

# Sociable Objects Workshop

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Instructor: Rob Faludi

# Plan for Today

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- Basic Pair Exercise: review
- Math for Mesh
- firmware updates if needed
- ZigBee and Arduino
- breakout board hookups
- doorbell exercises
- Readings & Assignments

# Pairs Exercise Review

# Math for Mesh

# Math for Mesh

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- Binary, Decimal, Octal, Hexadecimal
  - Why?
    - Serial communication
    - XBee configuration
    - Programming helper
  - What?
    - It's all notation

# Decimal

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- Place system
- Powers
- Adding and carries
- Finger counting, but is that base 10?

# Binary

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- Place system
- Notation: %010 010b 0b10
- Powers
- Adding and carries
- Finger counting!

# Octal

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- Place system
- Notation **073**
- Powers
- Adding and carries
- Finger counting, not really



# Hexadecimal

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- Place system
- Notation: extra digits, 0x10, #FFFFFF
- Powers
- Adding and carries
- Finger counting?
- Switches yes: 0xFF = 1111 1111 and 0x3C = 0011 1100

# ASCII

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- American Standard Code for Information Interchange
- 65 = A
- 48 = character zero, 49 = character one
- 32 = space, 10 = line feed, 13 = carriage return

# One Question Quiz

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- what is this: 10

Firmware Updates

# Protocols

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- Sending
- Flow control
- Call / response
- Broadcast
- Start / stop
- Checksums
- Collisions

ZigBee and Arduino

# Why Arduino

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- local logic
- pinouts
- fast prototyping
- lots of connection options

# Arduino Serial Library

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- `Serial.begin(speed)`
- `Serial.available()`
- `Serial.read()`
- `Serial.flush()`
- `Serial.print(data)`



# Software Serial

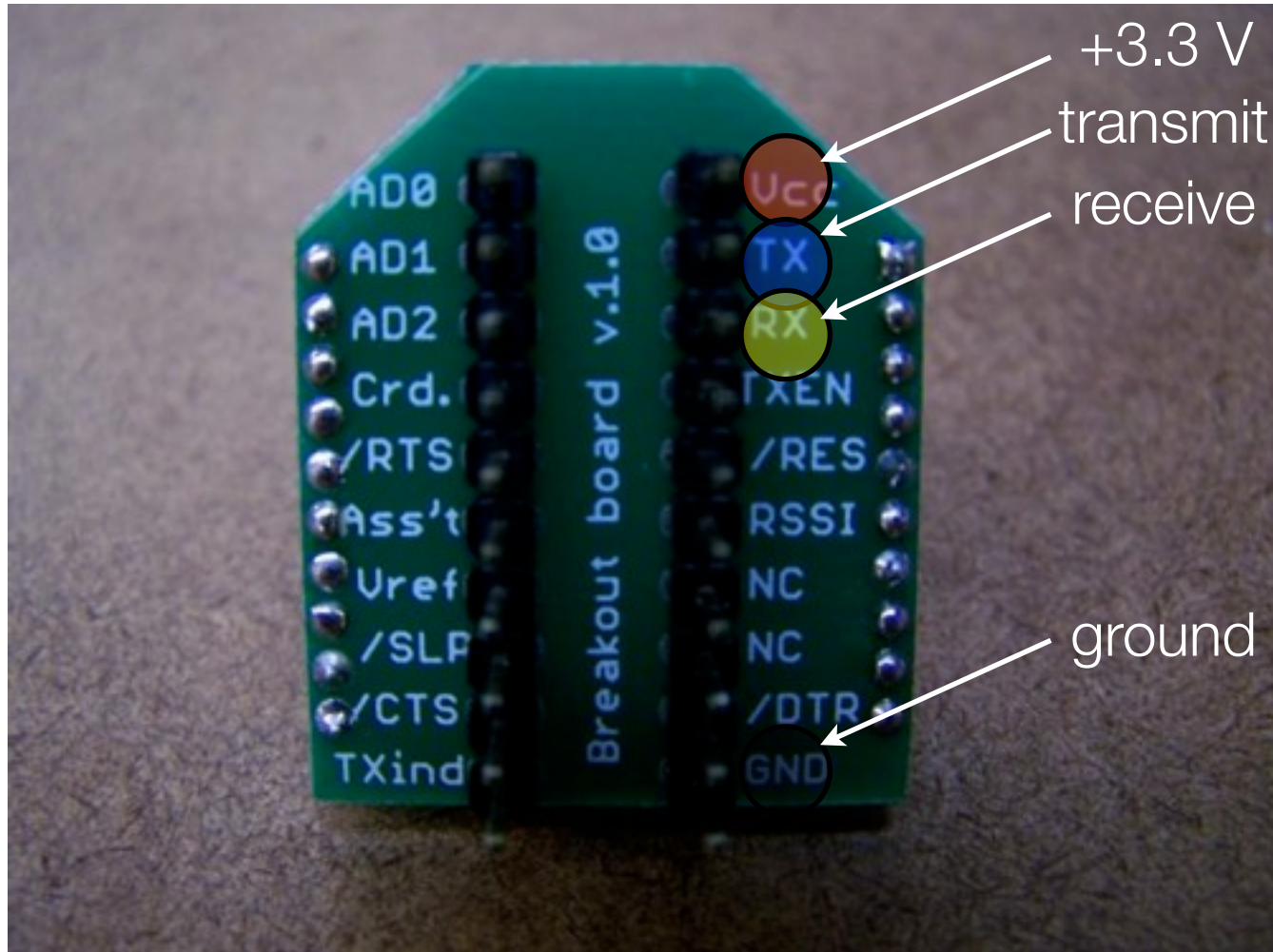
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- Hardware vs. software serial
  - 9600 baud max, typically pins 6 & 7 but any digital pins are okay
  - `SWserial.read()` is blocking
  - No `serial.available()` function in software serial
  - No buffering
  - Last choice for input, great for debug output w/ USB-serial converter
- <http://www.arduino.cc/en/Reference/SoftwareSerial>

