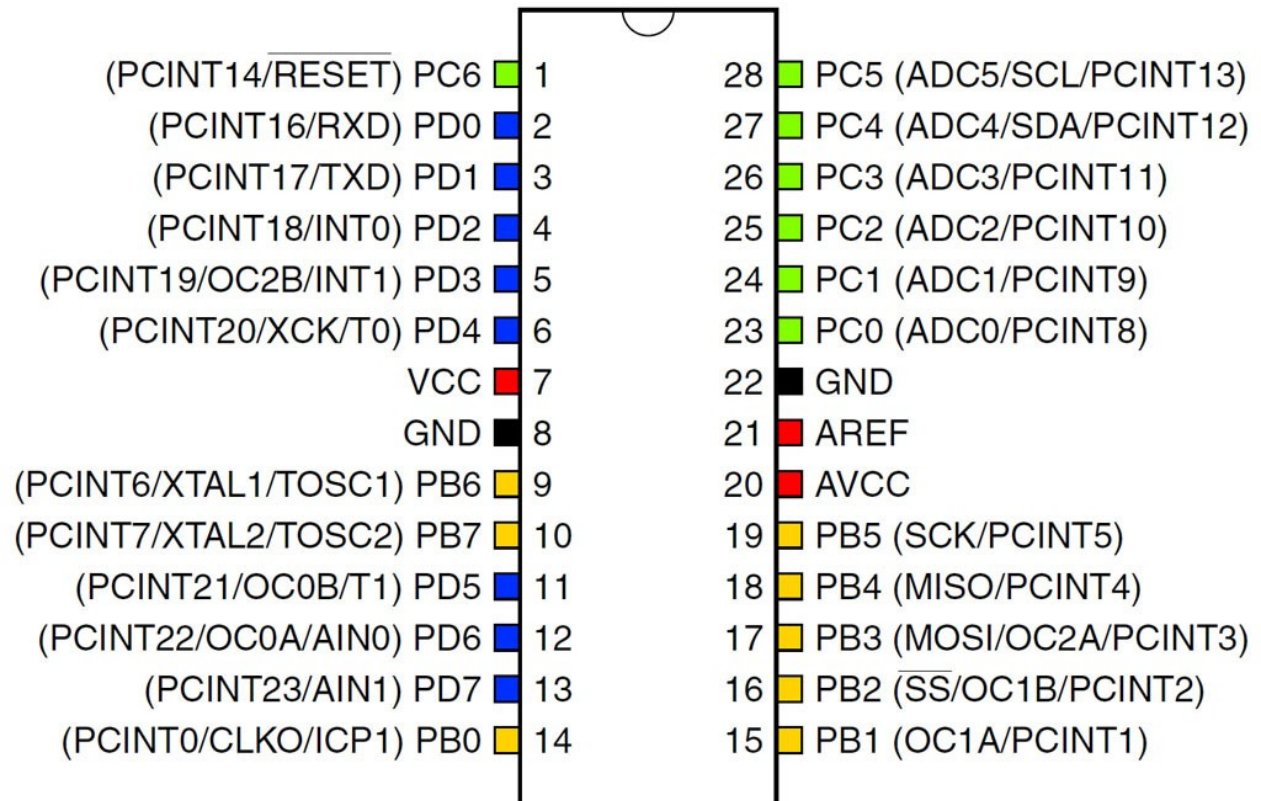
1982 – IBM 80286



Splitting the byte

Atmega 328

