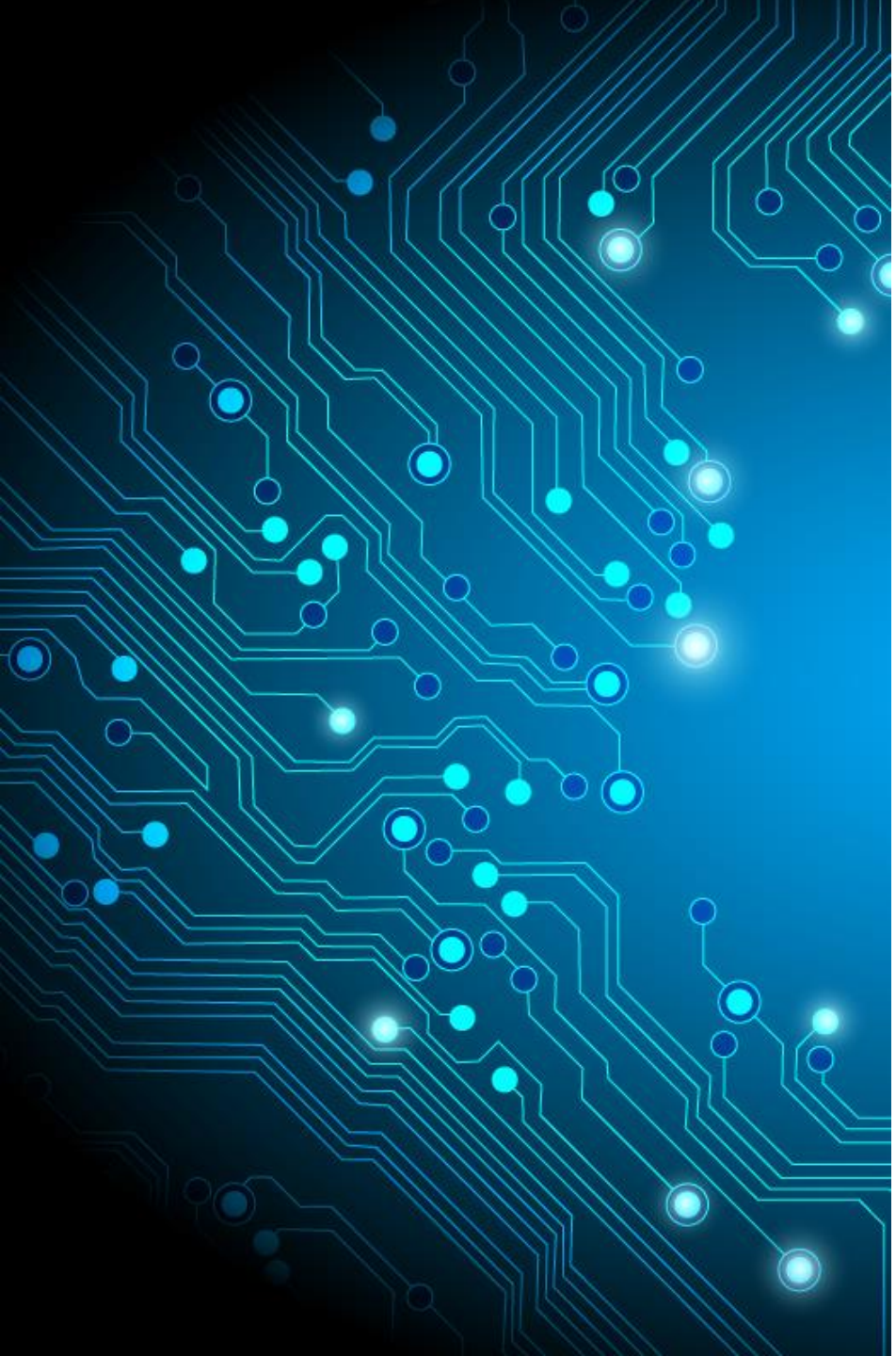


STM32 Microcontrollers Course

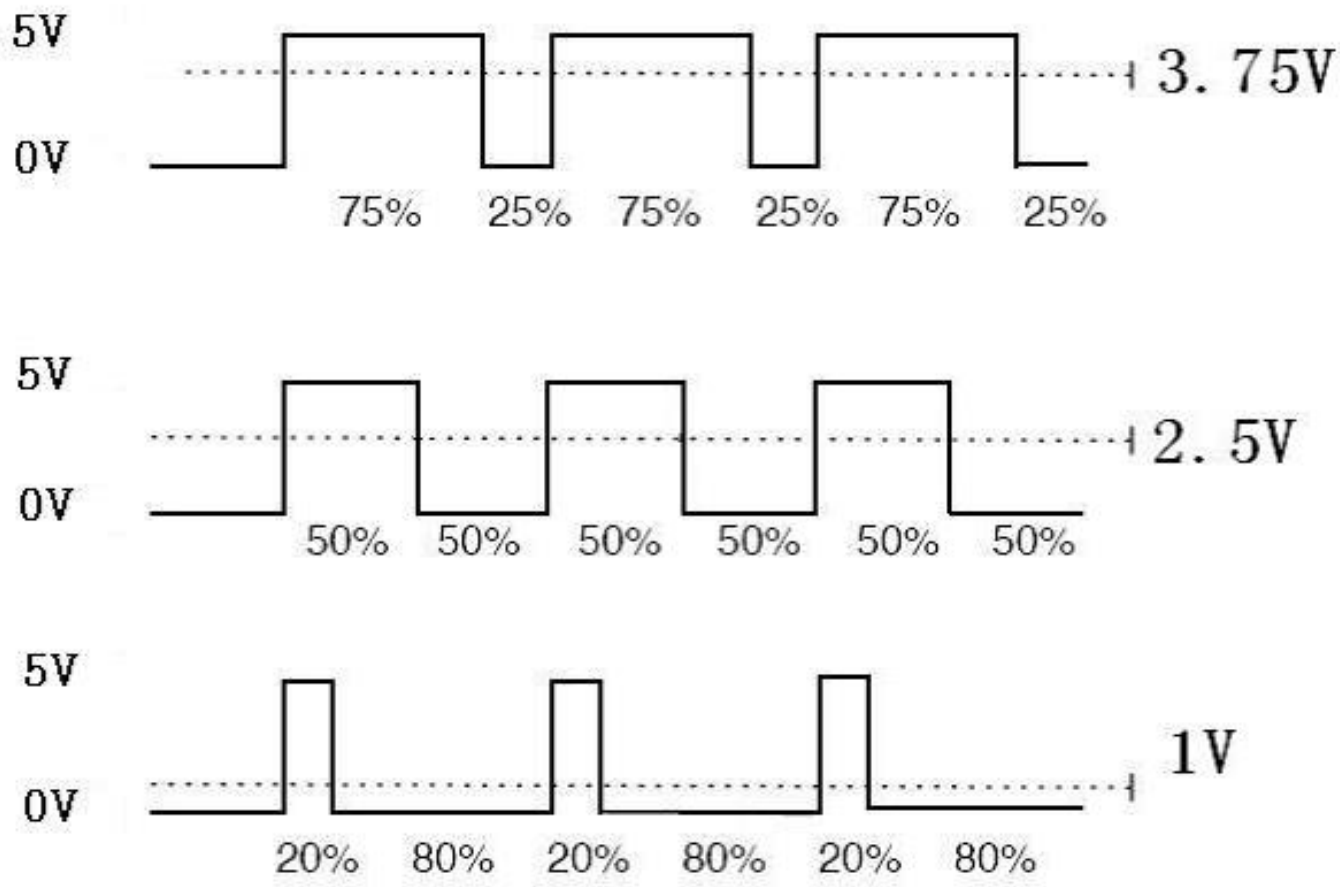
Hamed Jafarzadeh

Summer 2016

PWM & I2C

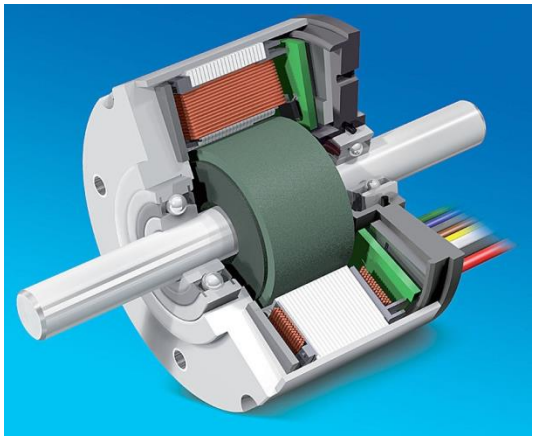
life.augmented

PWM Definition