# Breadboard Hookups

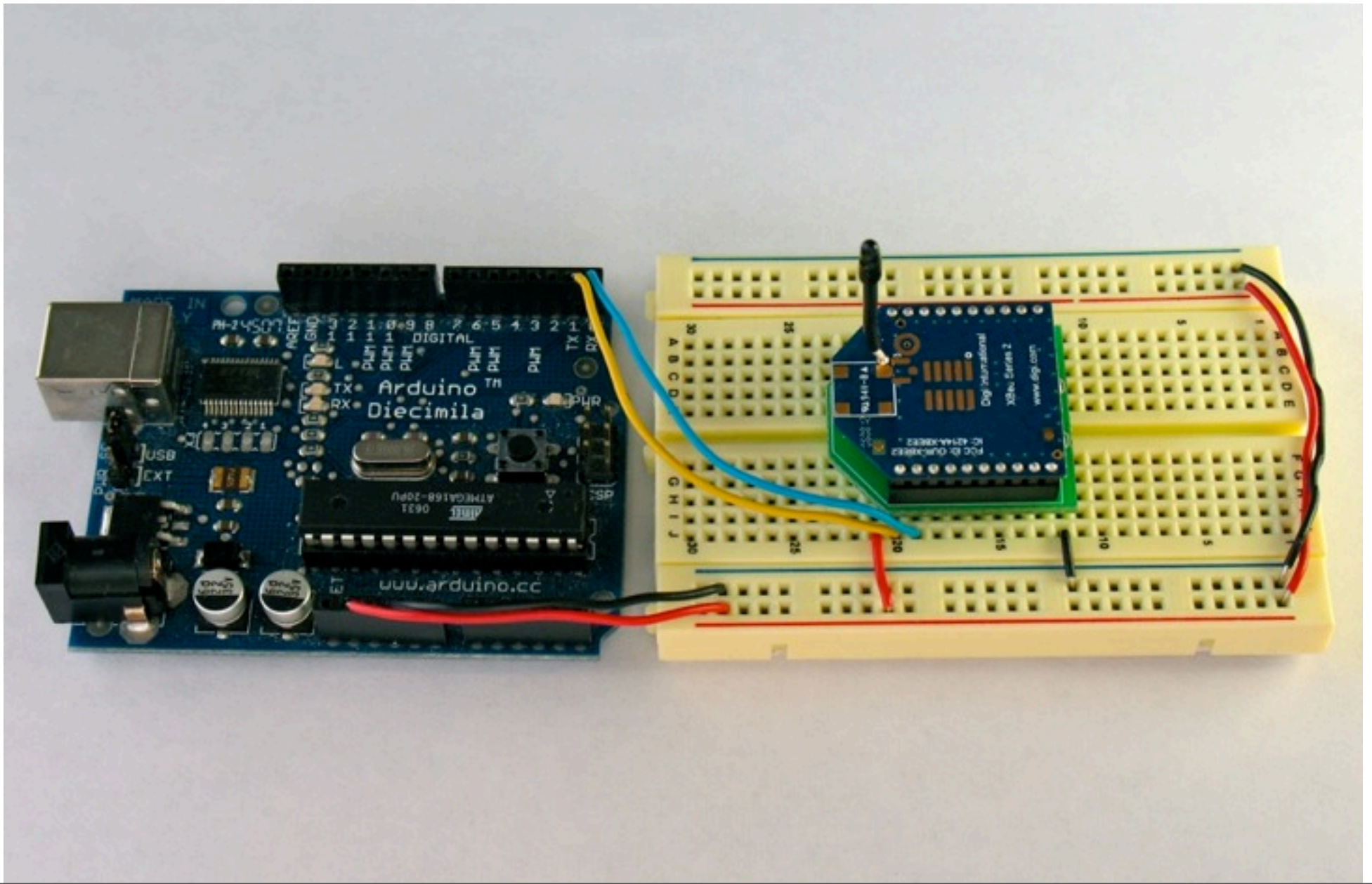
# Wiring

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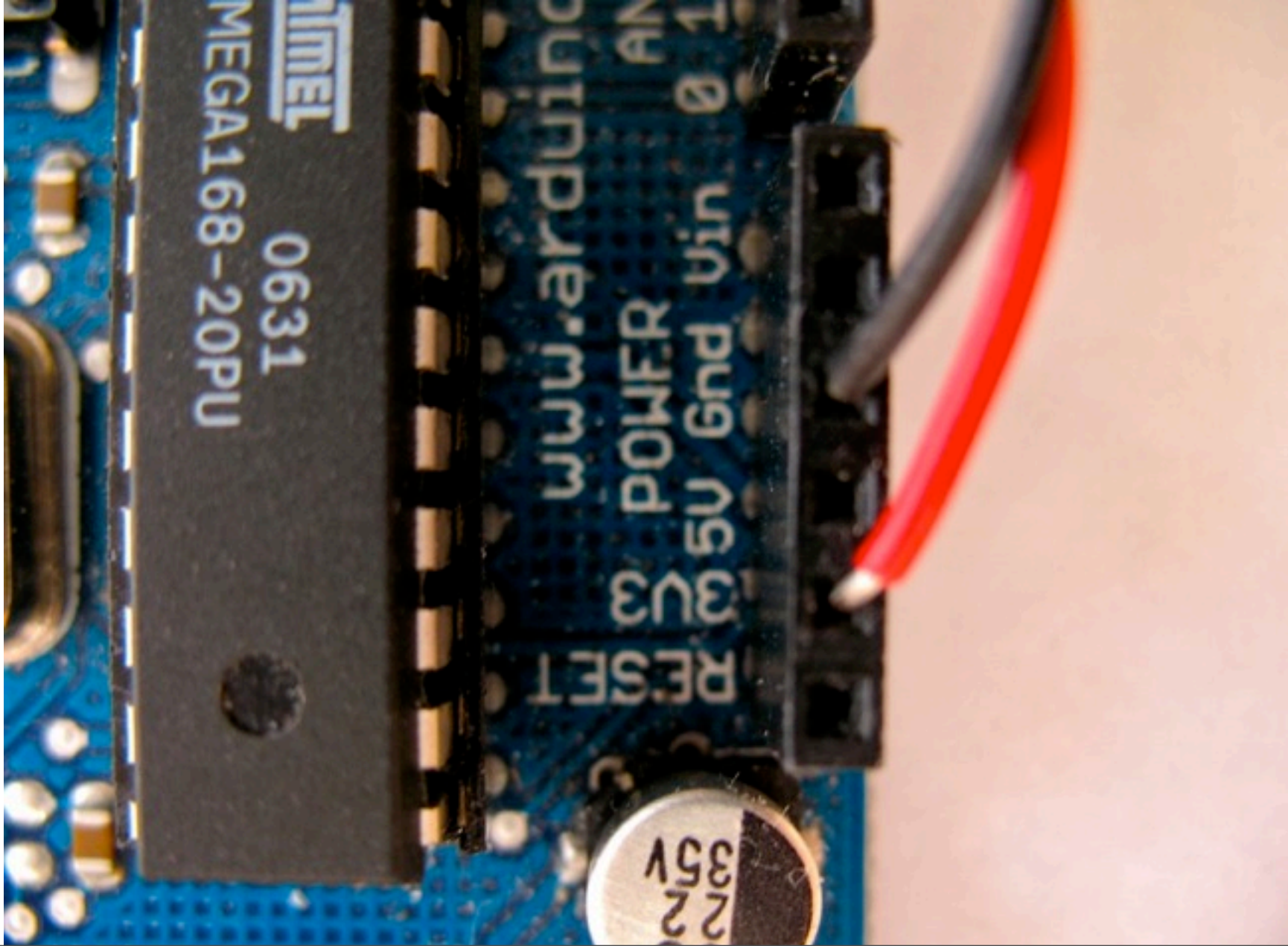
# XBee Arduino Breadboard Layout

