

# Capteurs Intelligents

## Protocol de communication

# Introduction aux systèmes intelligents et communicants

## Exemples de systèmes intelligents



TPE



Compteurs communicants  
(Smart Meters)



Réseaux électriques  
(Smart Grids)

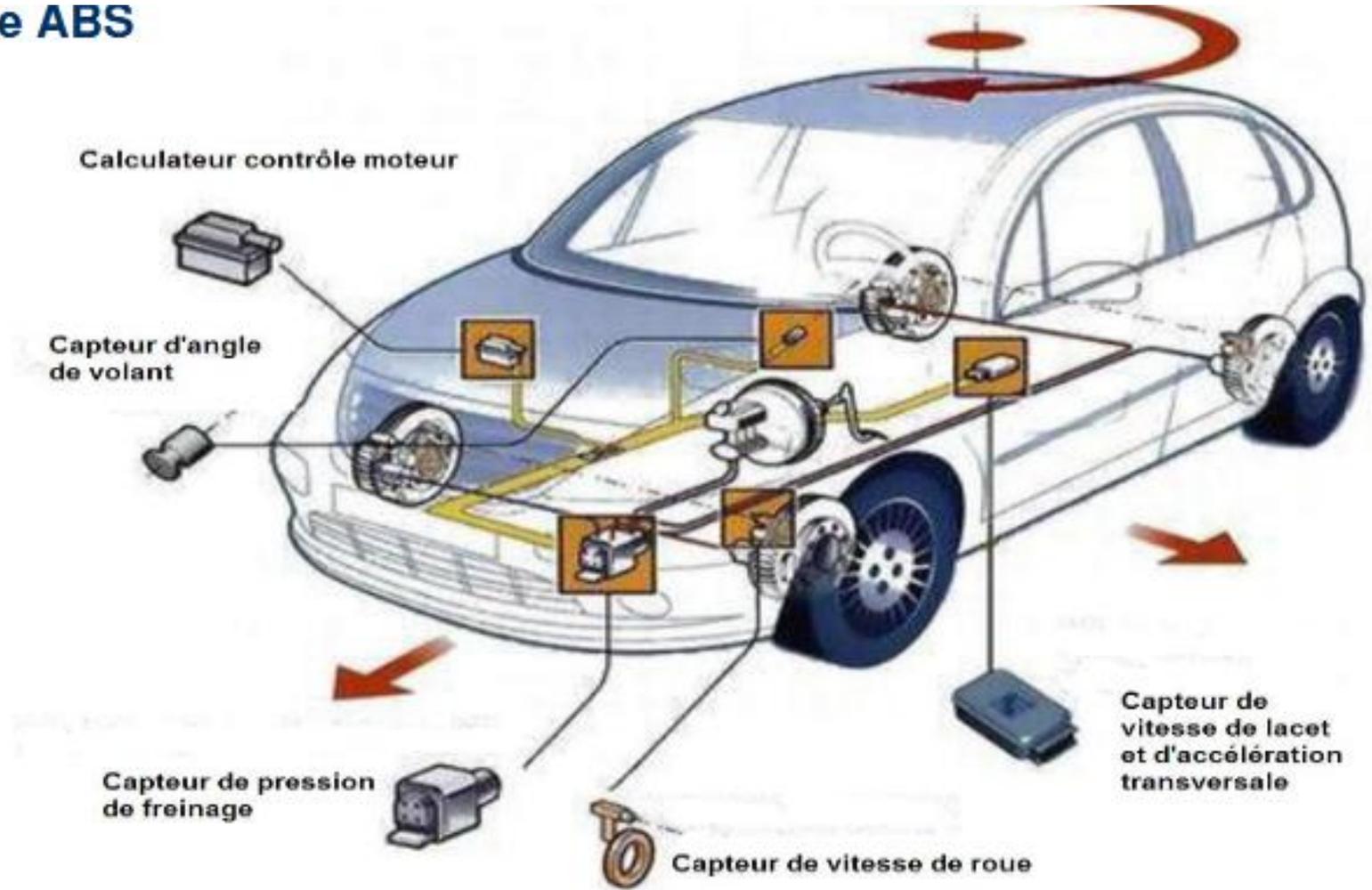


Automatismes industriels  
(Intelligence artificielle)



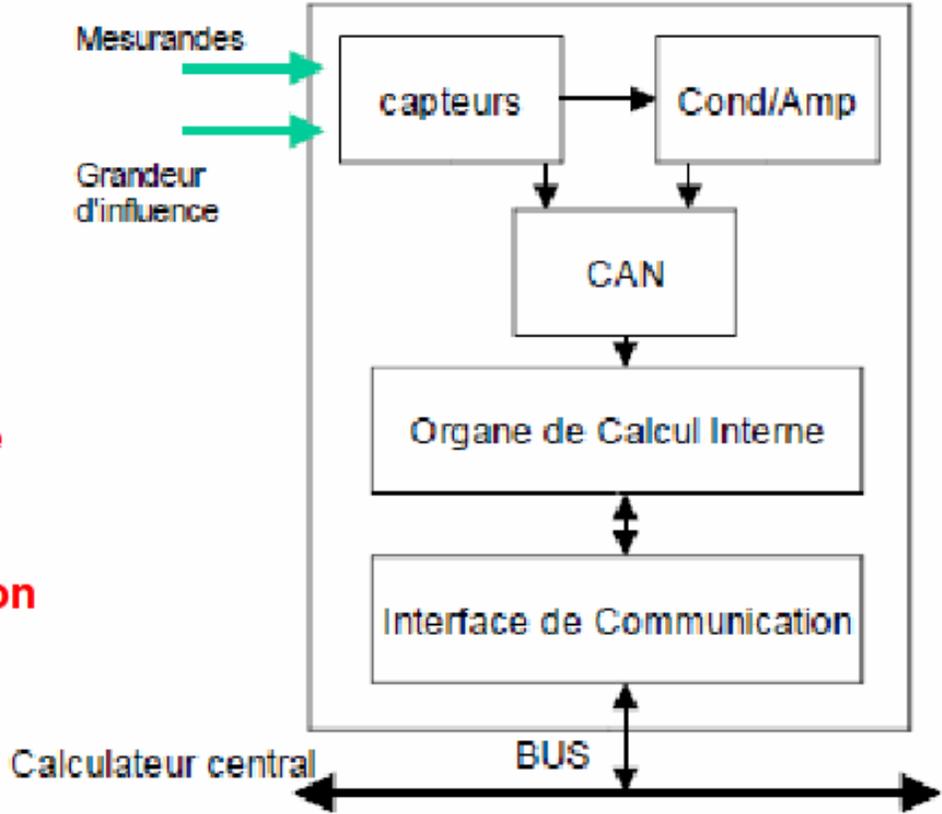
Applications domotiques  
(Smart Home)

## Systeme ABS

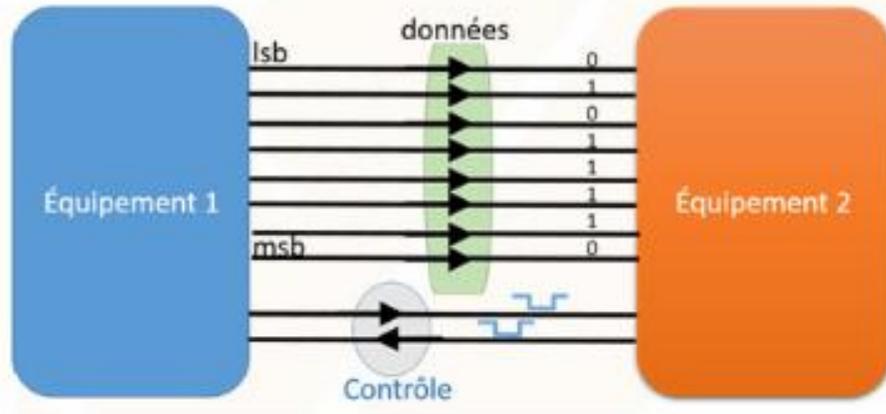


# Architecture interne

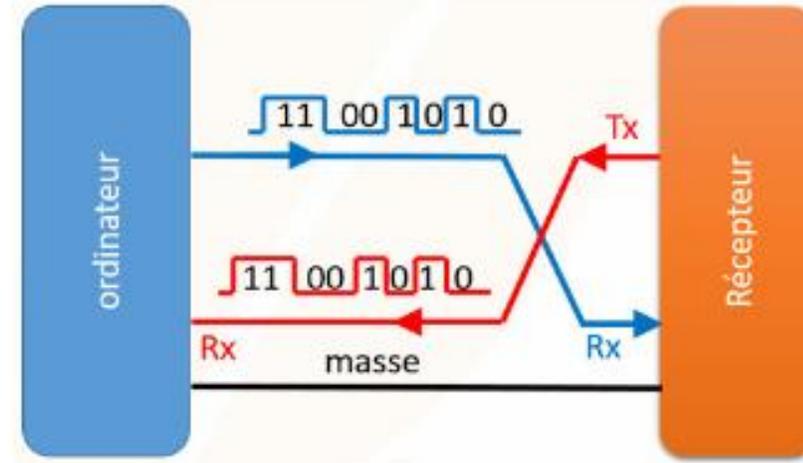
**Capteur intelligent**  
=  
**Capteur ordinaire**  
+  
**Organe de calcul interne**  
+  
**Interface de communication bidirectionnelle**