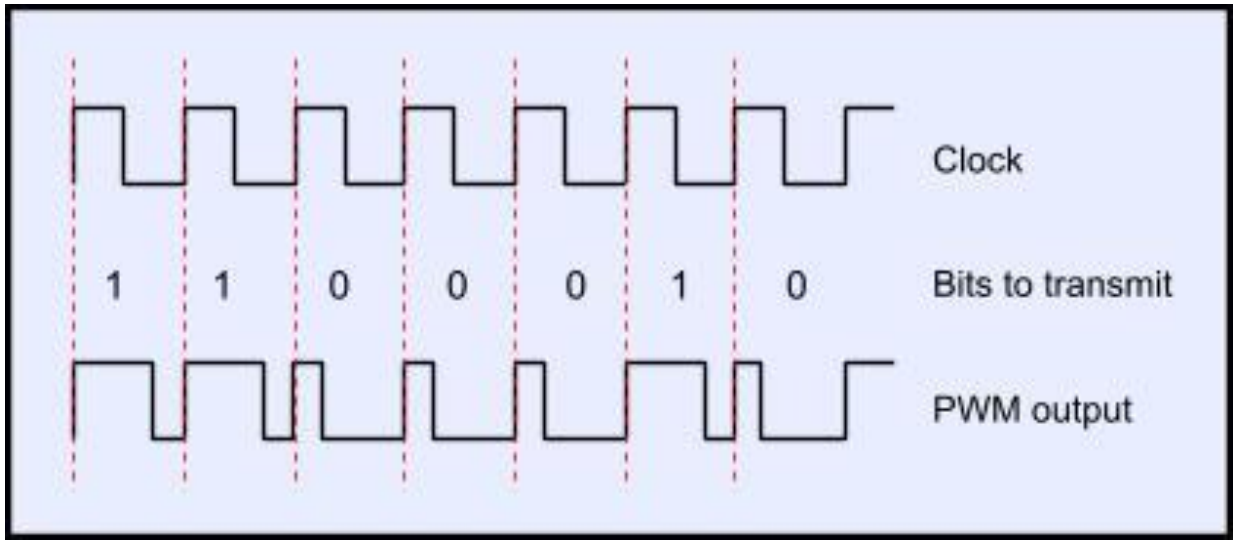
PWM Applications

- The voltage supplied to a DC motor is proportional to the duty cycle
- Both brushed and brushless motors can be used with PWM
- Both analog and digital control techniques and components are available