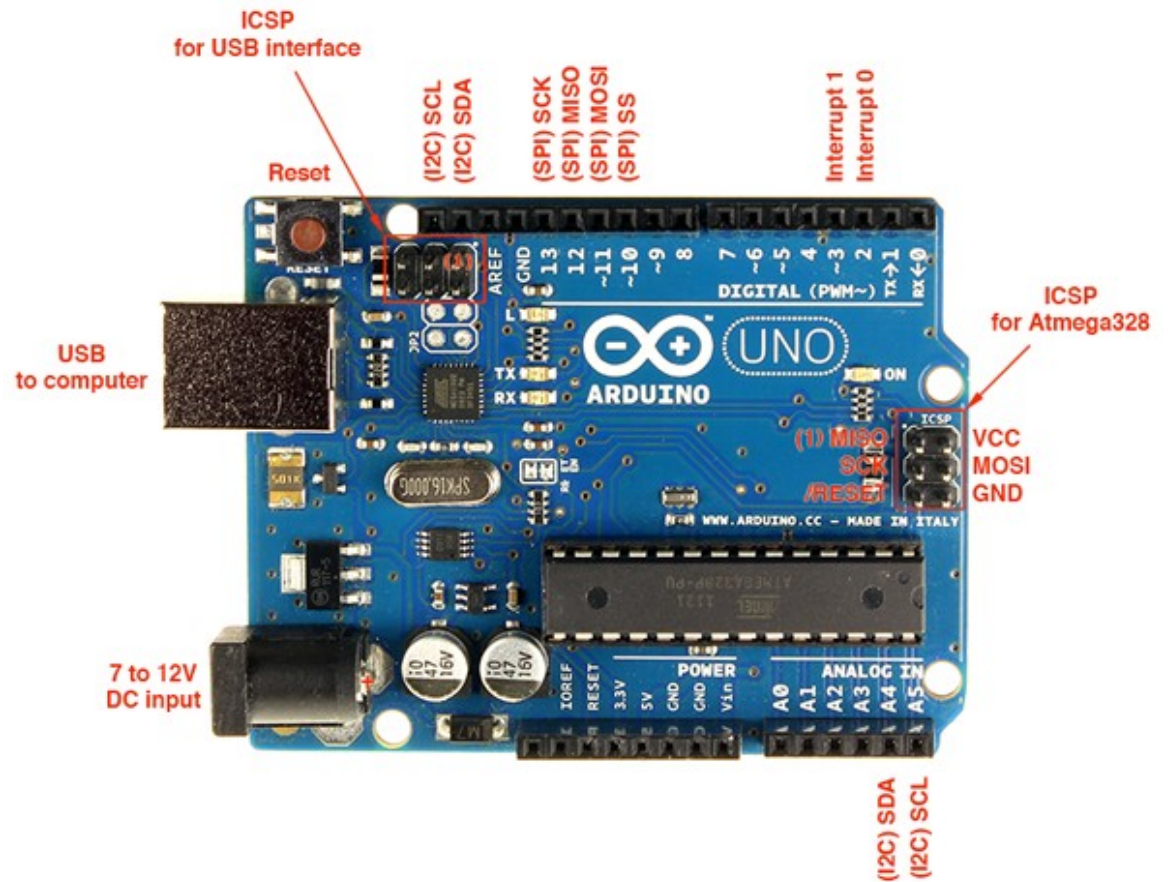
Registers and ports



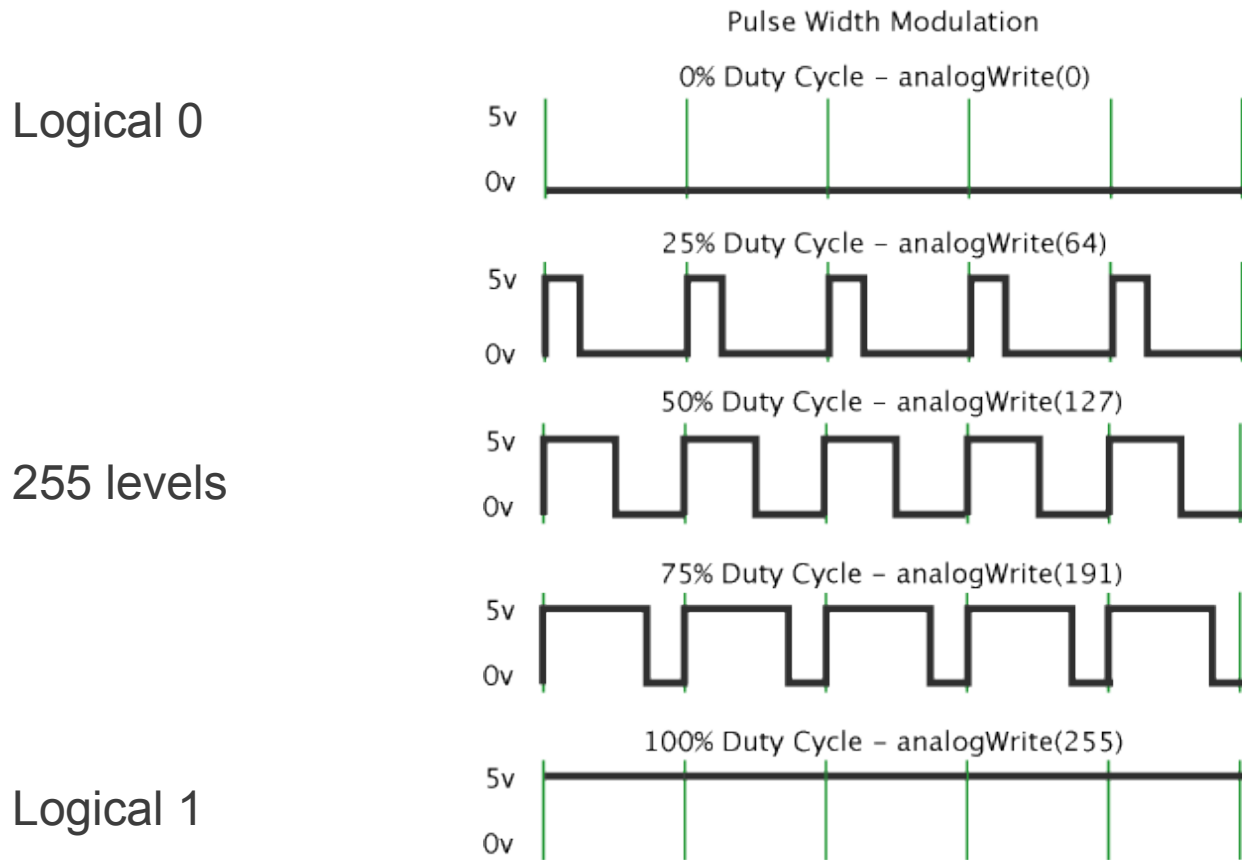
Pins

Digital IO