- **Communication parallèle ou série:**



Communication parallèle



Communication série

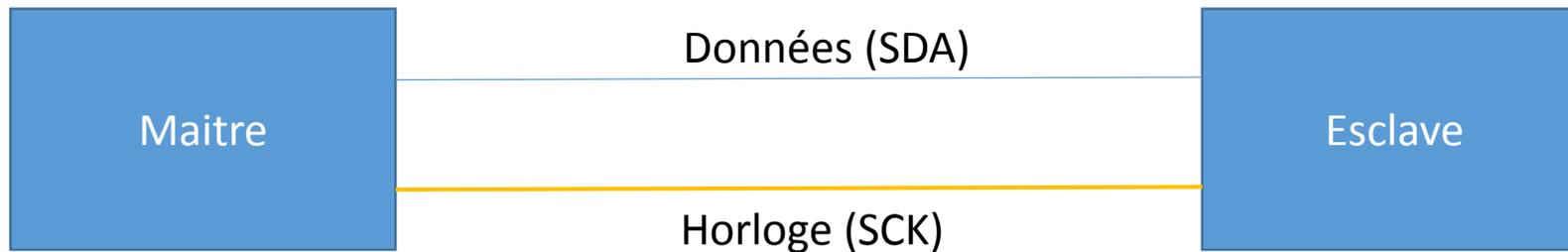
# Protocol I2C

- Inventé en 1982 par NXP
- Utilisé dans : Les téléphones portables, l'automobile, l'aéronautique, la robotique, instrumentation industrielle, communications entre microcontrôleurs et autres périphériques (capteurs, afficheurs ...)
- C'est un Protocol :
  1. Simple
  2. Robuste
  3. Prix réduit
  4. Fiable

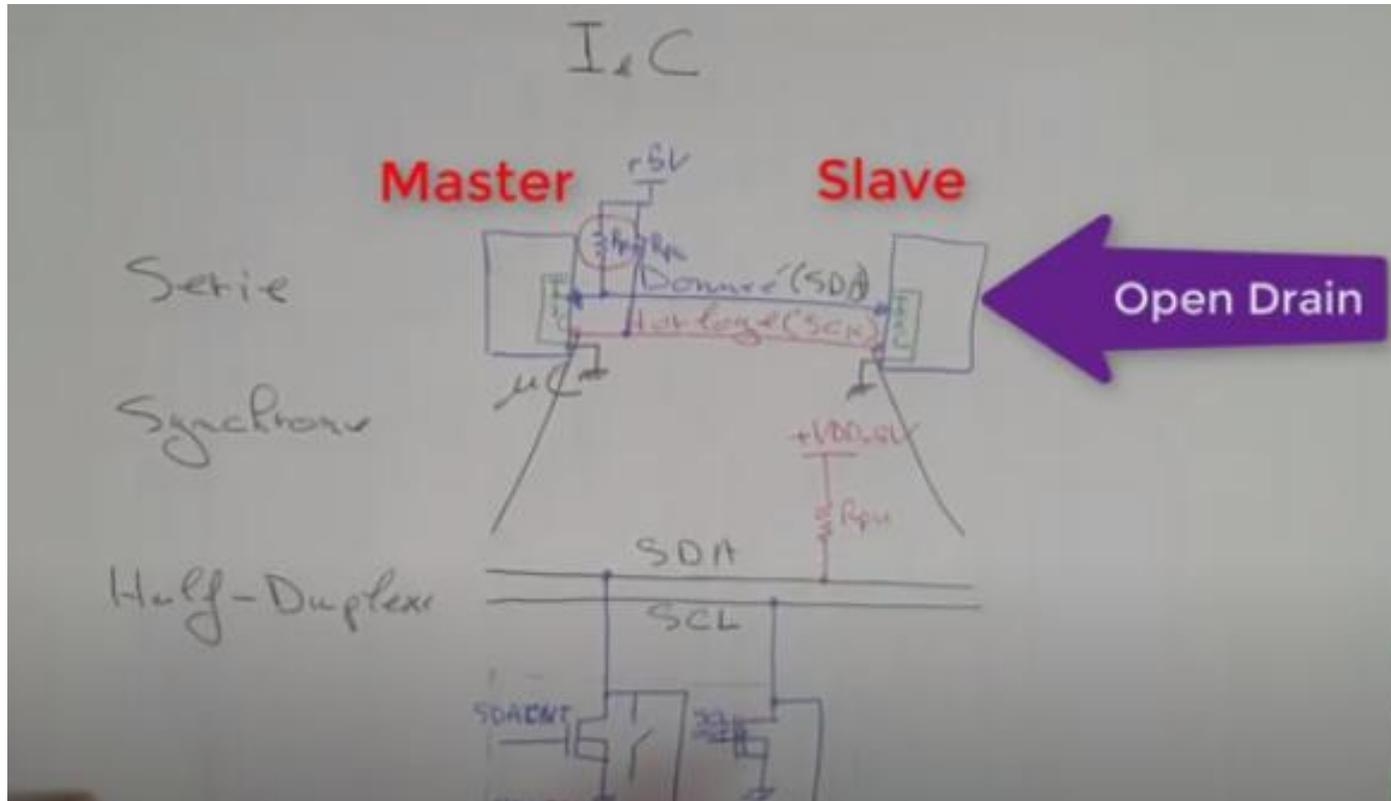
# Protocol I2C

## 1. Caractéristiques

- a) Série (données en séquentielle )
- b) Synchrone (signal d'horloge physique)
- c) Half-duplexe (transmission alternée)



# Protocol I2C



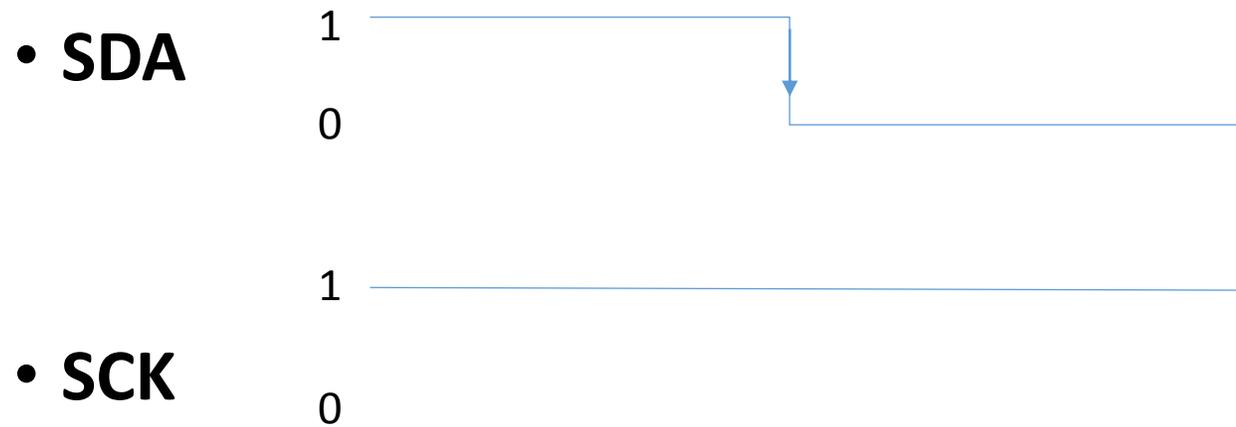
État de repos :