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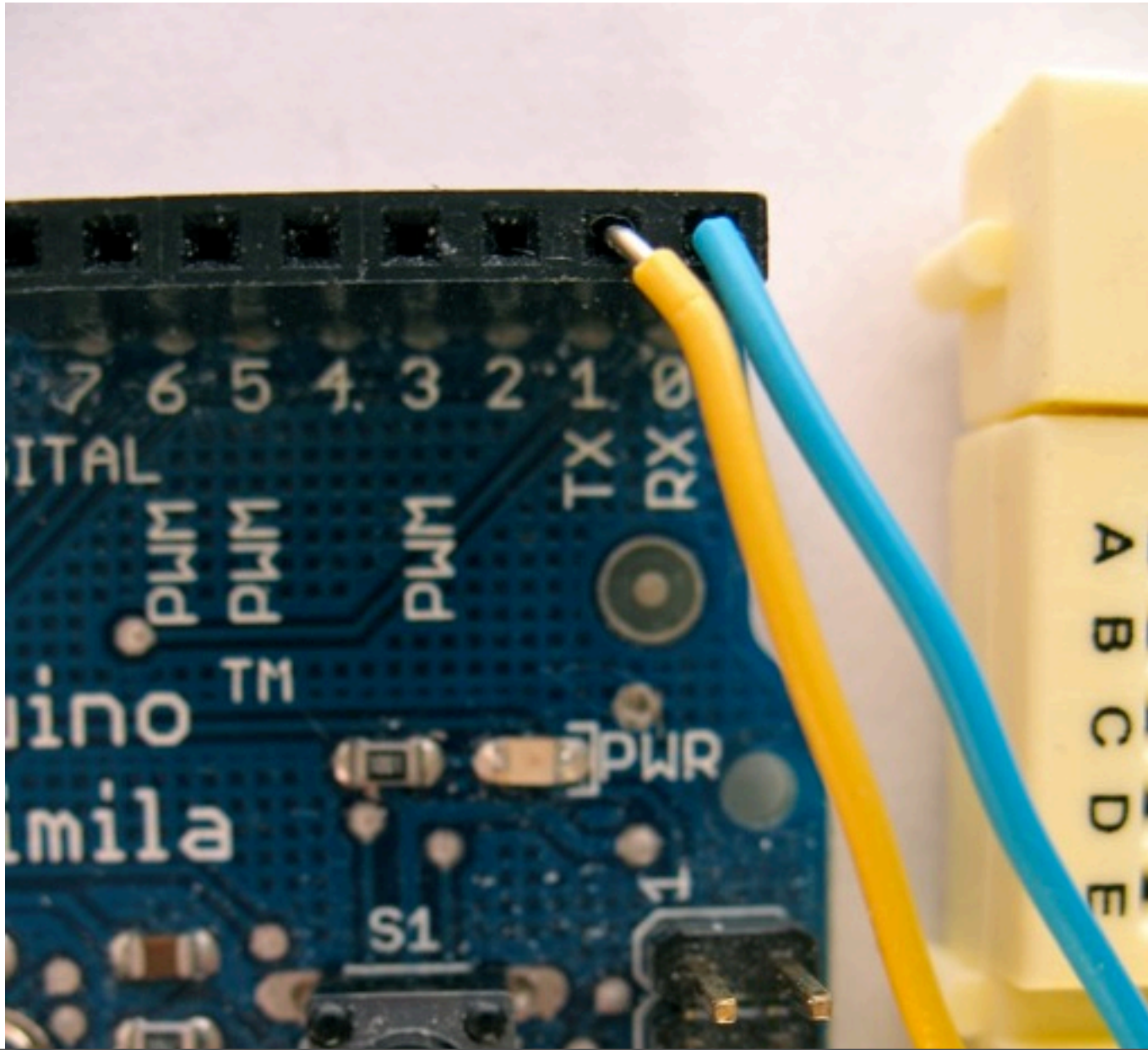
# Power, Ground