PWM (digital)

Analog inputs

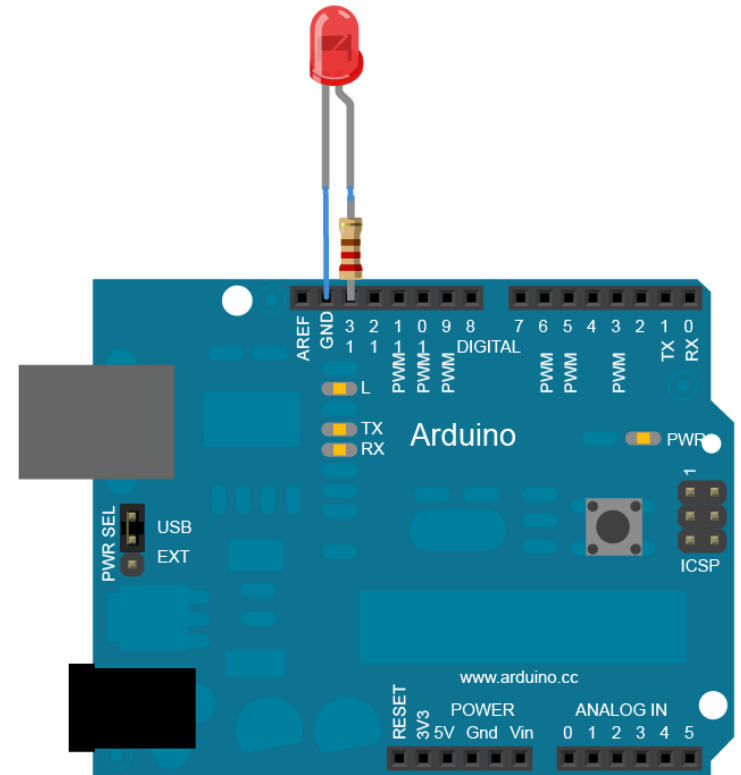


PWM (pulse width modulation)