**SDA = 1**

**SCK = 1**

# Protocol I2C

- **Start condition (Condition de départ )**



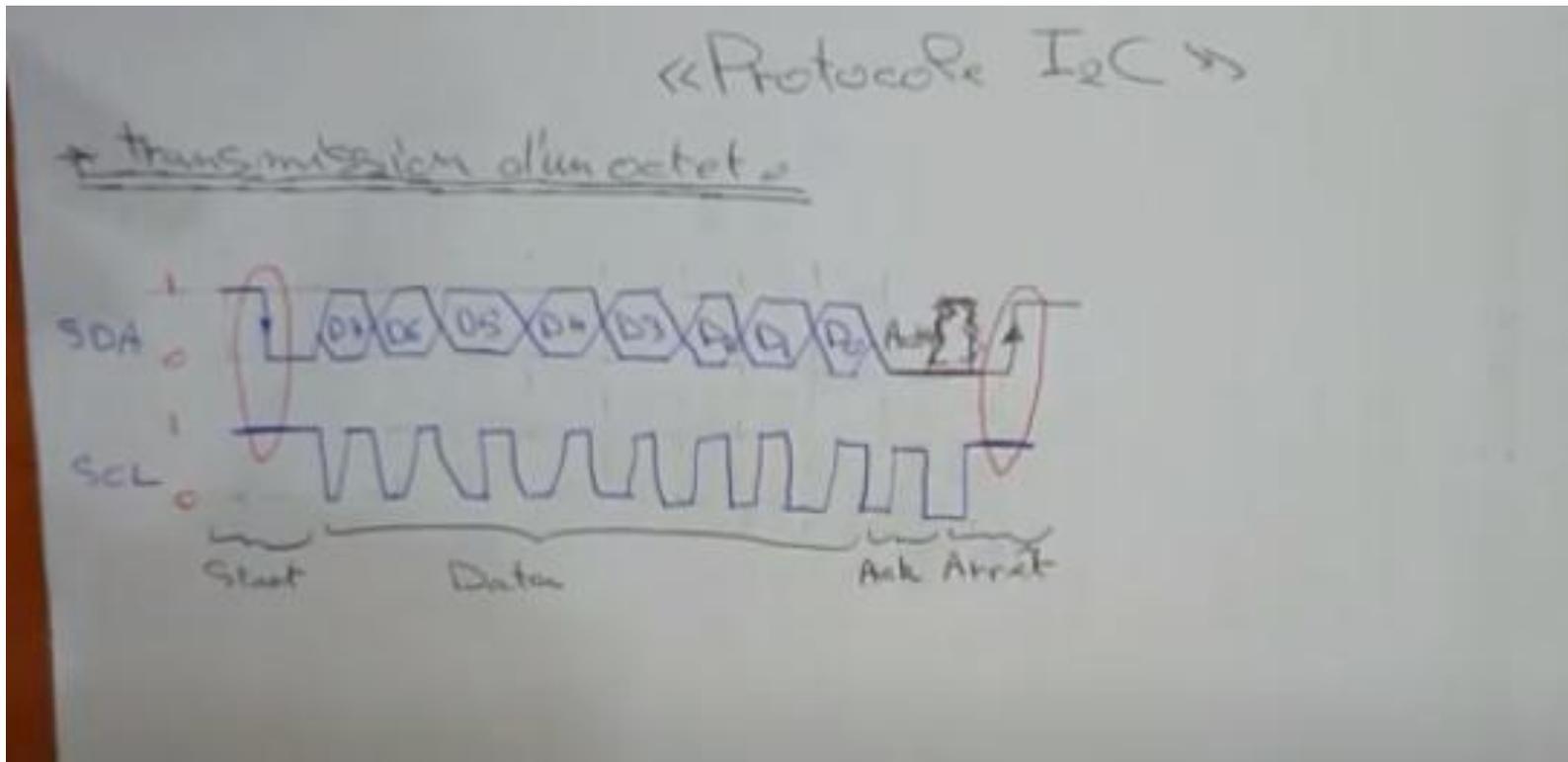
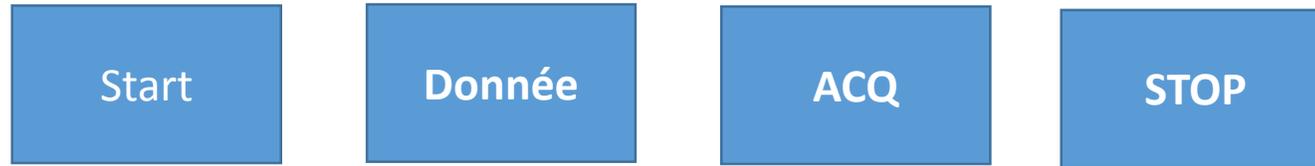
# Protocol I2C

- **Stop condition (Condition d'arrêt)**



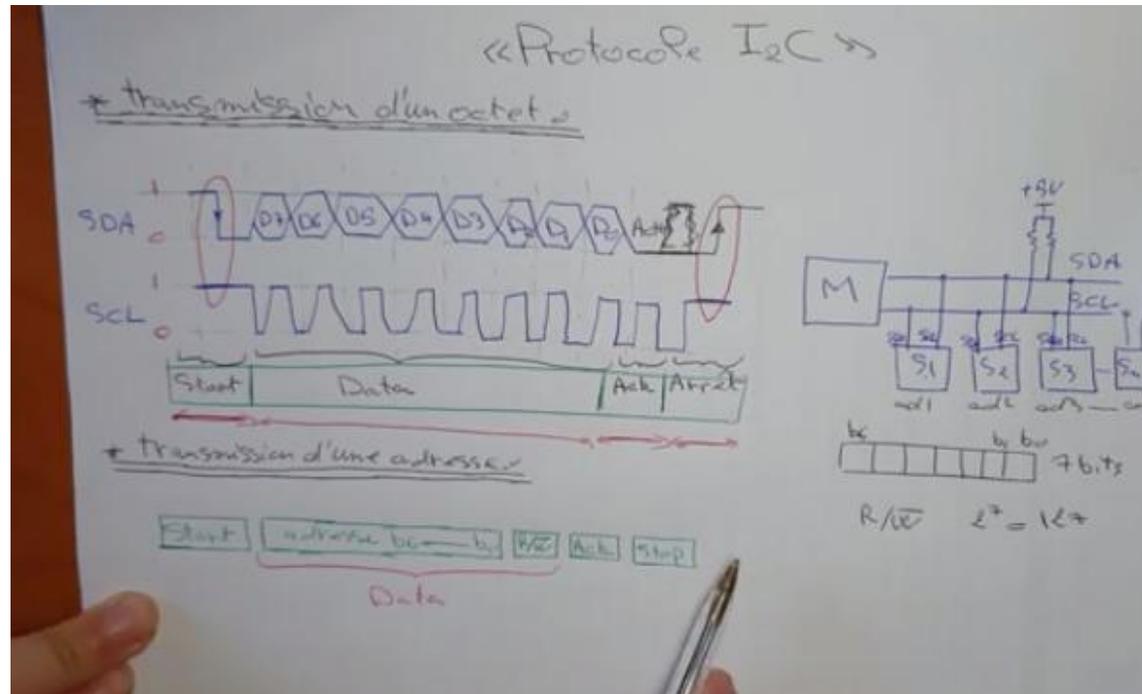
# Protocol I2C

## 1. Transmission d'un octet (Start, Octet, bit ACQ, STOP)



# Protocol I2C

## 1. Adressage (Start, Adresse (7 bits, bit R/W, bit ACQ, STOP))



# Protocol I2C

1. **Ecriture d'une donnée (Start, Adresse (7 bits, bit R/W [=0], bit ACQ, Donnée, ACQ, STOP)**



0

# Protocol I2C

1. Lecture d'une donnée (Start, Adresse (7 bits, bit R/W [=1], bit ACQ, Donnée, ACQ, STOP)



# Protocol I2C

1. En tant que protocole de communication, I2C présente les avantages suivants :
  - A. Taux de transmission de données flexibles.
  - B. Communication à plus longue distance que SPI .
  - C. Chaque périphérique sur le bus est adressable indépendamment.
  - D. Il ne nécessite que deux lignes de signal.

# Protocol SPI

Serial Peripheral Interface

Série & Synchrone

C'est quoi le protocole SPI ?