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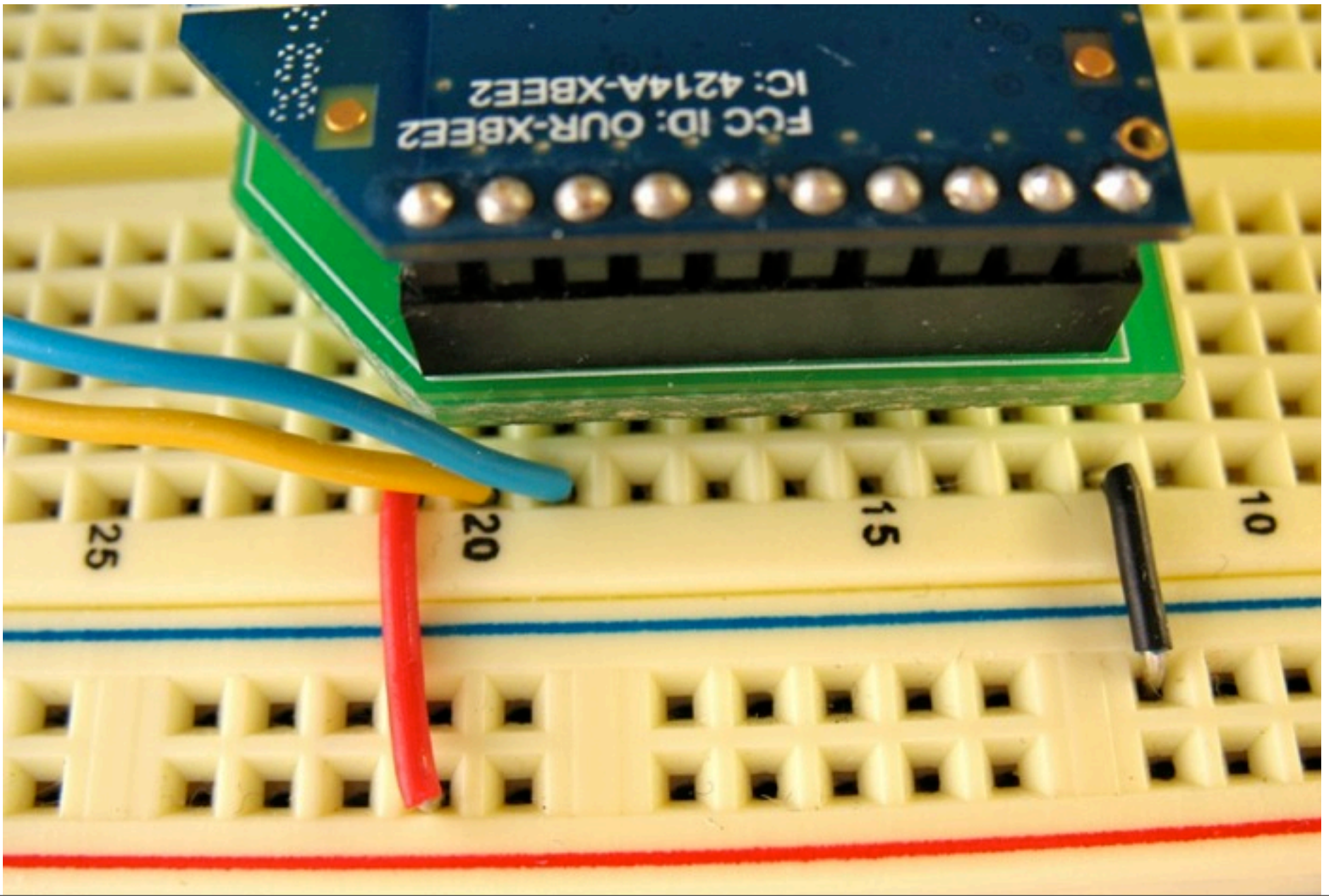


TX, RX

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# XBee Connections (pin 1, 2, 3 and 10)



