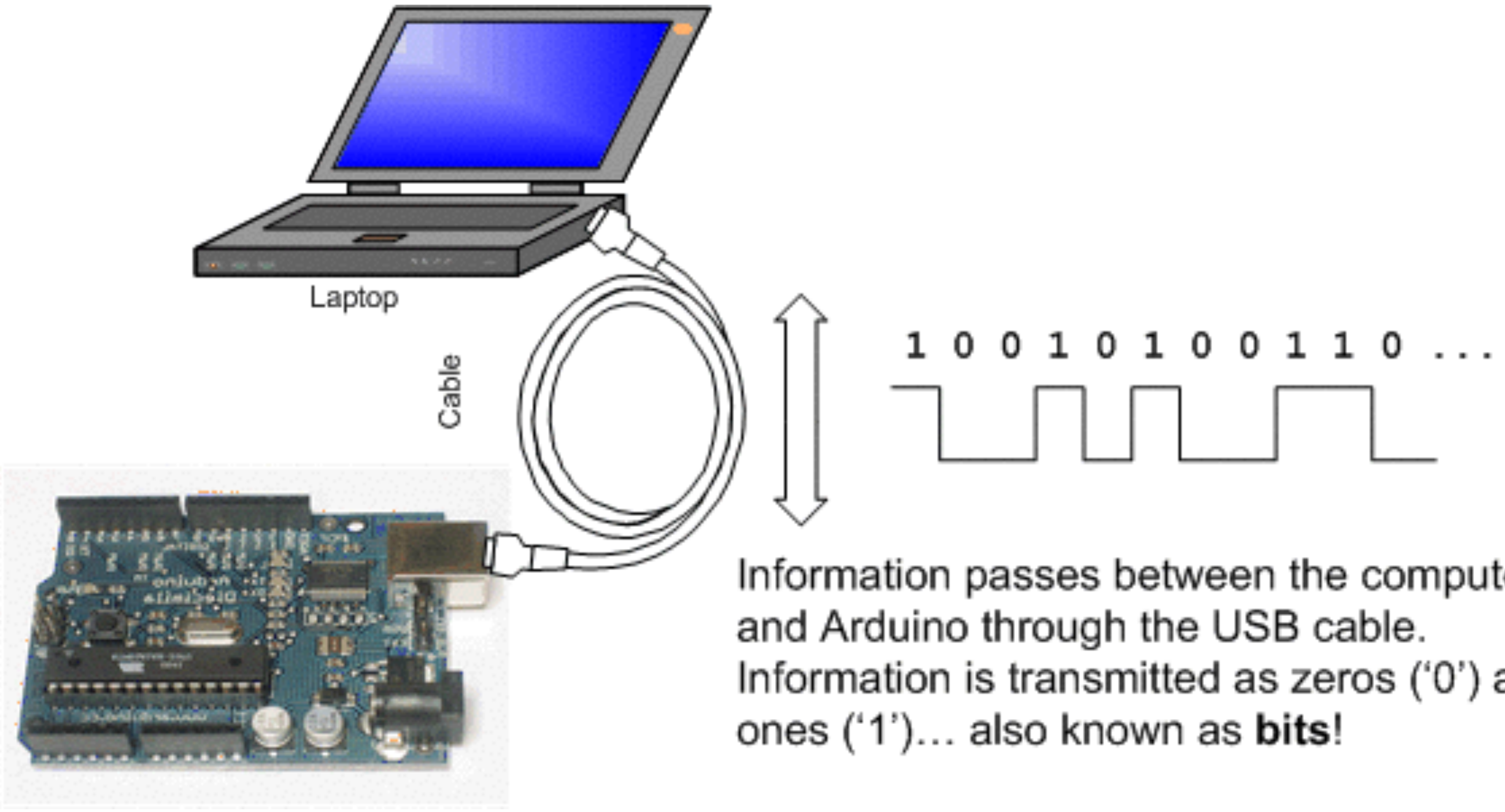
CUSP
CENTER FOR URBAN
SCIENCE+PROGRESS

# Rapid Prototyping of Urban Sensors

## Serial Communication

# SERIAL COMMUNICATION

- from Arduino to the rest of the world
- communication between LCD screen, GPS etc…
- communicates by sending 1s and 0s (bits)
- each character is encoded as a byte



Information passes between the computer and Arduino through the USB cable. Information is transmitted as zeros ('0') and ones ('1')… also known as **bits**!