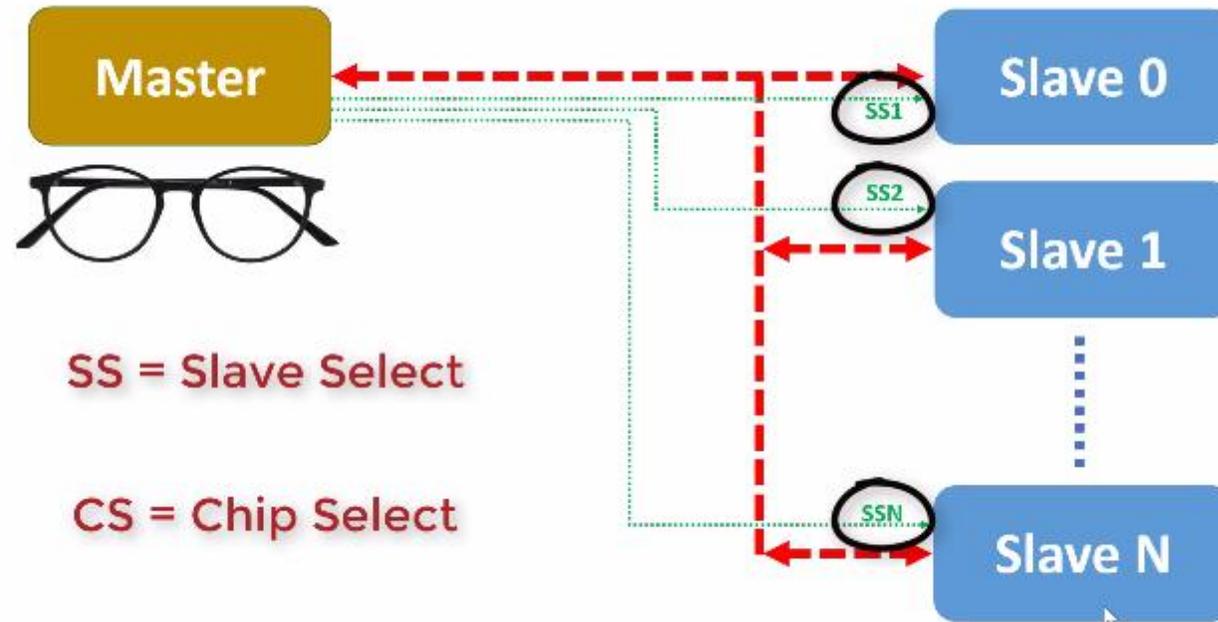


FULL DUPLEX

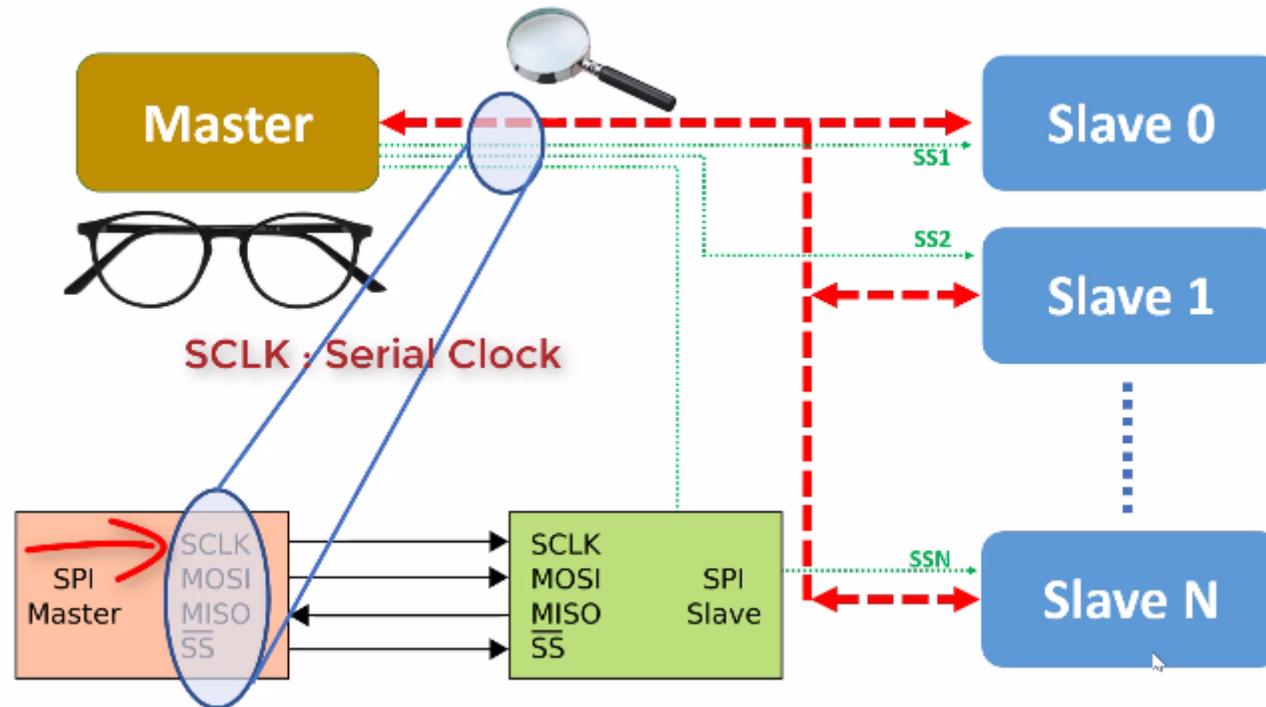


Le protocole SPI, Partie 1: "Principe & Architecture"