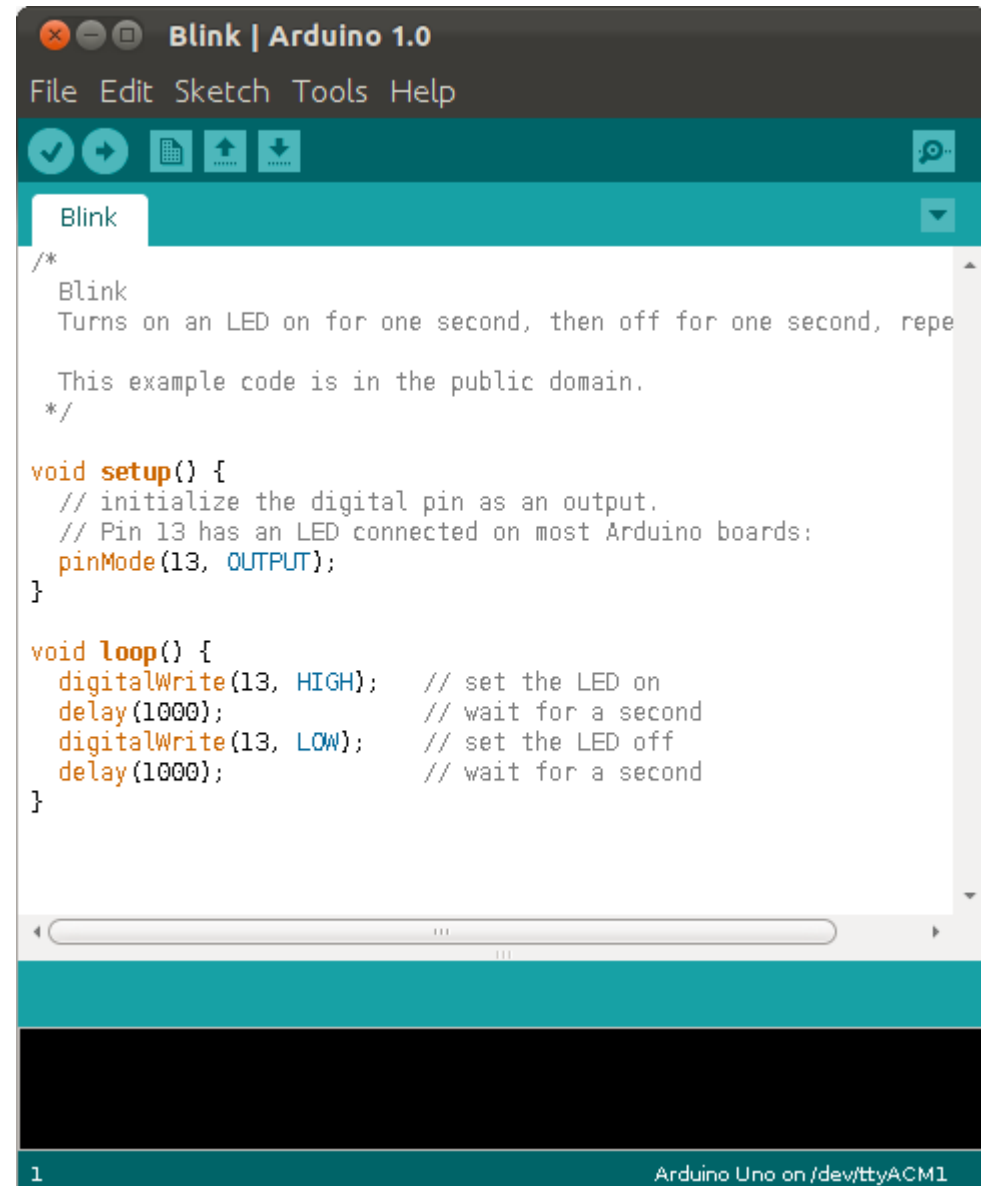
C programming

```
1 #define F_CPU 1000000UL
2 #include <avr/io.h>
3 #include <avr/delay.h>
4
5 void delays(uint16_t millis) {
6     uint16_t loop;
7     while ( millis ) {
8         _delay_ms(1);
9         millis--;
10    }
11 }
12
13 int main(void) {
14     /* set PB5 (digital pin 13)
15     to output */
16     DDRB |= 1<<PB5;
17     while(1) {
18         PORTB &= ~(1<<PB5); /* pin off */
19         delays(100);
20         PORTB |= 1<<PB5; /* pin on */
21         delays(900);
22     }
23     return 0;
24 }
```