# SERIAL COMMUNICATION

- computers must agree on:
    - Electrical Agreement
        - RX/TX/Gnd
    - Speed Agreement
        - 9600 bits-per-second
    - Logic Agreement - binary, hex, ascii
- ONLY ONE PROGRAM CAN READ SERIAL AT A TIME

# SERIAL COMMUNICATION

- UART (universal asynchronous receiver/transmitter), SPI (serial peripheral interface), I2C (Inter Integrated Circuit)
- **Synchronous** is when the sender and the receiver use the same clock signal
- **Asynchronous** is when the sender provides the synchronization signal
- This is when a sensor has it own microcontroller onboard and can just send data to another micro controller rather than reading a changing voltage.
- lots of development of these

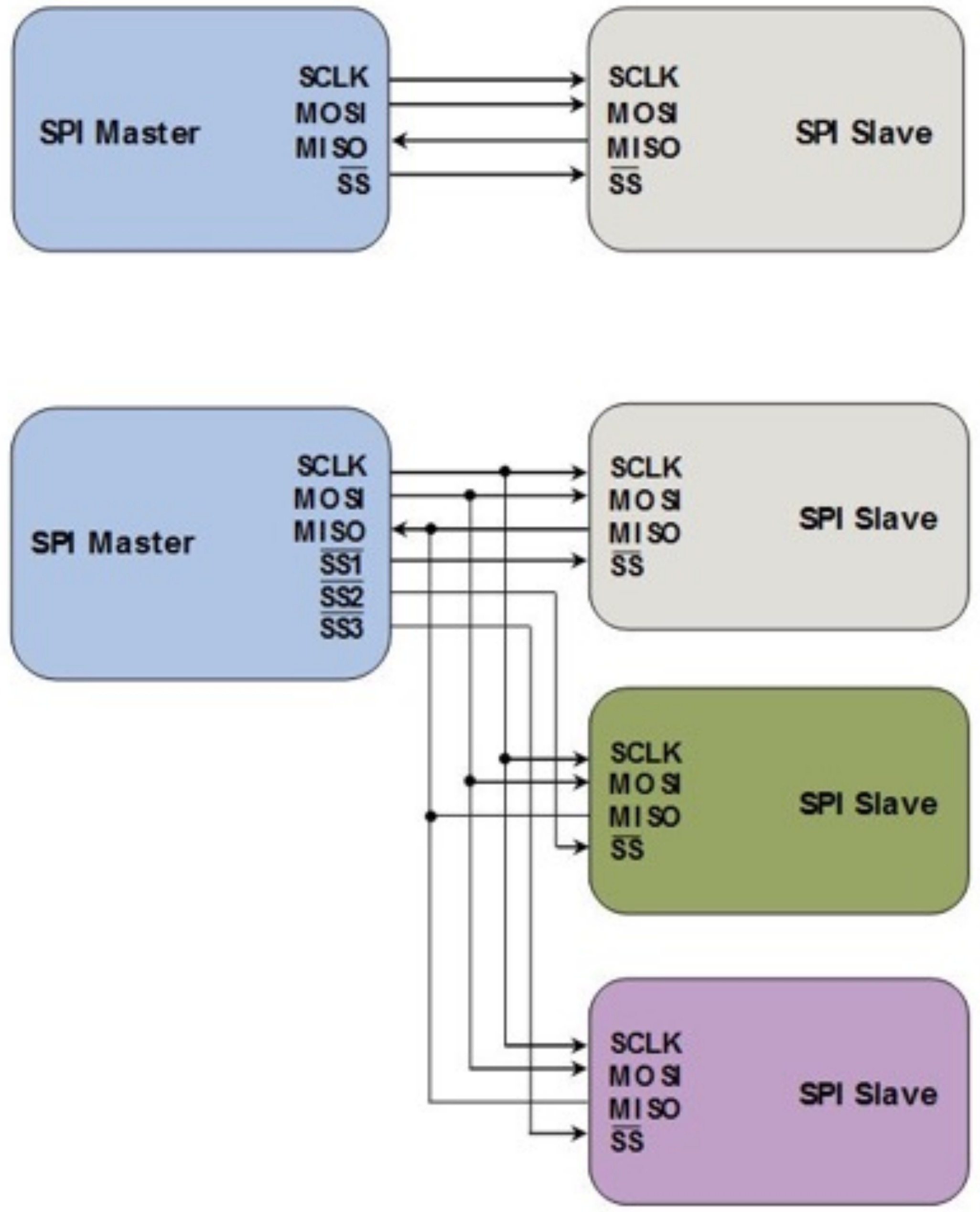
# ASYNCHRONOUS SERIAL

- Two computers with independent clocks.  Does not need clock signal between the sender and the receiver
- UART
- requires two reasonably complex devices
- slower data transfer rate
- lots of things - bluetooth, usb serial adapter, gps etc…