# Remember!

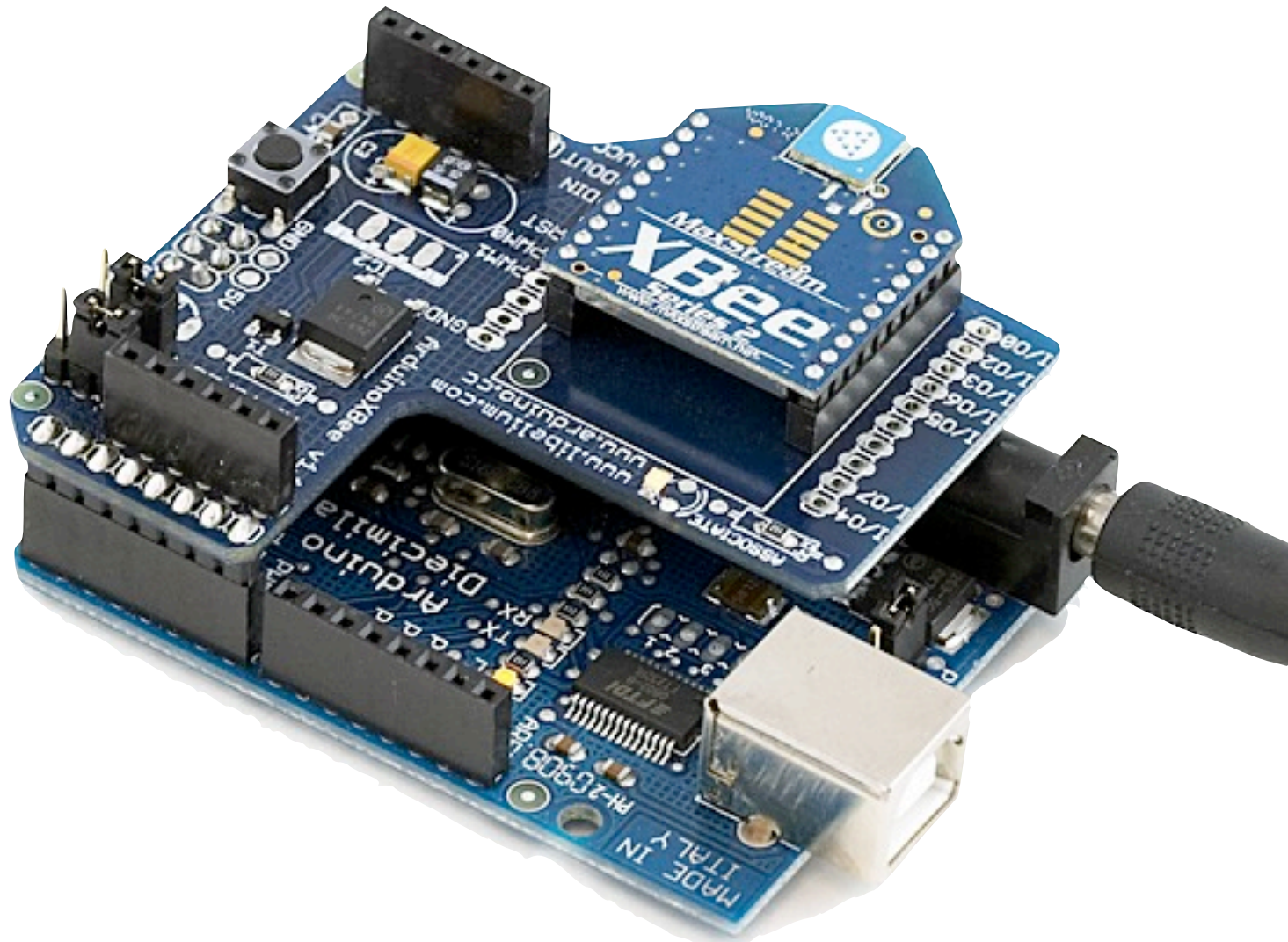
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- Use only +3.3 Volts. More than +7 Volts will kill your radio
- If you use a voltage regulator, always use decoupling capacitors. The radios often don't work without them.
- XBee TX goes to Arduino RX and vice versa.
- Unplug the TX & RX before uploading Arduino code (or use switches)
- You can't send infinitely fast. Try putting a 10 ms delay into your loop.



