Software Technology of Internet of Things

Building a Toolchain

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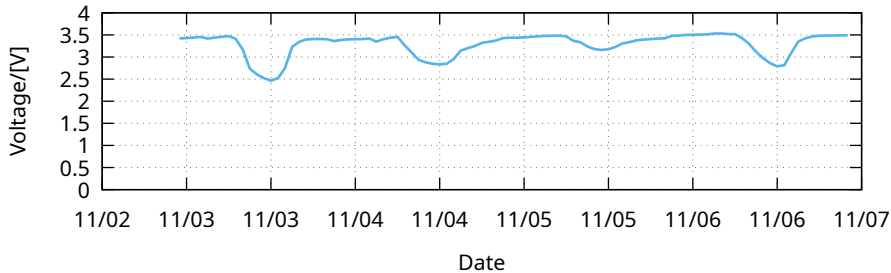
SDU

Part 1:
Background

Analog Signals

Definition: A signal is the evolution of the value of some metric, or *time* $\mapsto$ *value*.

Normally, with regards to electrical signals, what we care about is the voltage.



Voltage can *"easily"* be measured.

A cyber-physical system bridges the cyber world and the physical world.

Voltage

Definition: A difference in electrical potential.

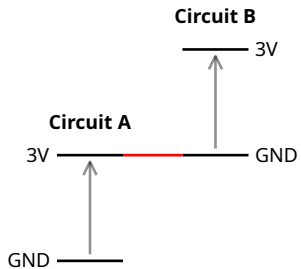
Implication: The metric relates to two points in a circuit.

Connecting two circuits by one wire will not drive a standing current.

We say that they *float*.

Ground (or GND) is needed for *grounding* the voltage.

Connecting 3V on **circuit A** to ground on **circuit B** will make 3V on **circuit B** equivalent to 6V from the context of **ciruit A**, and the ground of **circuit A** equivalent to -3V from the context of **circuit B**.



Transducers

Definition: A device which converts energy from one form to another.

Inputs include:

- Light
- Heat
- Force
- EM Radiation
- ...

Outputs include:

- Electrical signal (Voltage)
- ...

Thermistors

Voltage dividers:
$V_{out} = V_{in} \cdot \frac{R_2}{R_1 + R_2}$

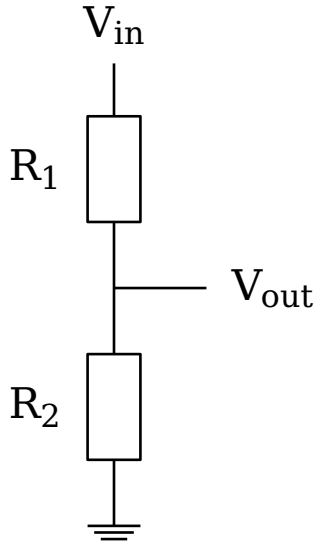
A thermistor (R_2) is a component whose resistivity is a *reversible* function of the temperature.

How does this affect the equation?

Assumption: high temperatures $\Leftrightarrow$ high resistance.

Then:

- high $V_{out} \Rightarrow$ high $R_2 \Rightarrow$ high temperature.
- low $V_{out} \Rightarrow$ low $R_2 \Rightarrow$ low temperature.



Digital Is the New Analog

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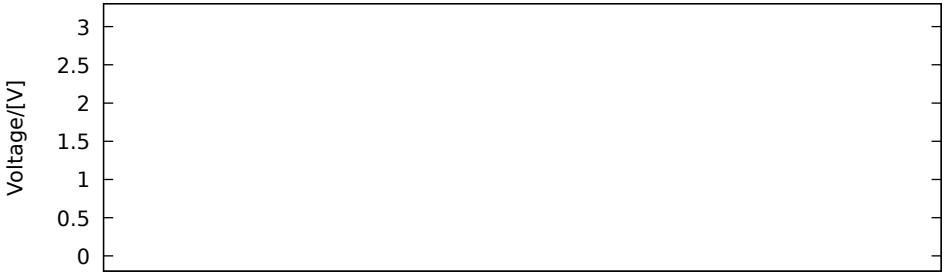

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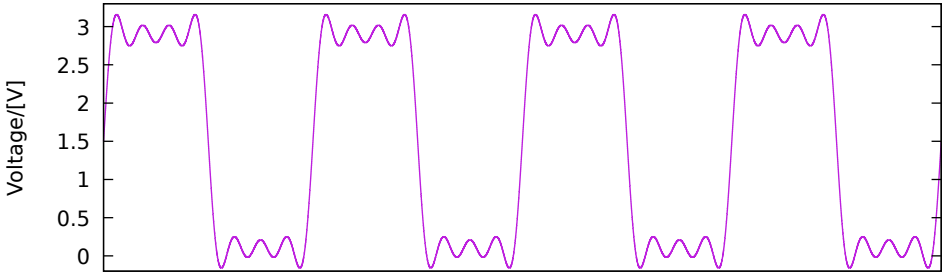