Programming

setup
loop
blink!



The image shows a screenshot of the Arduino IDE interface. The window title is "Blink | Arduino 1.0". The menu bar includes "File", "Edit", "Sketch", "Tools", and "Help". The toolbar contains icons for a checkmark, a right arrow, a document, an upload arrow, a download arrow, and a gear. The sketch name "Blink" is displayed in a teal bar. The code editor contains the following code:

```
/*  
  Blink  
  Turns on an LED on for one second, then off for one second, repe  
  
  This example code is in the public domain.  
  */  
  
void setup() {  
  // initialize the digital pin as an output.  
  // Pin 13 has an LED connected on most Arduino boards:  
  pinMode(13, OUTPUT);  
}  
  
void loop() {  
  digitalWrite(13, HIGH); // set the LED on  
  delay(1000);           // wait for a second  
  digitalWrite(13, LOW); // set the LED off  
  delay(1000);           // wait for a second  
}
```

At the bottom of the IDE, the status bar shows "1" on the left and "Arduino Uno on /dev/ttyACM1" on the right.

King's audience

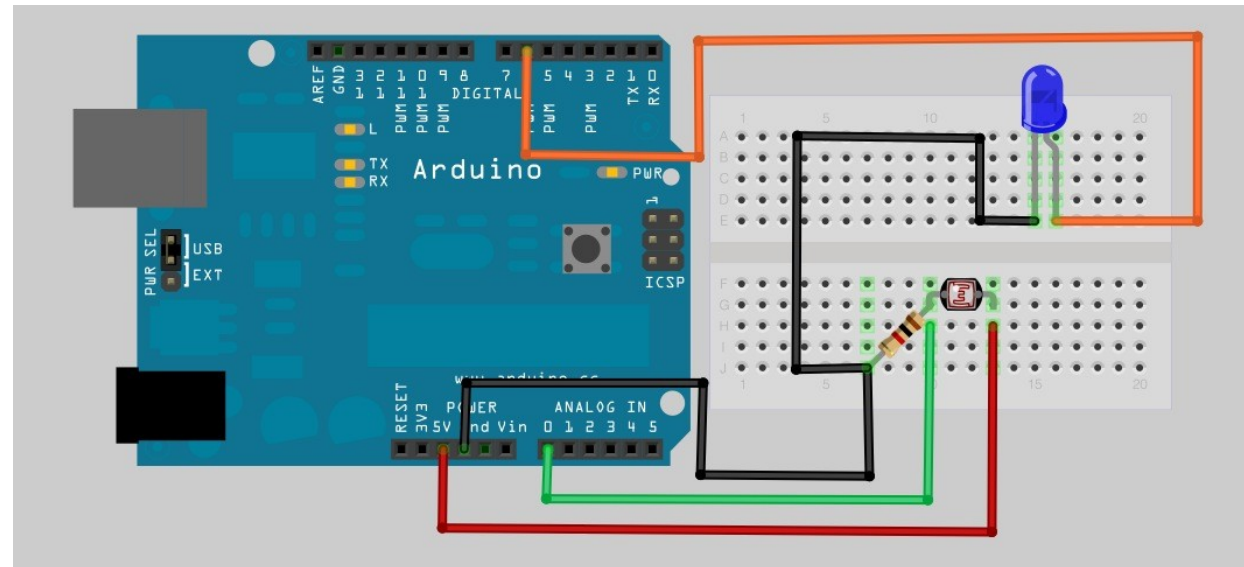
Arduino talks and listens

serial

sensors

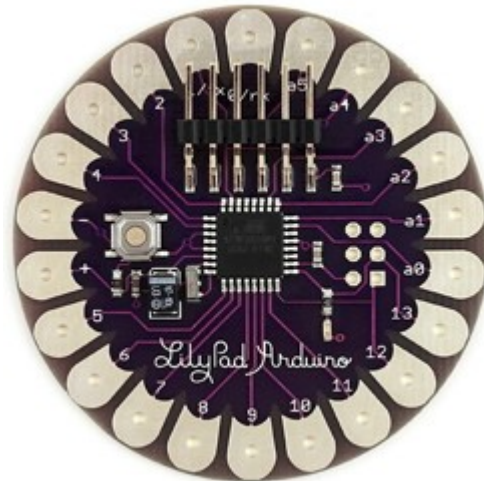
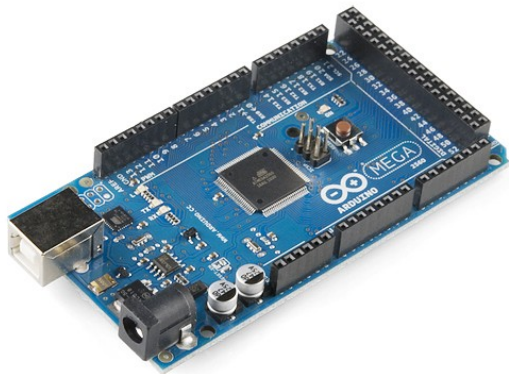
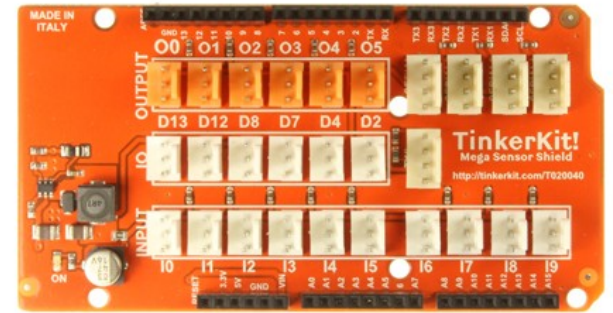
RF

ethernet



At the king's court

shields
clones



Snake's attack

ASCII messages
compact protocols

```