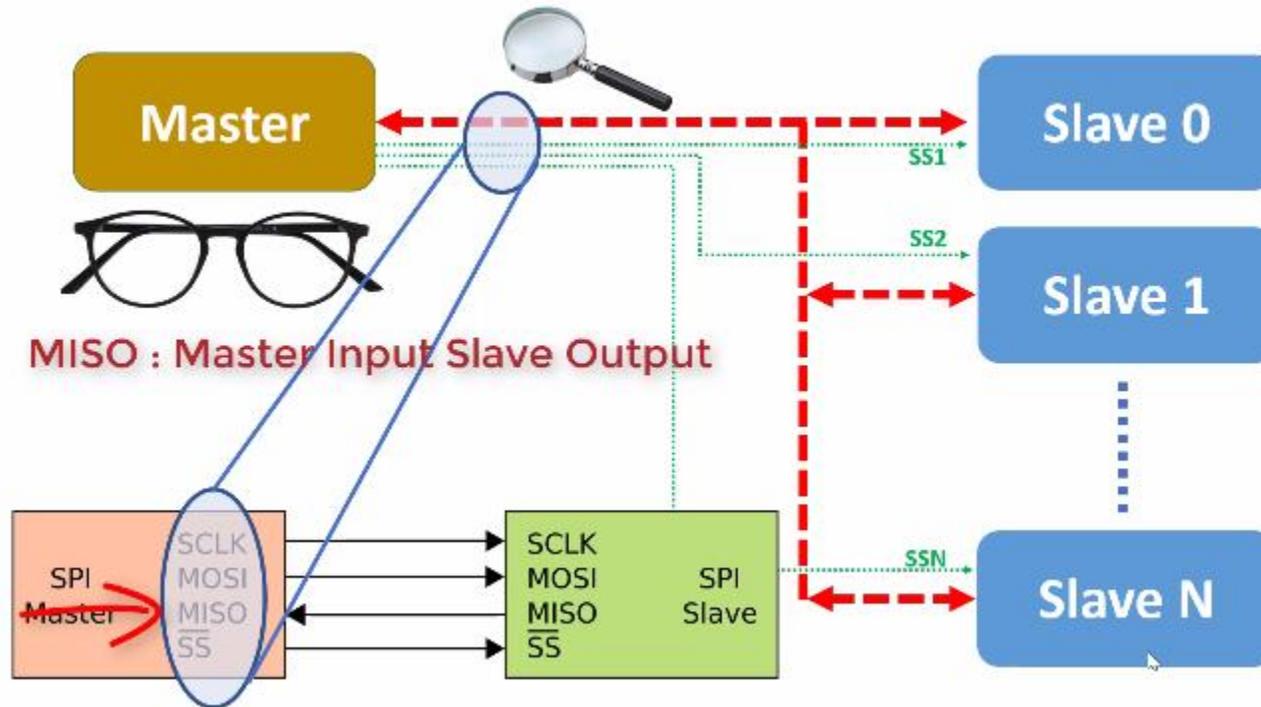
# Principe Protocol SPI



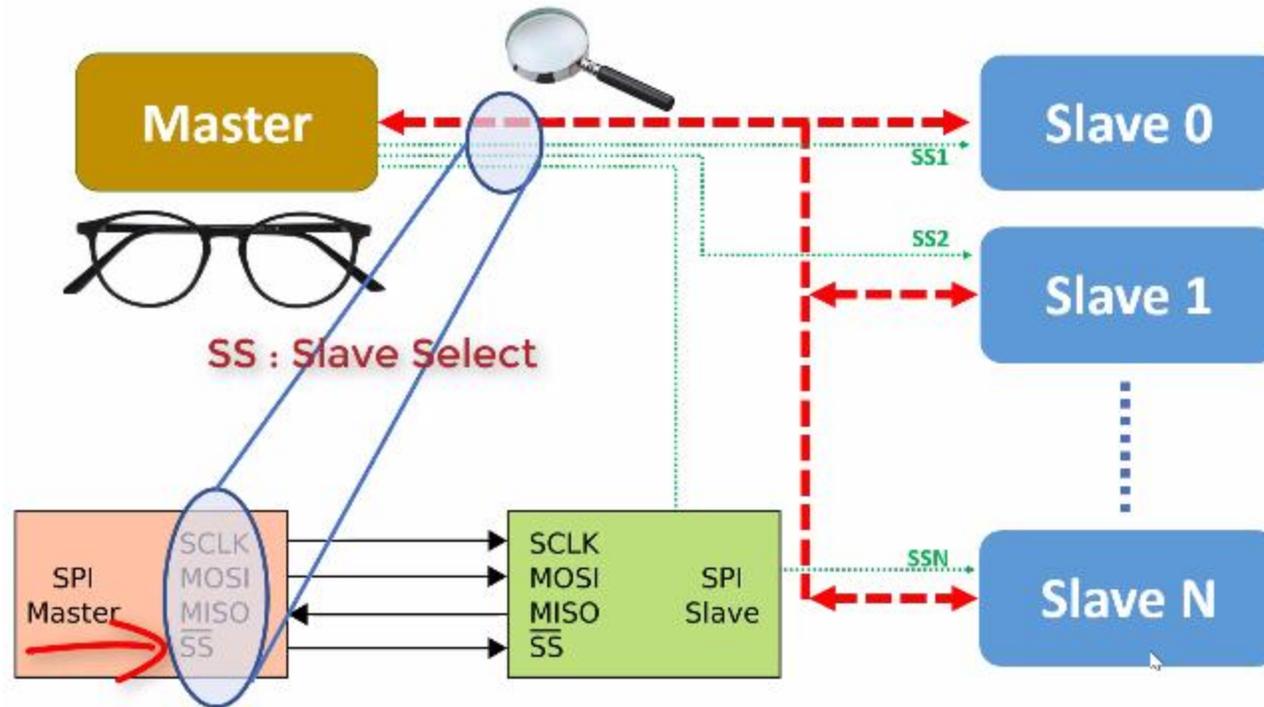
# Principe du Protocol SPI



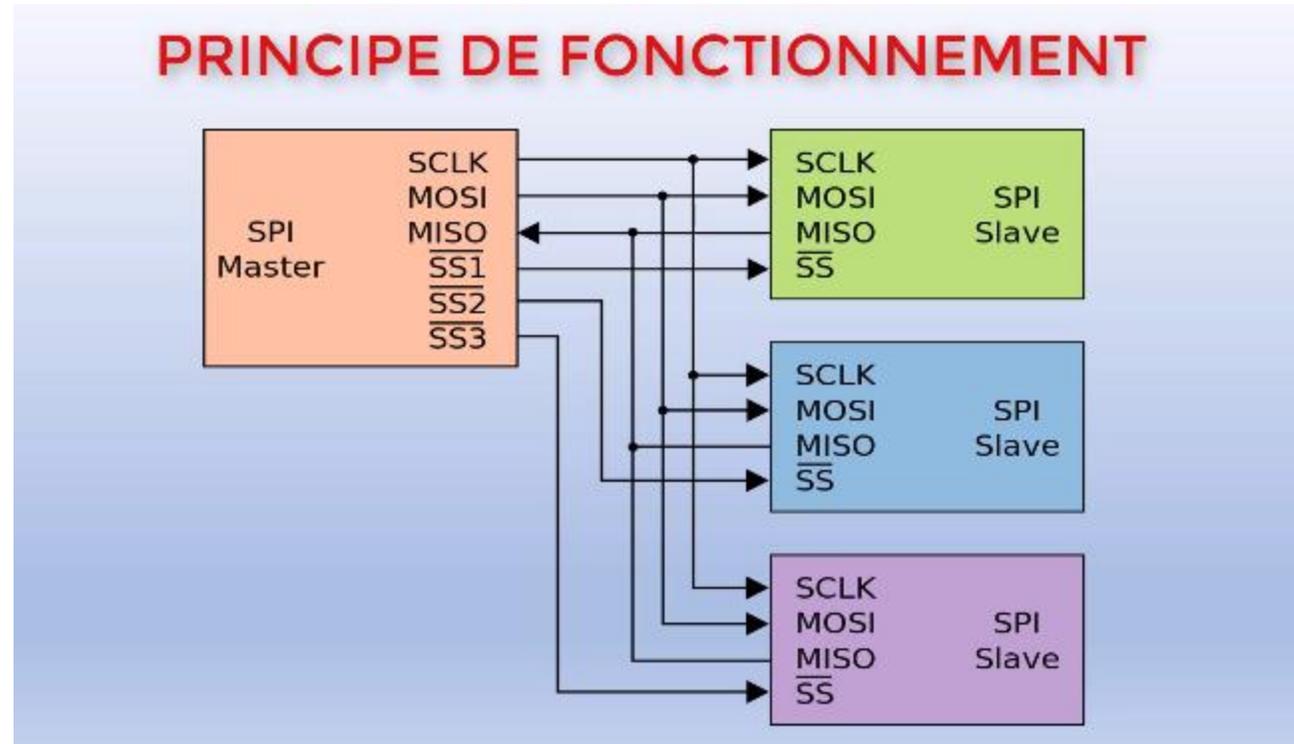
# Principe du Protocol SPI



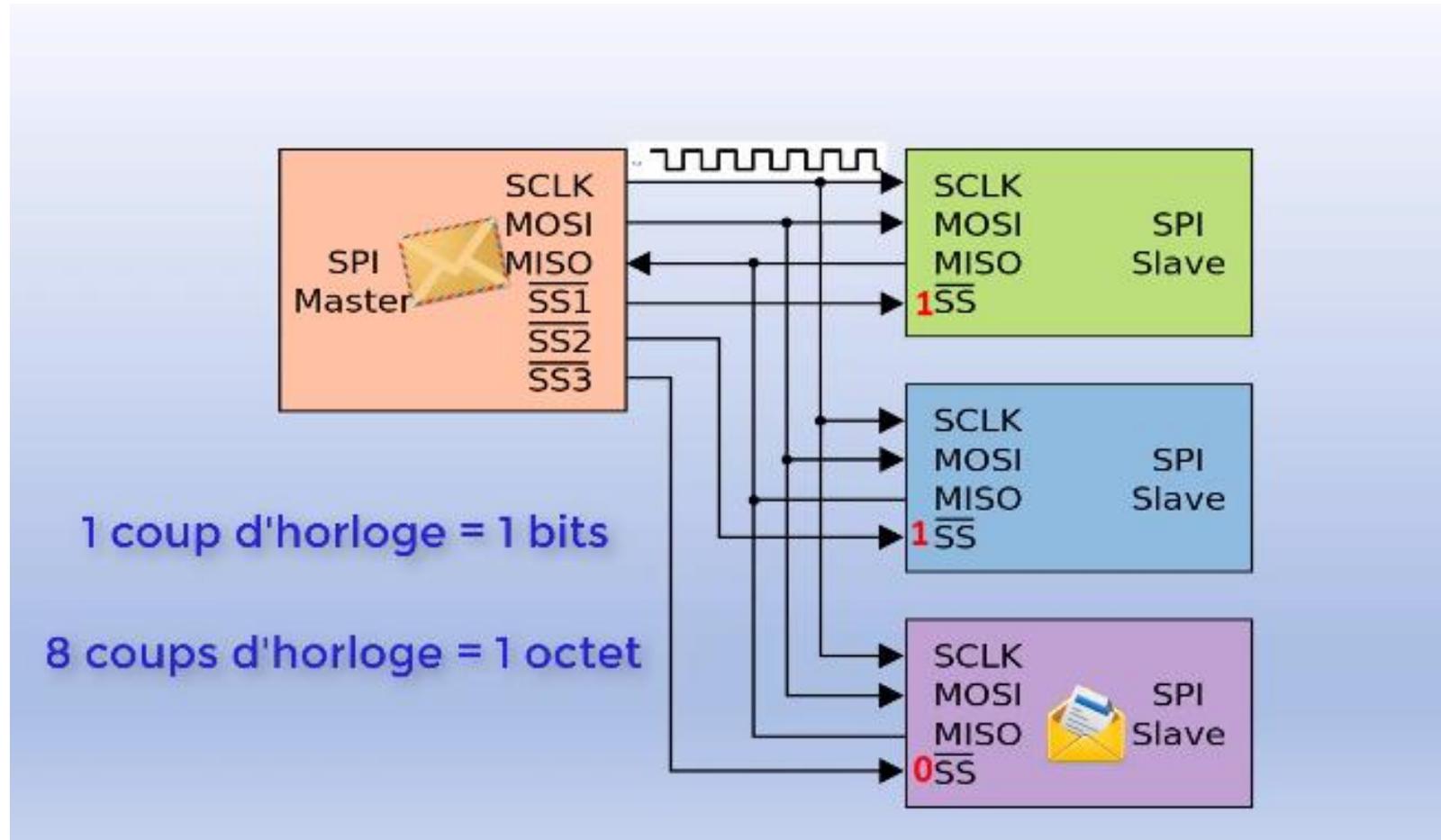
# Principe du Protocol SPI



# Principe du Protocol SPI



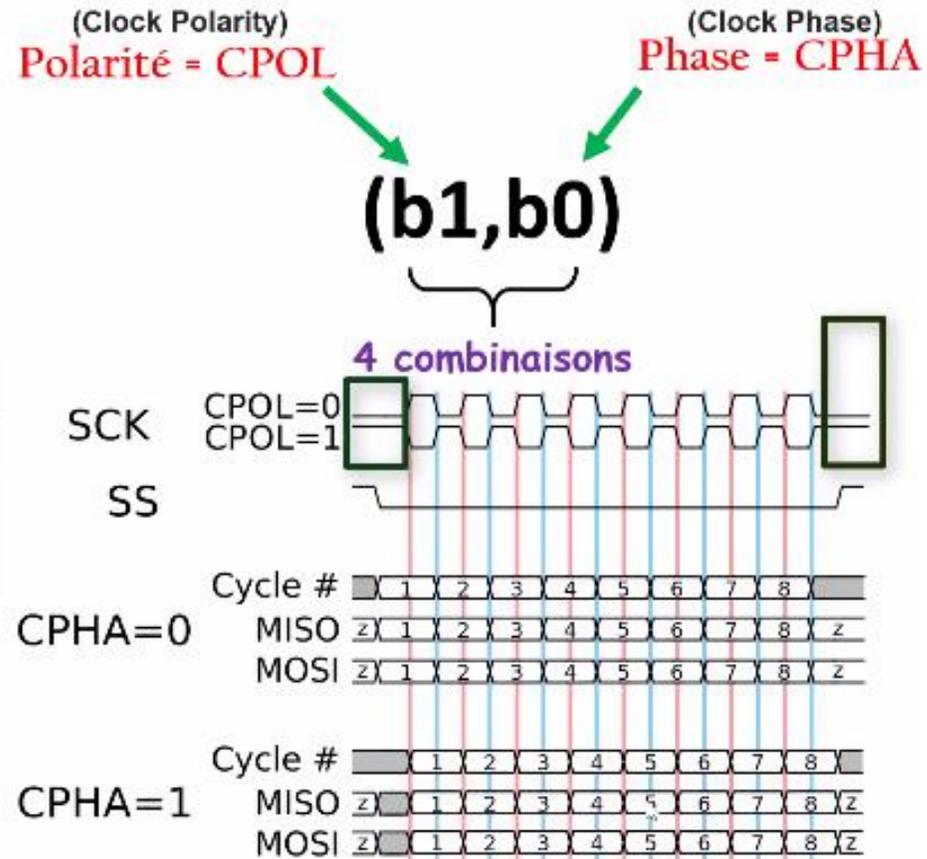
# Principe du Protocol SPI



# Principe du Protocol SPI

## □ La polarité et la phase

Mode	CPOL	CPHA