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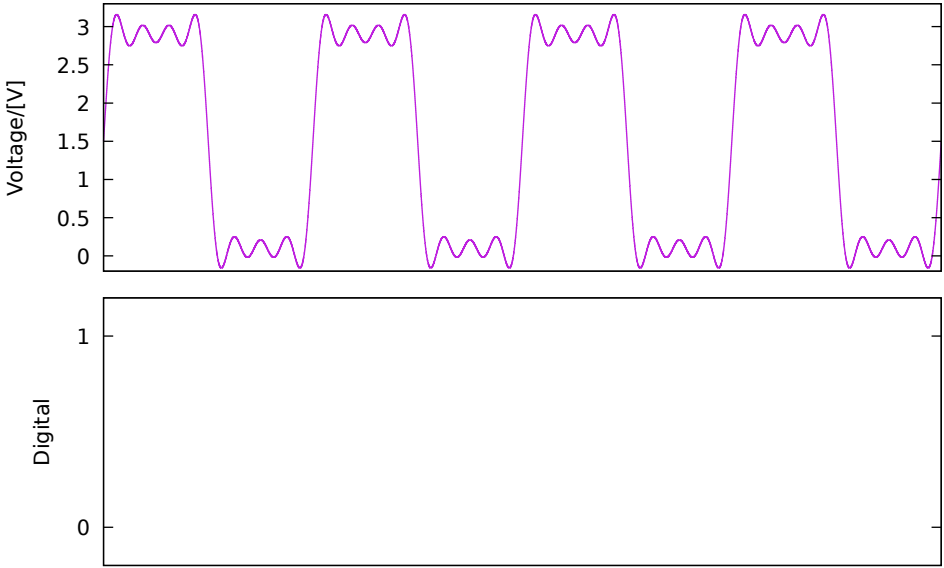

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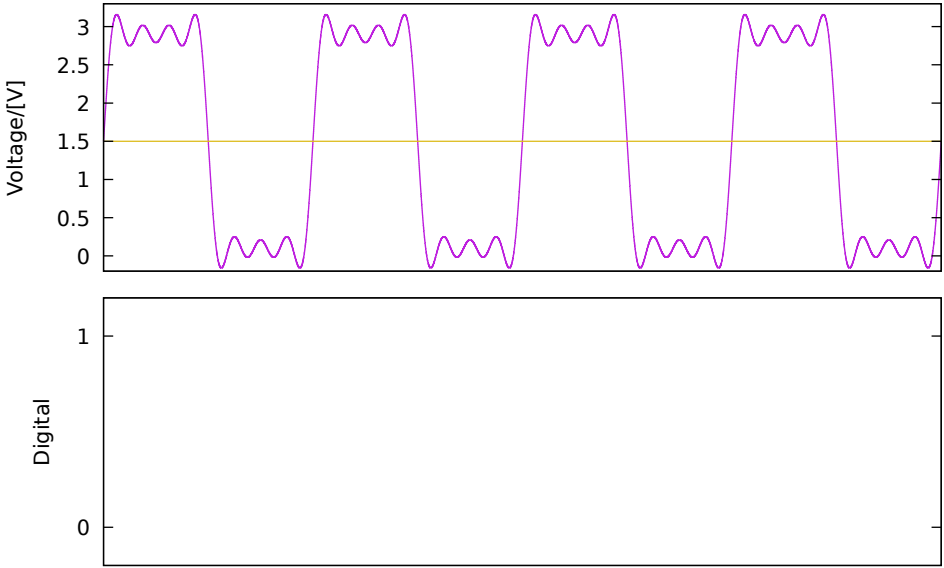