# SYNCHRONOUS SERIAL

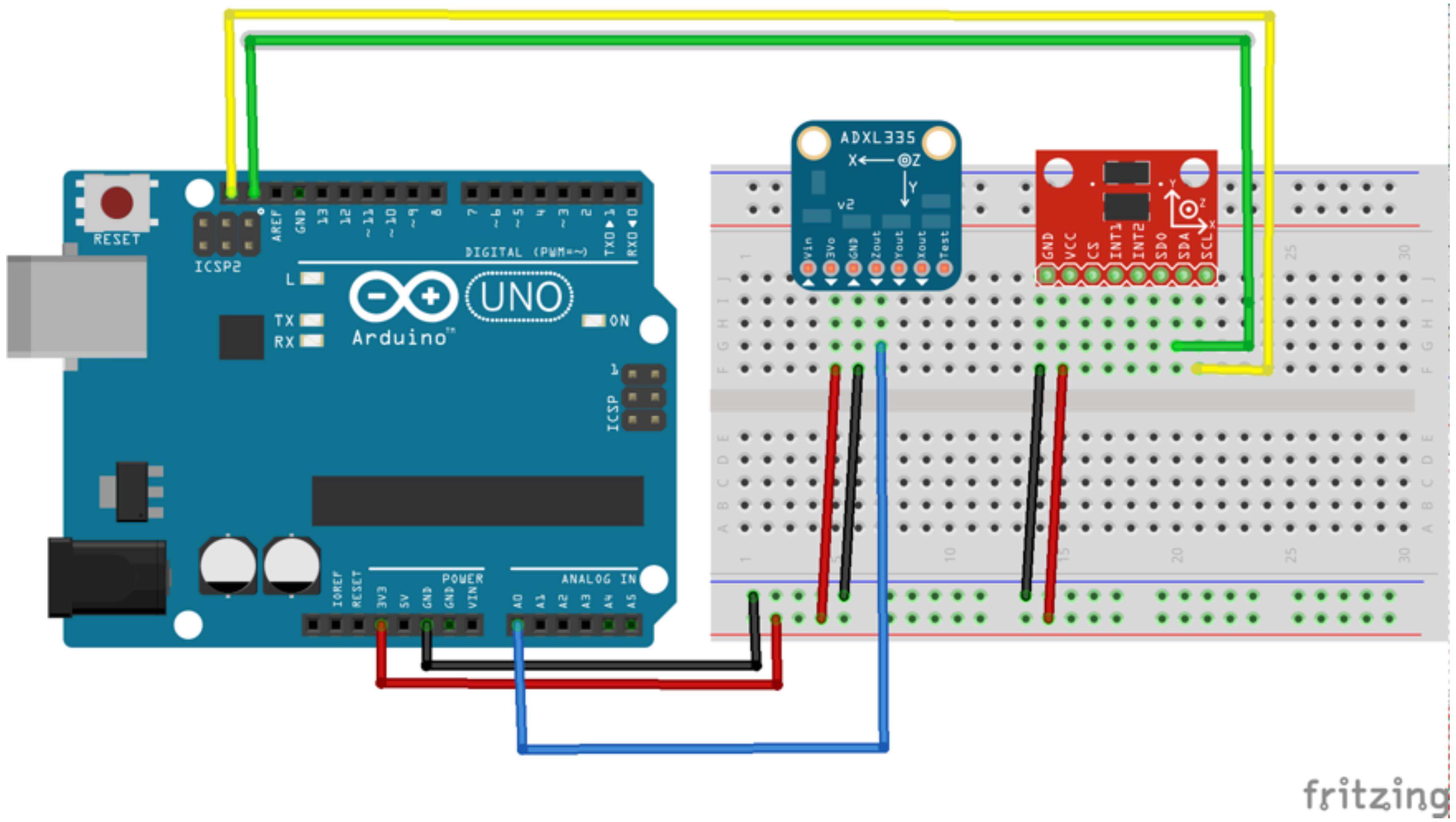
- The controlling devices supplies a clock signal
- on a second wire, the data signals
- supports high data transfer rate
- I2C - data in/out are on the same pin
- SPI - data in/out lines are separate

Figure 1 : Two SPI busses topologies. The upper figure shows a SPI master connected to a single slave (point-to-point topology). The lower figure shows a SPI master connected to multiple slaves.



# I2C (SYNCHRONUS)

- two wires: data(SDA) and clock(SCL)
- the pin switches from reading to sending


ADXL335
X
Z
Y
v2
Vin
3Vo
GND
Zout
Yout
Xout
Test
GND
VCC
CS
INT1
INT2
SDO
SDA
SCL
RESET
ICSP2
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX▶1
RX◀0
DIGITAL (PWM=~)
L
TX
RX
UNO
Arduino
ON
ICSP
IOREF
RESET
3V3
5V
GND
GND
VIN
POWER
ANALOG IN
A0
A1
A2
A3
A4
A5
fritzing