0 (0,0)	0	0
1 (0,1)	0	1
2 (1,0)	1	0
3 (1,1)	1	1



# Avantages Protocol SPI

- ✓ Full duplex
- ✓ Débit plus important
- ✓ Flexibilité du nombre de bits
- ✓ simplicité de l'interface



# Inconvénients Protocol SPI



- ❖ Monopolise plus de broches
- ❖ Absence d'une procédure pour l'adressage
- ❖ Pas d'acquittement
- ❖ Ne s'utilise que sur de courtes distances

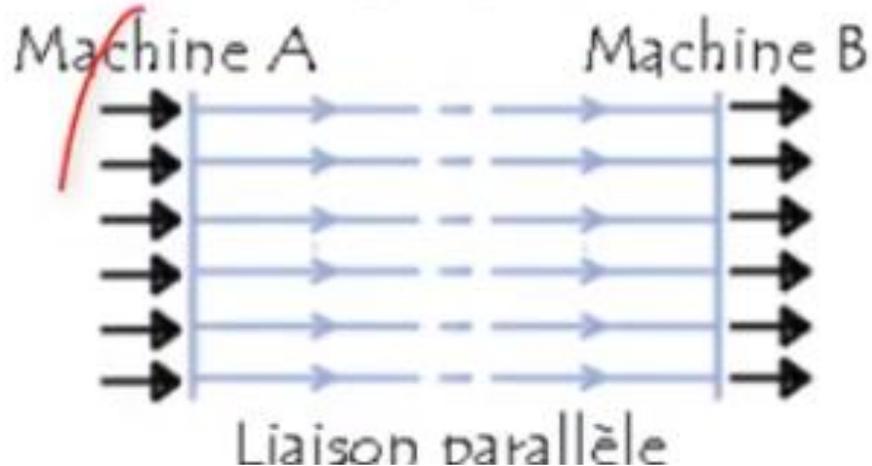
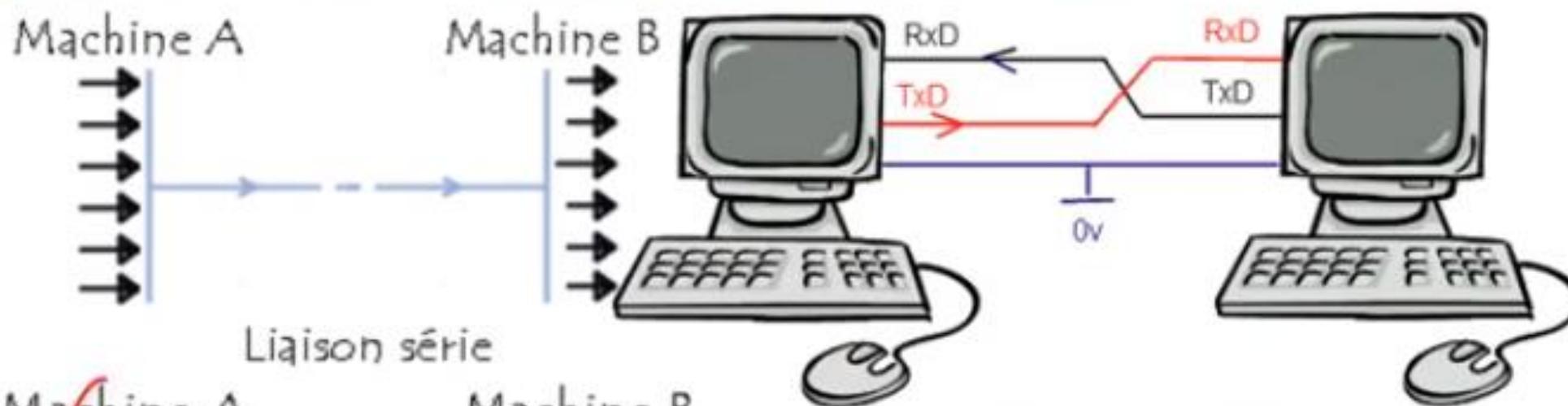
# Protocol UART