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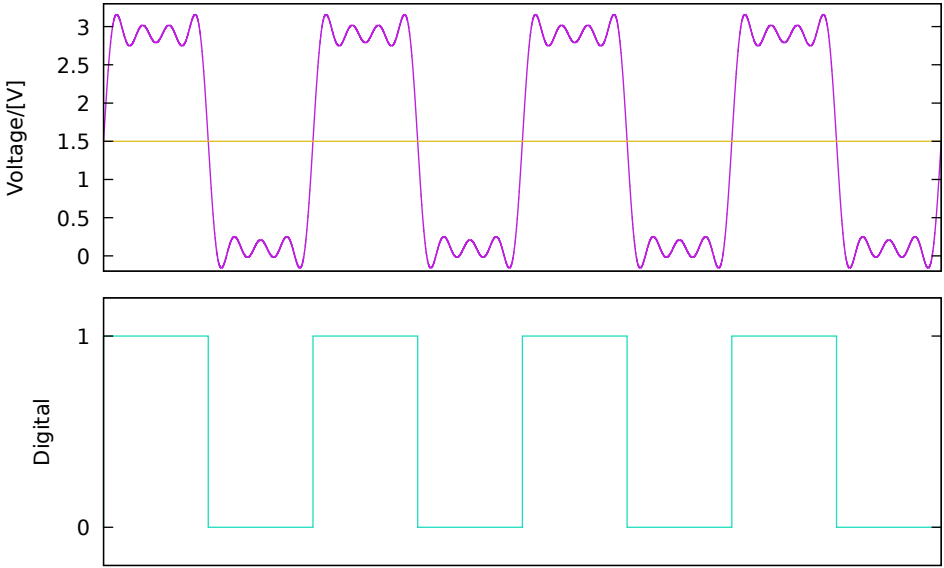
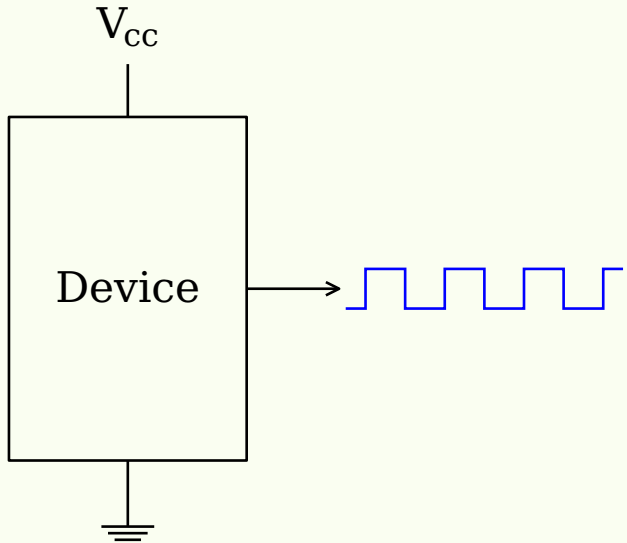
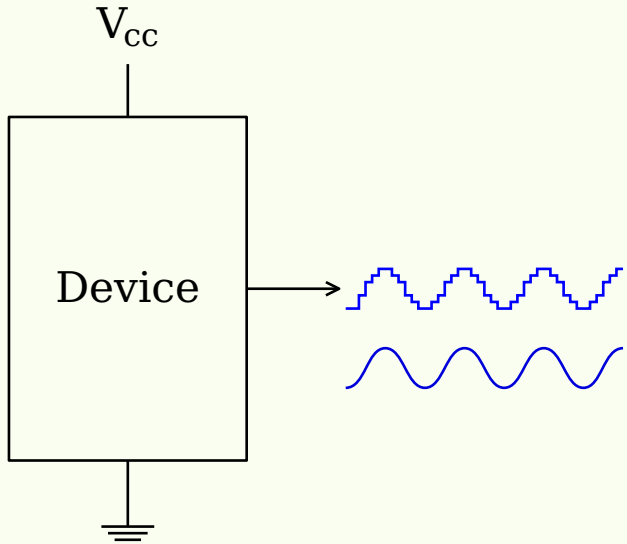
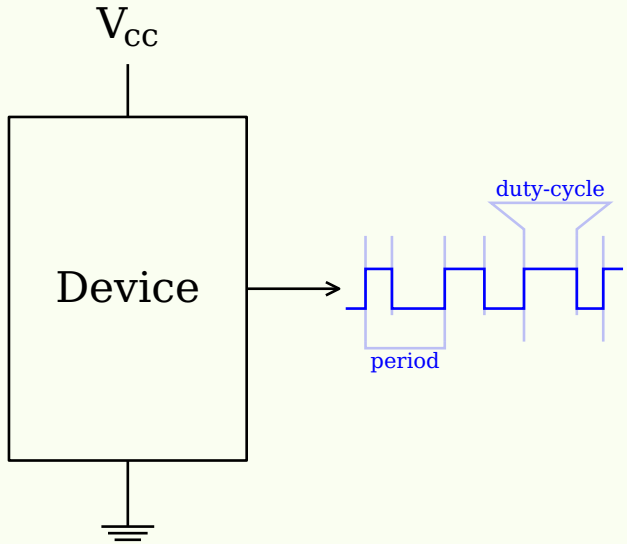


