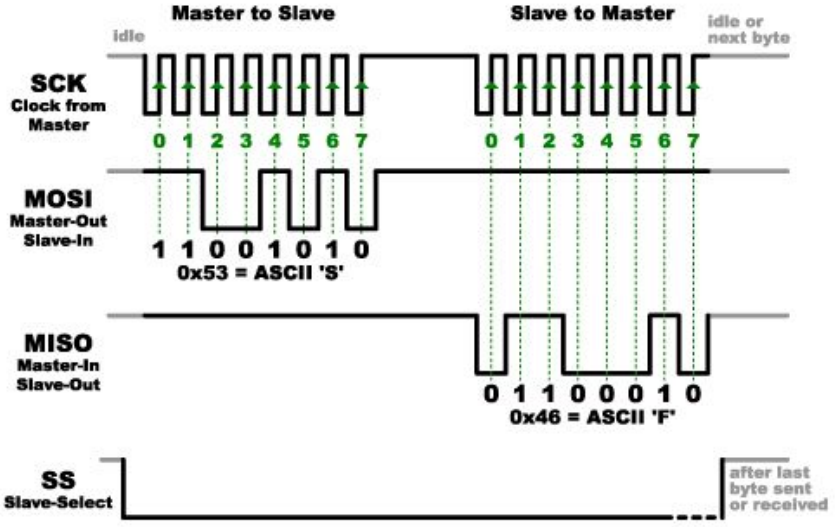
SPI-Protocol

Overview

Advantages	Disadvantages
Speed: I²C=3.4MBs & SPI 10-20MBs	More Pins than I²C
Simple Shift Register	No Inter-Slave communication
Support Multiple Slaves	Separate SS Lines
Less Energy	No FLow COntrol
	Only 1 Master on SPI Bus

Read/Write Example



Source: https://circuitdigest.com/microcontroller-projects/arduino-spi-communication-tutorial

Master Arduino Code:

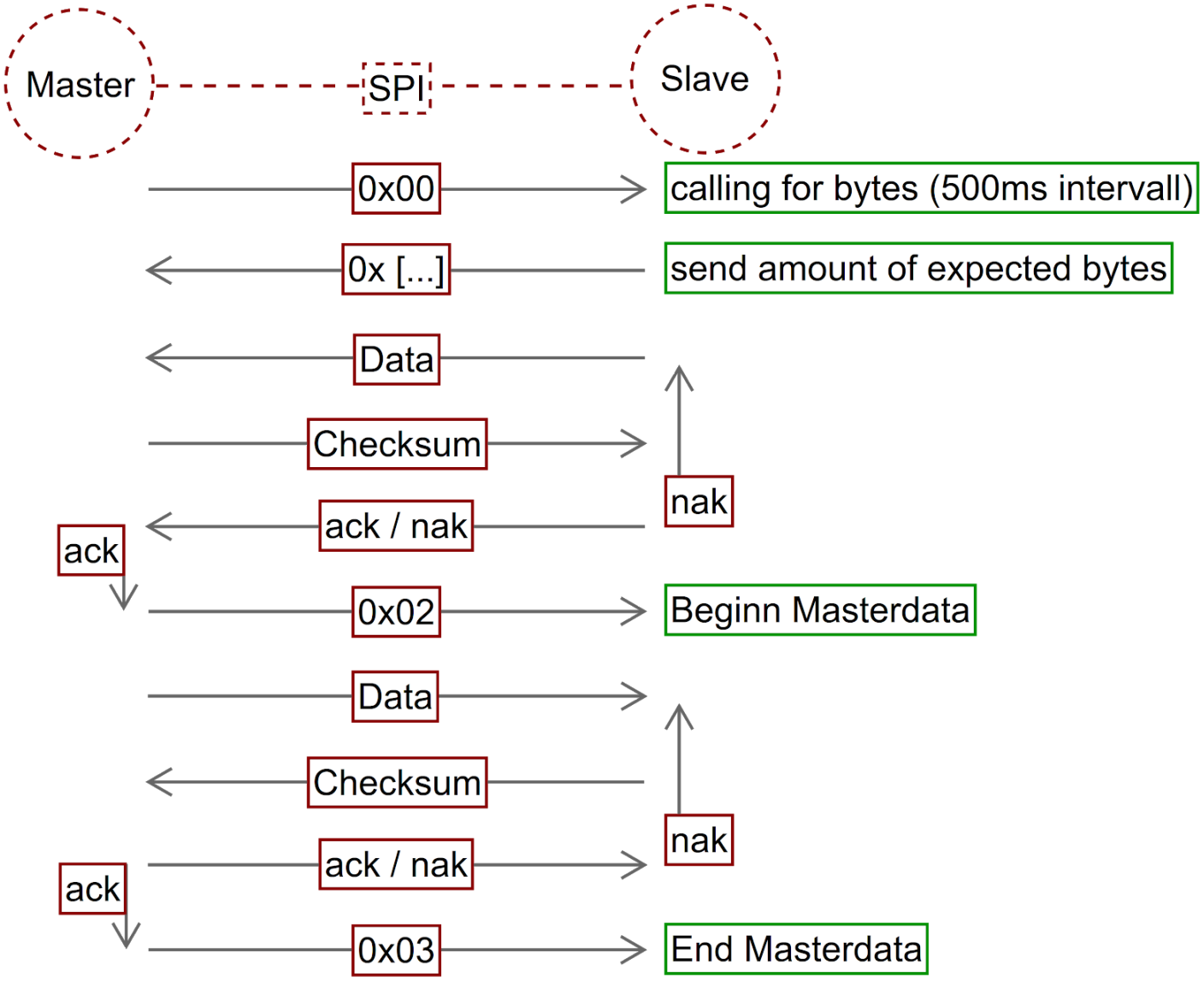
```
#include<SPI.h>        //Library for SPI
#define LED 7
#define ipbutton 2
int buttonvalue;
int x;
void setup (void){
   Serial.begin(115200);                 //Starts Serial Communication at Baud Rate 115200
   pinMode(ipbutton,INPUT);              //Sets pin 2 as input
   pinMode(LED,OUTPUT);                  //Sets pin 7 as Output
   SPI.begin();                          //Begins the SPI commnuication
   SPI.setClockDivider(SPI_CLOCK_DIV8);  //Sets clock for SPI communication at 8 (16/8=2Mhz)
   digitalWrite(SS,HIGH);                //Setting SlaveSelect as HIGH (So master doesnt connnect with
slave)
}
void loop(void){
   byte Mastersend,Mastereceive;
   buttonvalue = digitalRead(ipbutton);   //Reads the status of the pin 2
   //Logic for Setting x value (To be sent to slave) depending upon input from pin 2
   if(buttonvalue == HIGH){
      x = 1;
   }
   else{
     x = 0;
   }
   digitalWrite(SS, LOW);                  //Starts communication with Slave connected to master
   Mastersend = x;
   Mastereceive=SPI.transfer(Mastersend); //Send the mastersend value to slave also receives value from
slave
   //Logic for setting the LED output depending upon value received from slave
   if(Mastereceive == 1){
      digitalWrite(LED,HIGH);              //Sets pin 7 HIGH
      Serial.println("Master LED ON");
   }
   else{
      digitalWrite(LED,LOW);               //Sets pin 7 LOW
      Serial.println("Master LED OFF");
   }
   delay(1000);
}
```