# Protocol UART

1

Introduction Générale du Protocole

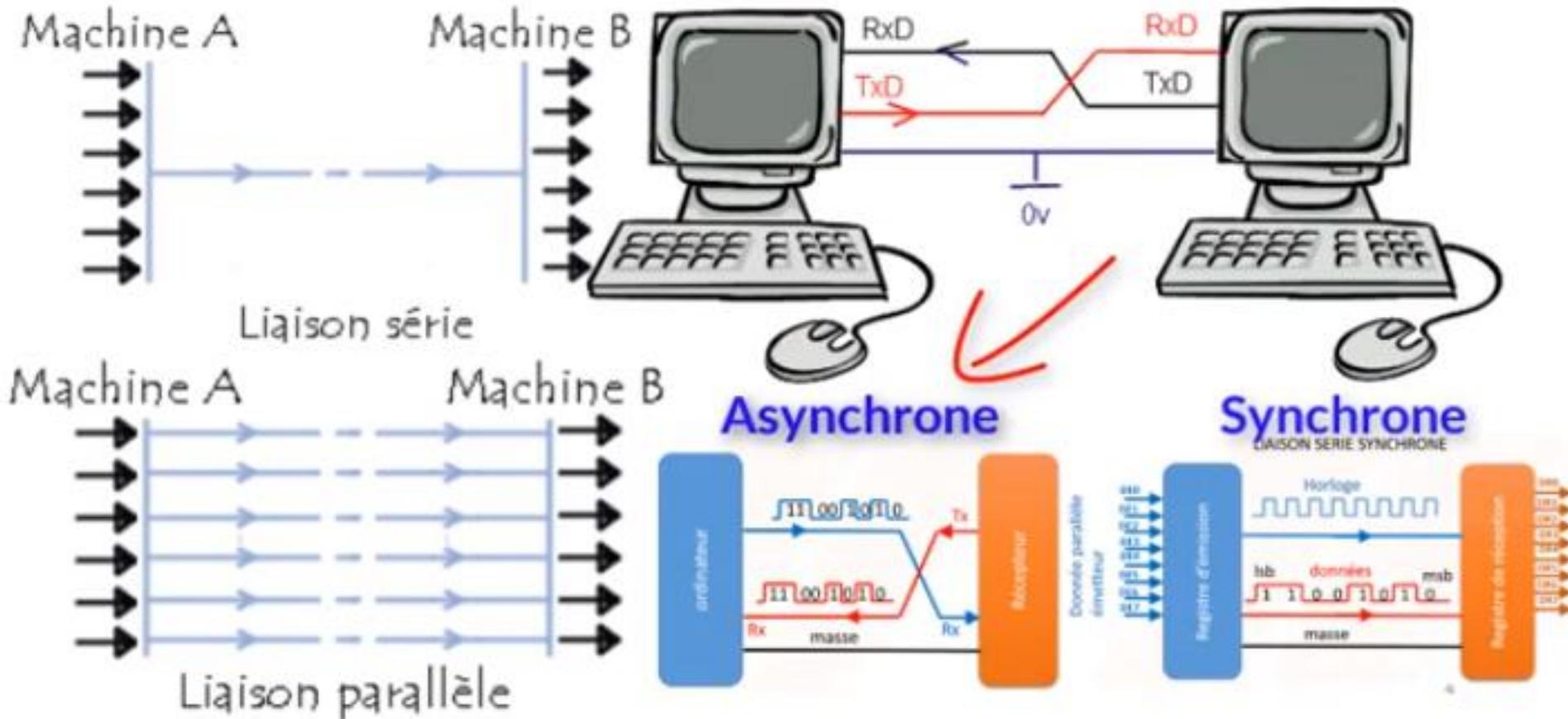


c'est quoi la liaison UART ?

# Protocol UART

1

## Introduction Générale du Protocole

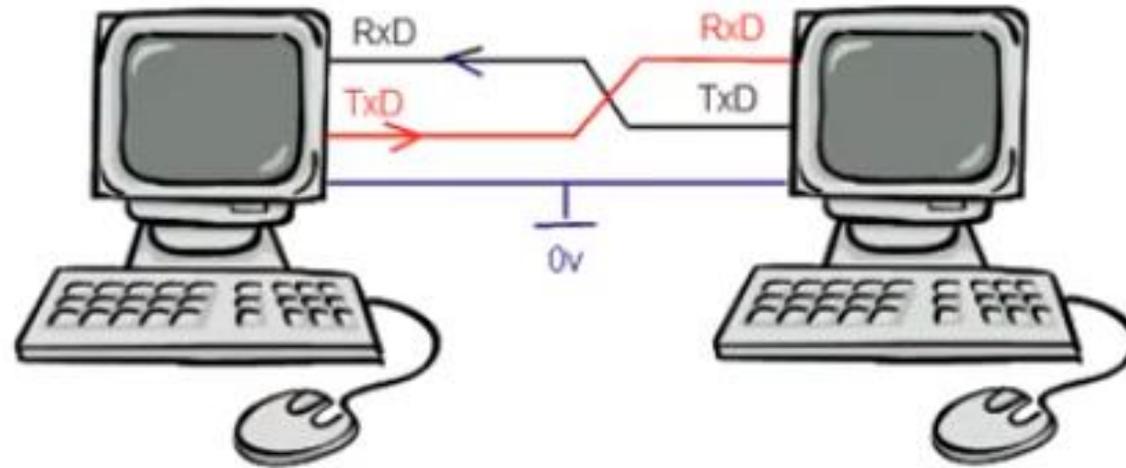


# Protocol UART

1

Introduction Générale du Protocole

- (a) *SIMPLEXE*
- (b) *Full DUPLEXE*
- (c) *Half DUPLEXE*



(a) simplex

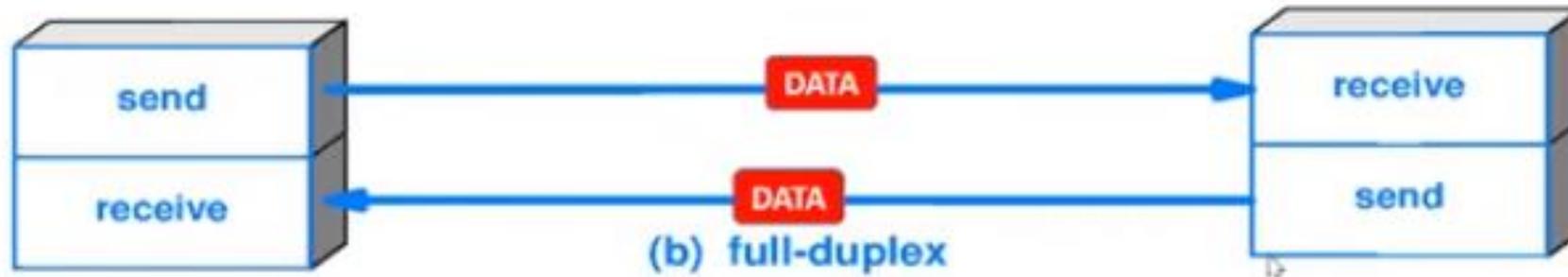
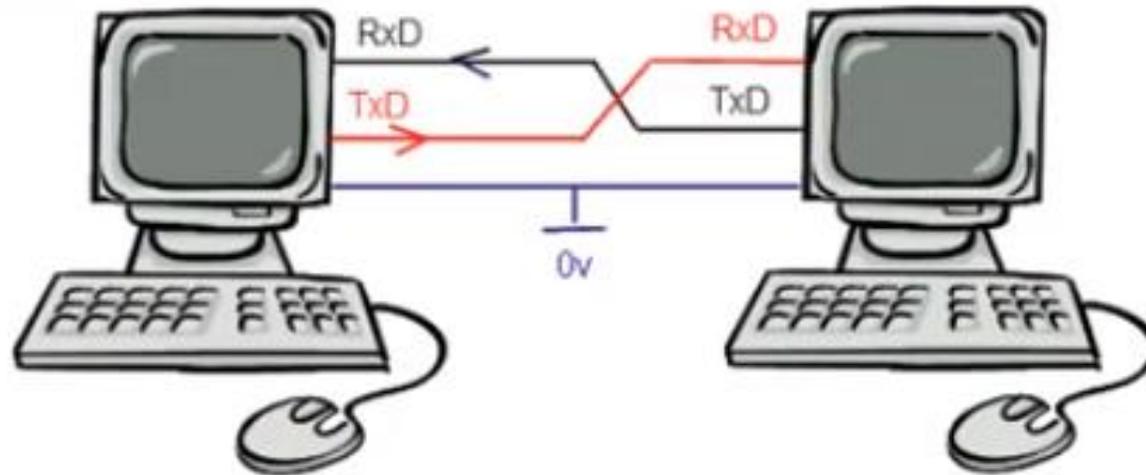


# Protocol UART

1

## Introduction Générale du Protocole

- (a) SIMPLEXE
  - (b) Full DUPLEXE**
  - (c) Half DUPLEXE
- 



# Protocol UART

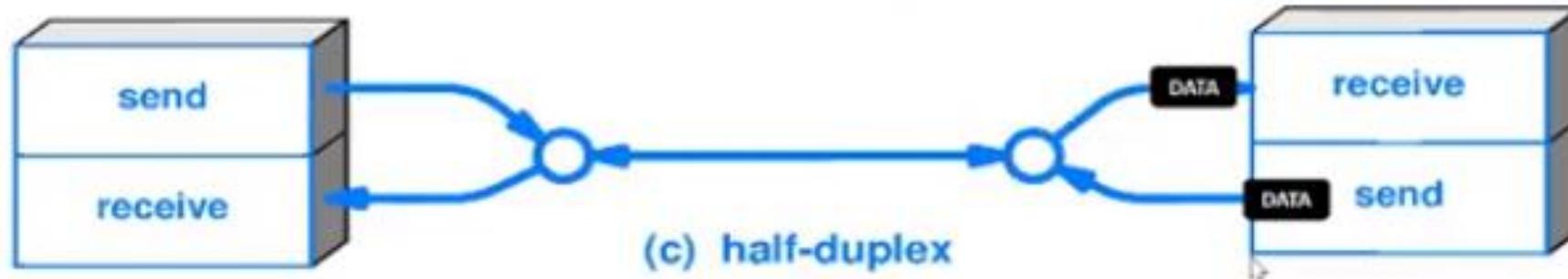
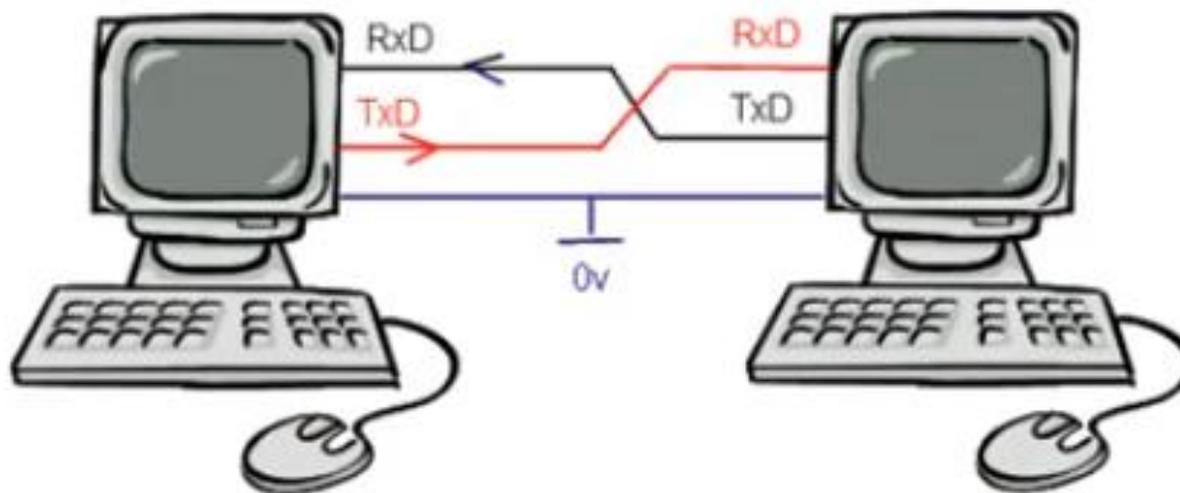
1