Part 2:
Basic Output

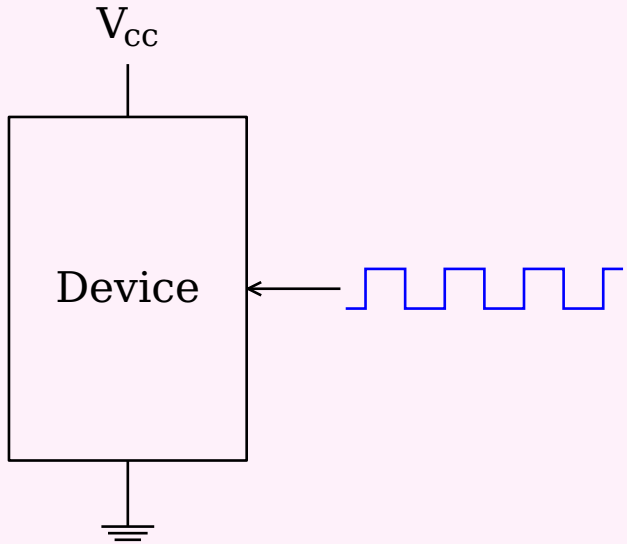

V_{cc}
Device

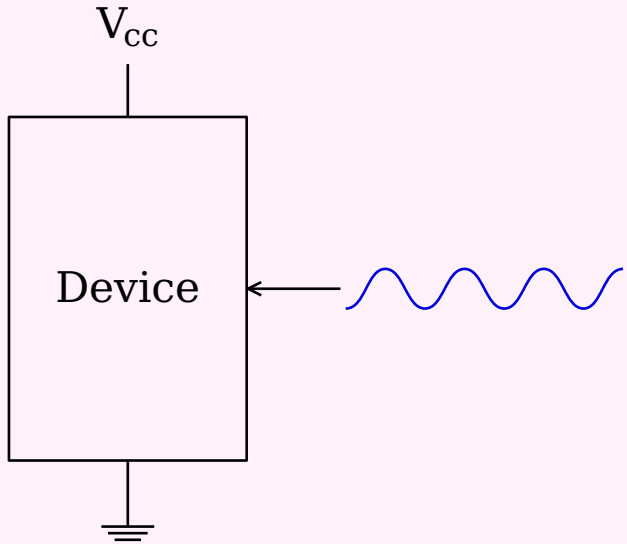

V_{cc}
Device

Basic Output ▷ Pulse Width Modulation (PWM)



Part 3:
Basic Input


V_{cc}
Device


V_{cc}
Device

Part 4:
Serial Communication

Introduction

What is serial communication?

Definition: A way of transferring a chunk of data one bit after the other.

There are many ways of doig so ...

- SPI *"spy"*
- I2C *"I-squared-C"*
- RS232 (the subject of today)

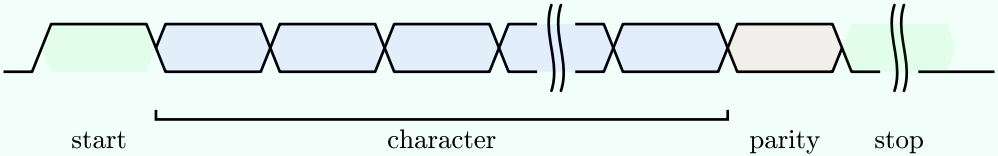
In its simplest form, RS232 is a three wire protocol:

1. Communication in one direction
2. Communication in the other direction
3. Ground

RS232 Frame Format

Contents of the RS232 frame (transmitted at some baud rate):

- 1 start bit
- a *character* spanning 7-8 bits (we will focus on the full byte)
- an (optional) parity bit wich may follow one of a number of standards
- a number of stopbits (usually 1-3)



Working with Incoming Data

How do you decide what to do with data arriving to the device?

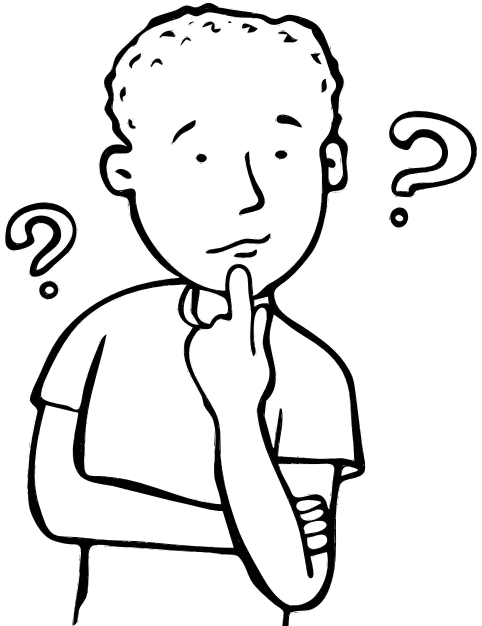
Choices on data format:

1. Machine-readable makes it simple to parse
2. Human-readable makes it simpler to debug

Choices on dispatch mechanism:

1. Lookup using table
2. Lookup using map
3. Chain of branches
4. Deterministic finite automaton

Questions?



https://openclipart.org/detail/238087/boy-thinking-of-question