# Arduino Shield

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# Seeduino Shield

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# Doorbell Exercises



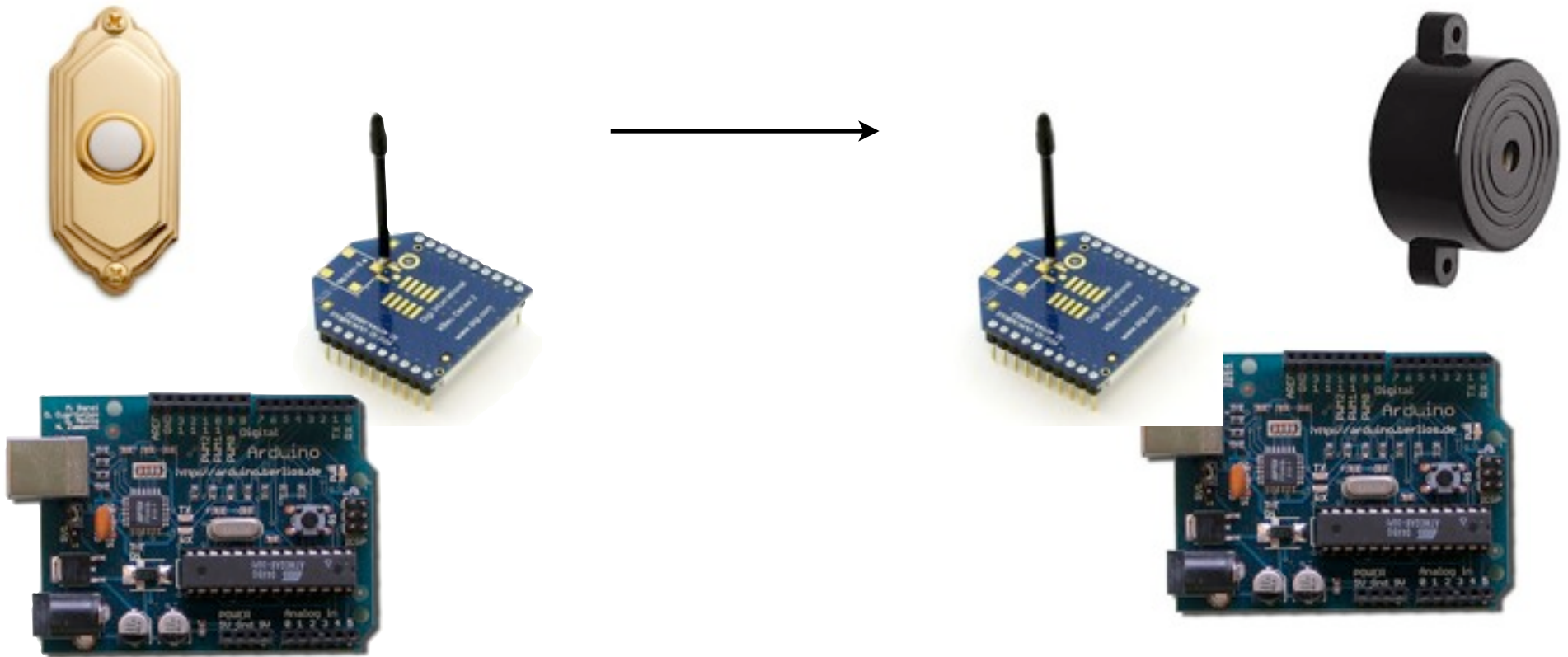
# Remember

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- All these exercises assume you have paired two radios together:
  - ATID set to the same value
  - ATDH & ATDL set to the SH and SL of the other radio
  - ATWR to write these settings so they're set for next power up
  - and don't forget that sometimes ATND will help recover your network
    - you can also try writing ATJV1 on the router so it resets automatically if it can't find its coordinator; useful if you change radios