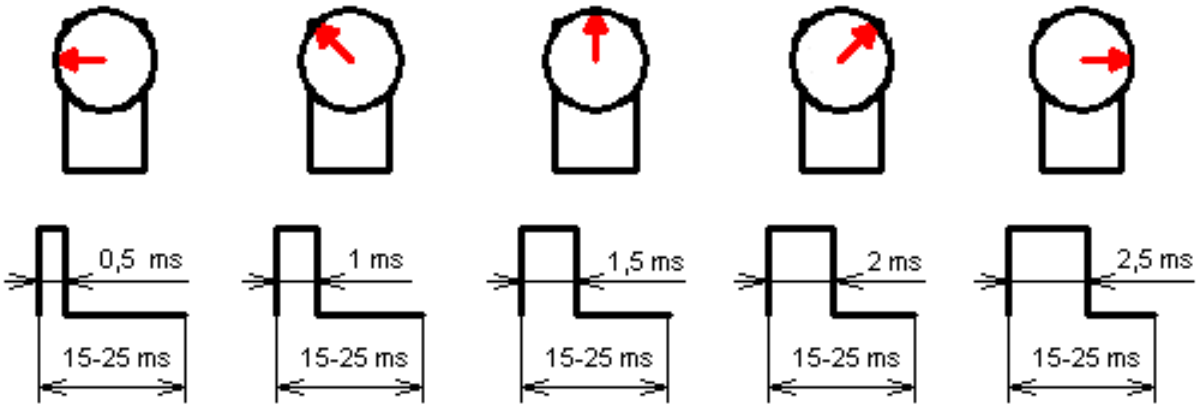


PWM Applications

- clock signal is found “inside” PWM signal
- more resistant to noise effects than binary data alone
- effective at data transmission over long distance transmission lines