Slave Arduino Code:

```
//SPI SLAVE (ARDUINO)
//SPI COMMUNICATION BETWEEN TWO ARDUINO
//CIRCUIT DIGEST
//Pramoth.T

#include<SPI.h>
#define LEDpin 7
#define buttonpin 2
volatile boolean received;
volatile byte Slavereceived,Slavesend;
int buttonvalue;
int x;
void setup(){
  Serial.begin(115200);
  pinMode(buttonpin,INPUT);               // Setting pin 2 as INPUT
  pinMode(LEDpin,OUTPUT);                 // Setting pin 7 as OUTPUT
  pinMode(MISO,OUTPUT);                   //Sets MISO as OUTPUT (Have to Send data to Master IN
  SPCR |= _BV(SPE);                       //Turn on SPI in Slave Mode
  received = false;
  SPI.attachInterrupt();                  //Interupt ON is set for SPI commnication
}

ISR (SPI_STC_vect){                       //Inerrrput routine function
  Slavereceived = SPDR;                   // Value received from master if store in variable slavereceived
  received = true;                        //Sets received as True
}

void loop(){
   if(received){                     //Logic to SET LED ON OR OFF depending upon the value receieved from
master
      if (Slavereceived==1){
        digitalWrite(LEDpin,HIGH);         //Sets pin 7 as HIGH LED ON
        Serial.println("Slave LED ON");
      }
      else{
        digitalWrite(LEDpin,LOW);          //Sets pin 7 as LOW LED OFF
        Serial.println("Slave LED OFF");
      }
      buttonvalue = digitalRead(buttonpin);  // Reads the status of the pin 2
      if (buttonvalue == HIGH){               //Logic to set the value of x to send to master
        x=1;
      }
      else{
        x=0;
      }
      Slavesend=x;
      SPDR = Slavesend;                           //Sends the x value to master via SPDR
      delay(1000);
      }
  }
```

Testing

A proper test can be done in the next sprint. First I have to organize some LED’s, resistors and buttons. To detect errors during transmitting and receiving a checksum or CRC could be realized. This could also be part of the next sprint.


Master
SPI
Slave
0x00
calling for bytes (500ms intervall)
0x [...]
send amount of expected bytes
Data
Checksum
nak
ack / nak
ack
0x02
Beginn Masterdata
Data
Checksum
nak
ack / nak
ack
0x03
End Masterdata