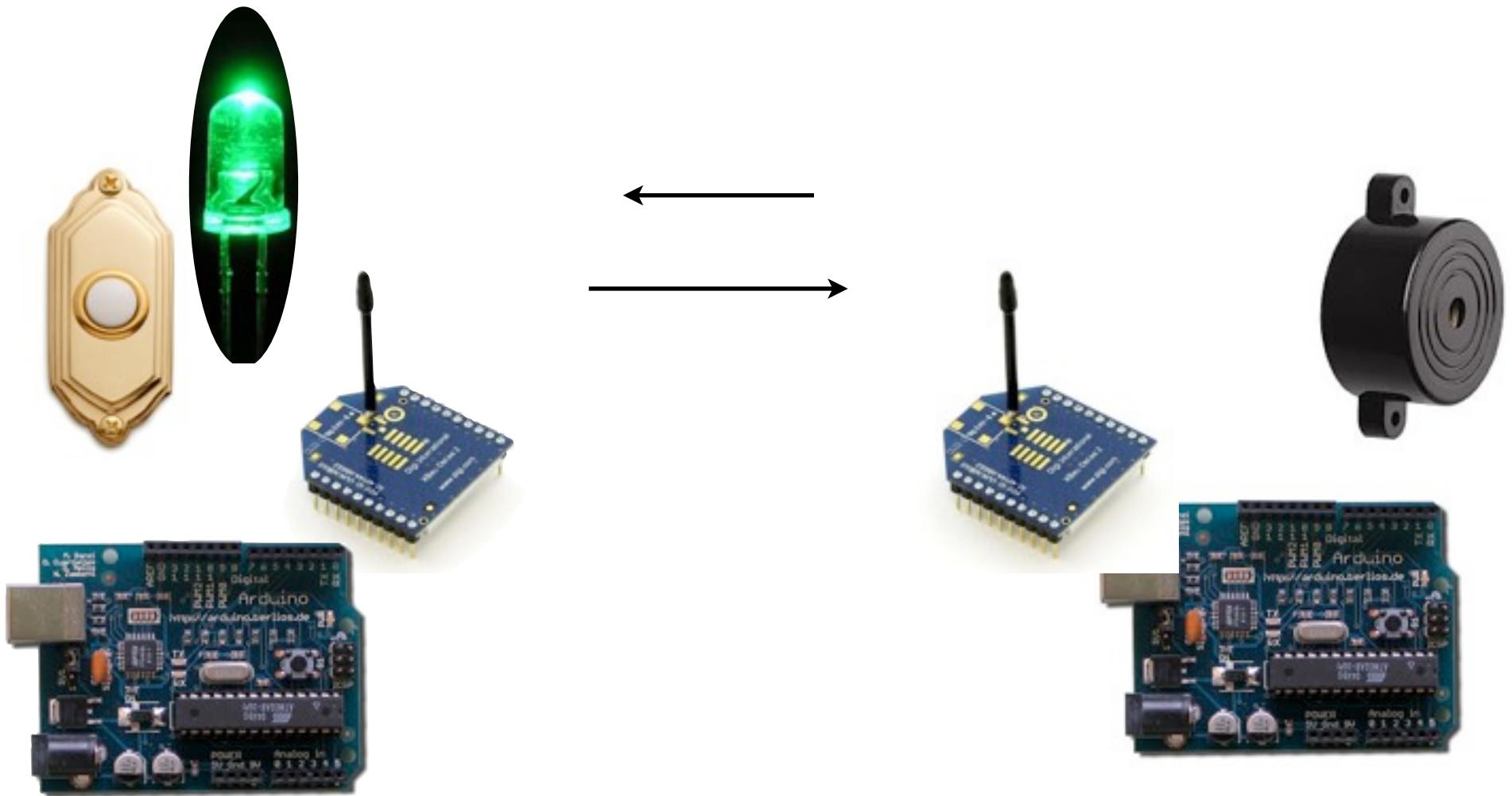
# Basic Doorbell

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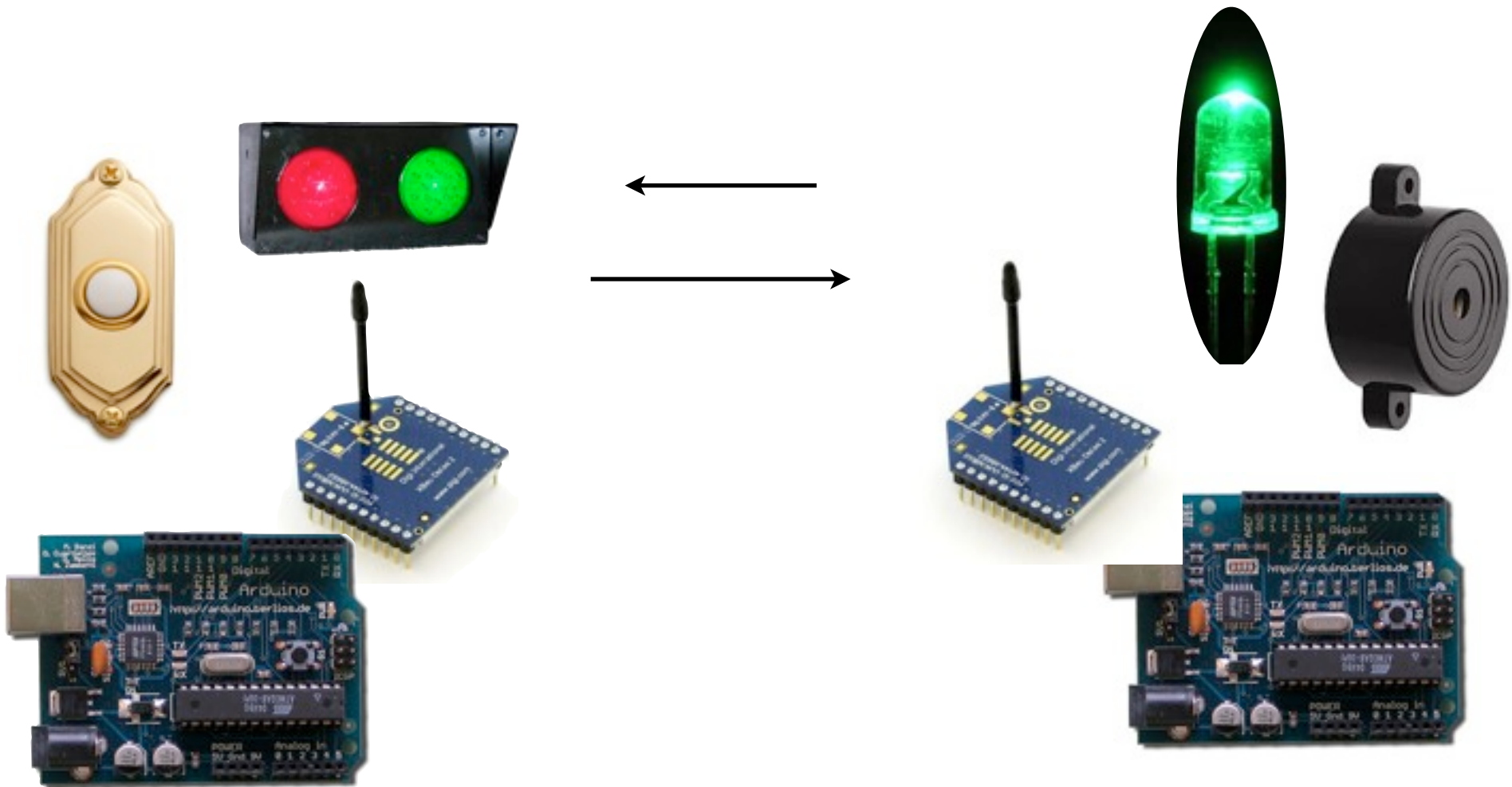


# Feedback Doorbell

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# Nap Doorbell



# Other Doorbell Enhancements

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# Readings and Assignments

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- Readings

- XBee Antenna Whitepaper
- Zigbee vs. 802.15.4 Whitepaper

- Assignments

- finish doorbell exercises
  - basic, feedback, nap, your own doorbells