PWM Applications



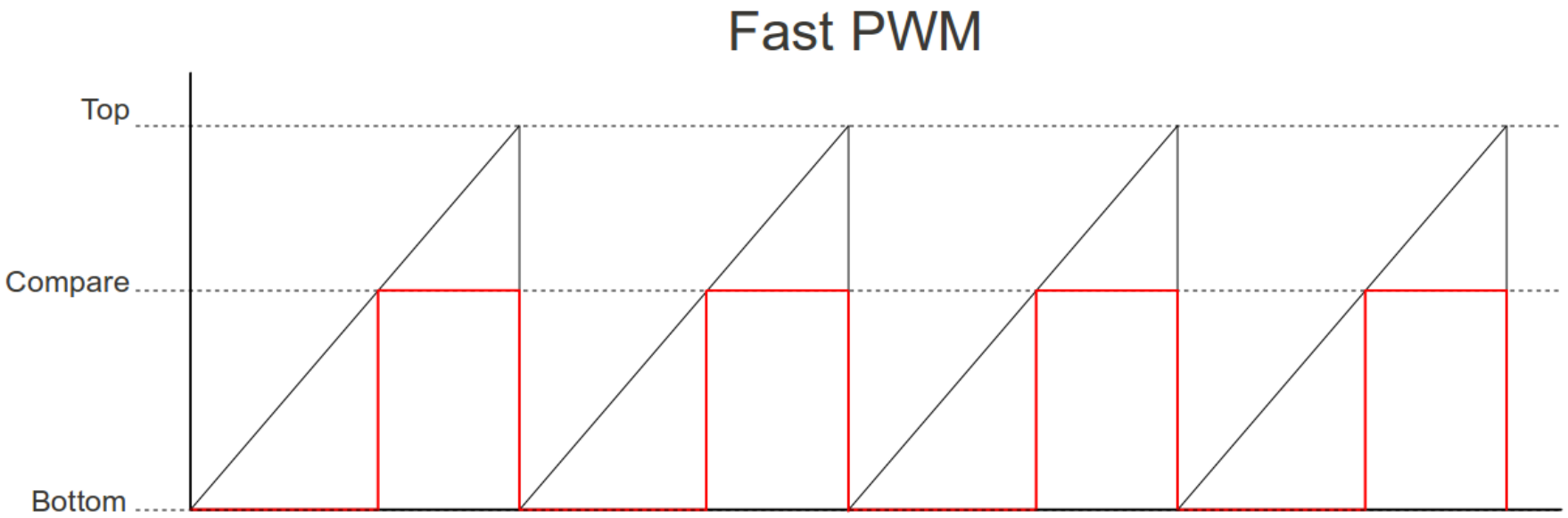
PWM Advantages

- Average value proportional to duty cycle, D
- Low power used in transistors used to switch the signal
- Digital signal is resistant to noise
- Less heat dissipated versus using resistors for intermediate voltage values