>>> import pyfirmata  
>>> print "yeah, it works!! :-D"
```


ASCII snake

```
>>> import serial
>>> ser = serial.Serial('/dev/ttyACM0', 9600)
>>> while 1:
...     ser.readline()
'1 Hello world!\r\n'
'2 Hello world!\r\n'
'3 Hello world!\r\n'
```

```
>>> import serial
>>> ser = serial.Serial('/dev/ttyACM0', 9600)
>>> ser.write('5')
```

The firmata protocol

http://firmata.org/wiki/Main_Page

pyfirmata to the rescue

<https://bitbucket.org/tino/pyfirmata/src>

PyFirmata example

```
1 import pyfirmata
2
3 PIN = 13 # Pin 13 is used
4 DELAY = 2 # A 2 seconds delay
5
6 PORT = '/dev/ttyACM0'
7
8 # Creates a new board
9 board = pyfirmata.Arduino(PORT)
10
11 # Loop for blinking the led
12 while True:
13     # Set the LED pin to 1 (HIGH)
14     board.digital[PIN].write(1)
15     board.pass_time(DELAY)
16     # Set the LED pin to 0 (LOW)
17     board.digital[PIN].write(0)
18     board.pass_time(DELAY)
19
```

Embedded snakes

Python on a chip 

<http://code.google.com/p/python-on-a-chip/>

Other projects

Python Arduino Prototyping API

<https://github.com/HashNuke/Python-Arduino-Prototyping-API>

Python 2B (ASCII protocol)

<http://arduino.cc/playground/Code/2B>

OpenERP arduino controller

Demo



<https://github.com/elpaso/arduinocontroller>

http://www.youtube.com/watch?feature=player_embedded&v=MkxK9bHPZxQ



THANKS!

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