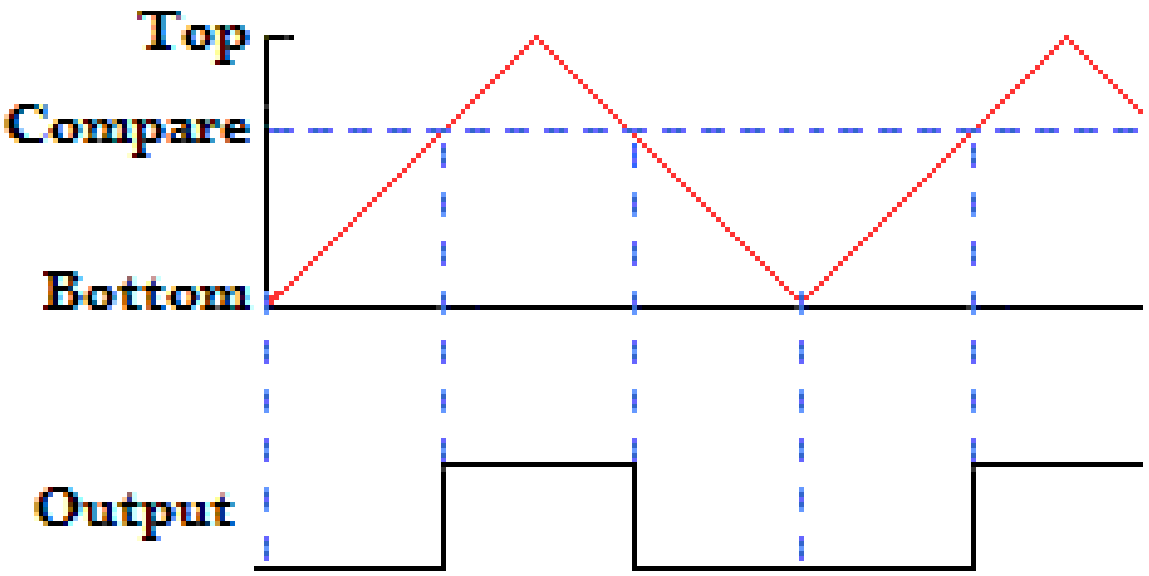
PWM Disadvantages

- Cost
- Complexity of circuit
- Radio Frequency Interference
- Voltage spikes
- Electromagnetic noise

PWM Modes



PWM Modes



Phase Correct PWM

I2C


Communications
USB
UNIVERSAL SERIAL BUS
Consumer
Automotive
SERIAL BUSES
IEEE1394
UART
CAN
CONTROLLER AREA NETWORK
SPI
I2C BUS
Industrial
DesignCon 2003 TecForum I2C Bus Overview
5

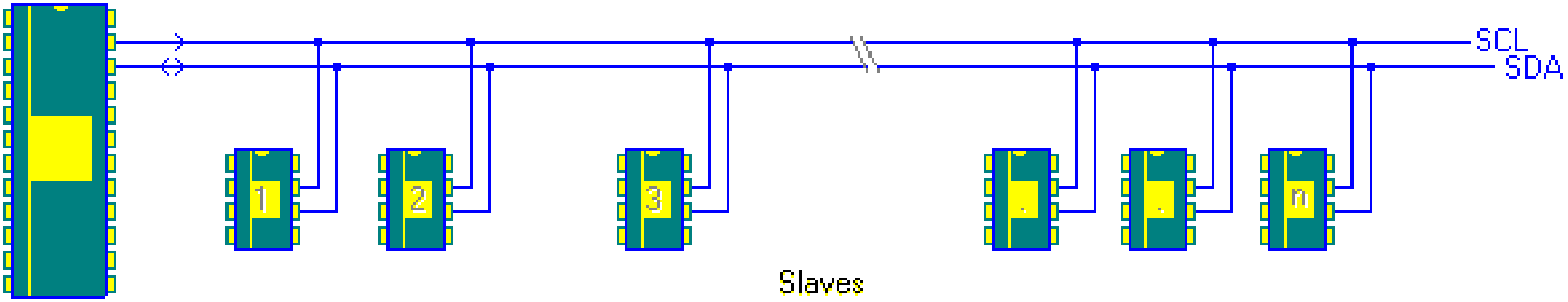
I2C

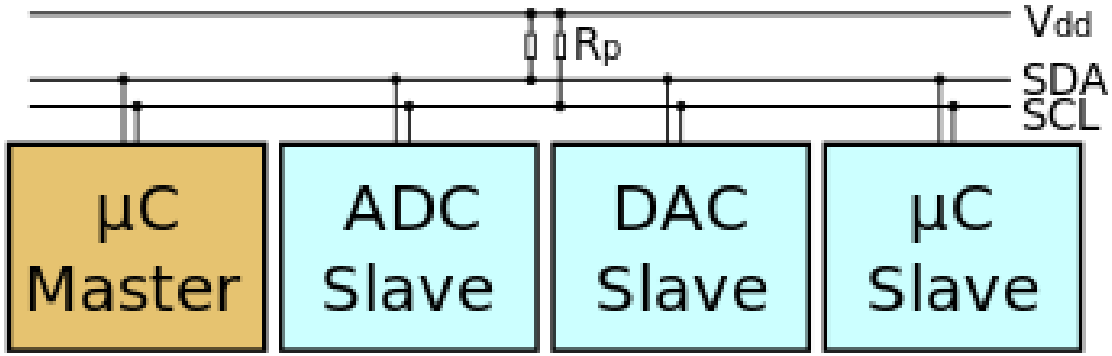
- Stands for Inter-Integrated Circuit
- multi-master, multi-slave, single-ended, serial computer bus invented by Philips Semiconductor (now NXP Semiconductors)
- Talking with 2 Pins only
- No specific wiring or connectors , Simple Hardware
- Standard and Simple Software Codes
- Industry Grade

I2C

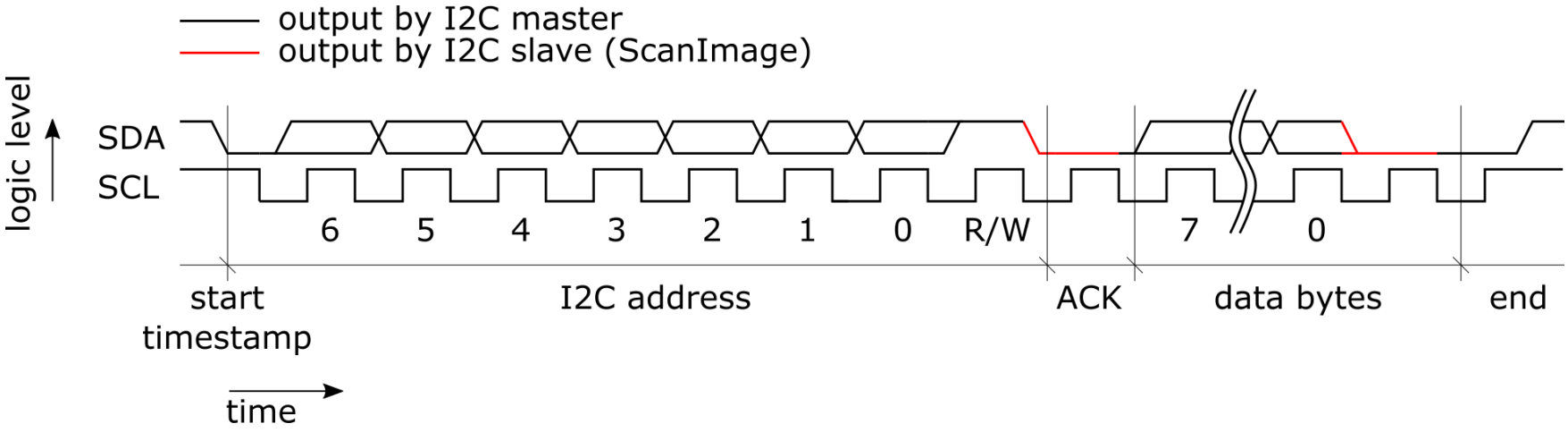
- Simple Procedure that allow communications to start , to achieve data transfer and to stop
- Several Devices can use same two wires to connect to master
- Every device has it own address
  - For connecting multiple devices addresses should be unique
- The **Master** Initialized the communication and provides signal
- The Slaves respond to Master commands only

I2C


SCL
SDA
1
2
3
n
Slaves


Vdd
Rp
SDA
SCL
µC
Master
ADC
Slave
DAC
Slave
µC
Slave

I2C Packets


output by I2C master
output by I2C slave (ScanImage)
logic level
SDA
SCL
6
5
4
3
2
1
0
R/W
7
0
start
timestamp
I2C address
ACK
data bytes
end
time


Start
Address
R/W
Ack
Data0
Ack0
Data1
Ack1
...
DataN
AckN
Stop
7 or 10 bits
1 bit
1 bit
8 bits
1 bit
8 bits
1 bit
1 bit
8 bits
1 bit

END