Introduction Générale du Protocole

(a) SIMPLEXE

(b) Full DUPLEXE

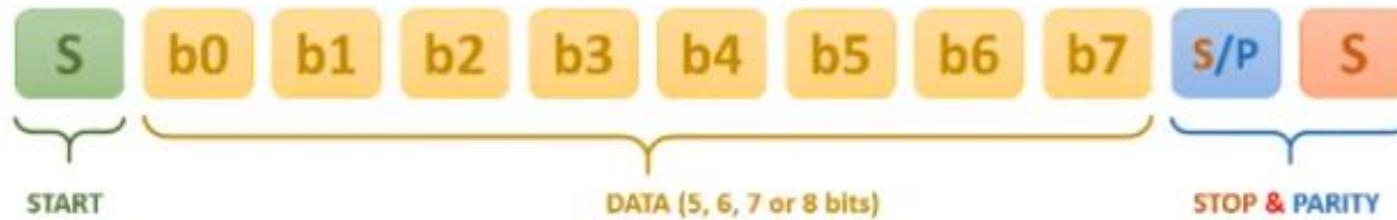
(c) Half DUPLEXE



# Protocol UART

2

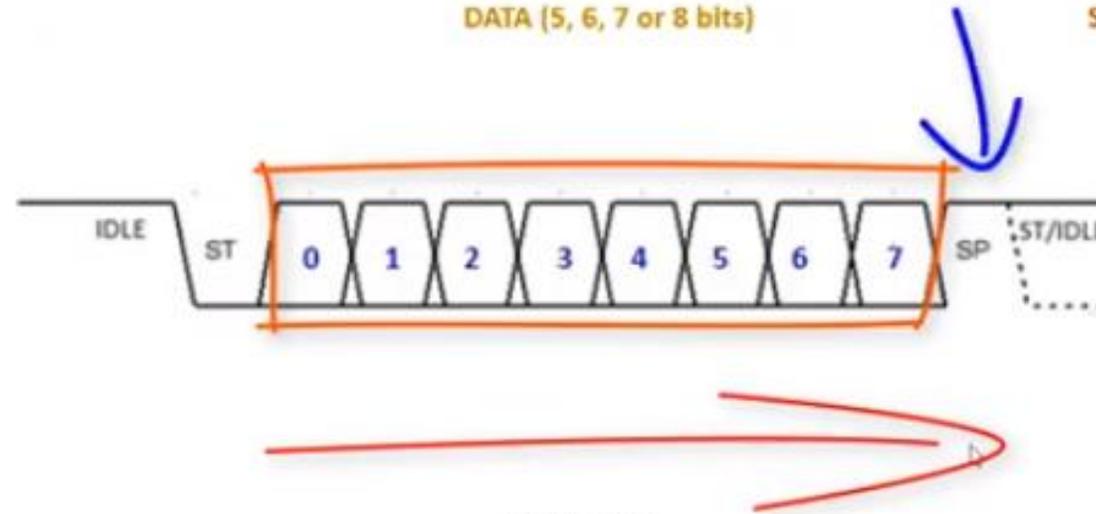
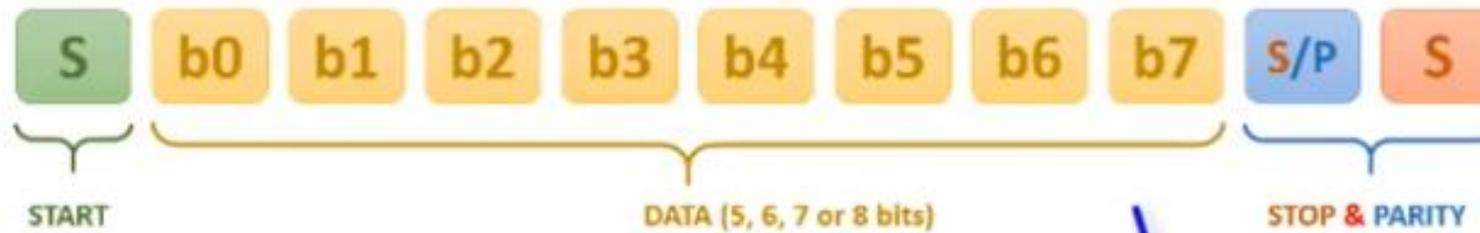
Format D'une Trame UART



# Protocol UART

2

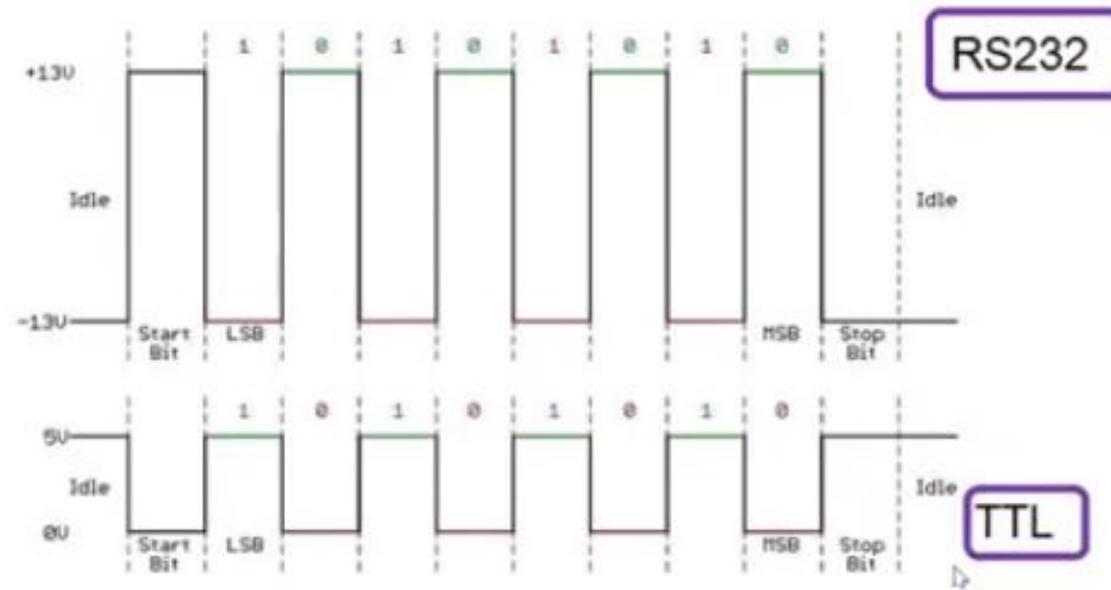
Format D'une Trame UART



# Protocol UART

3

Niveaux Electriques

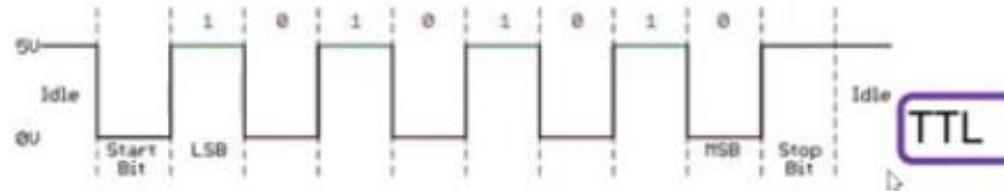


# Protocol UART

3

Niveaux Electriques

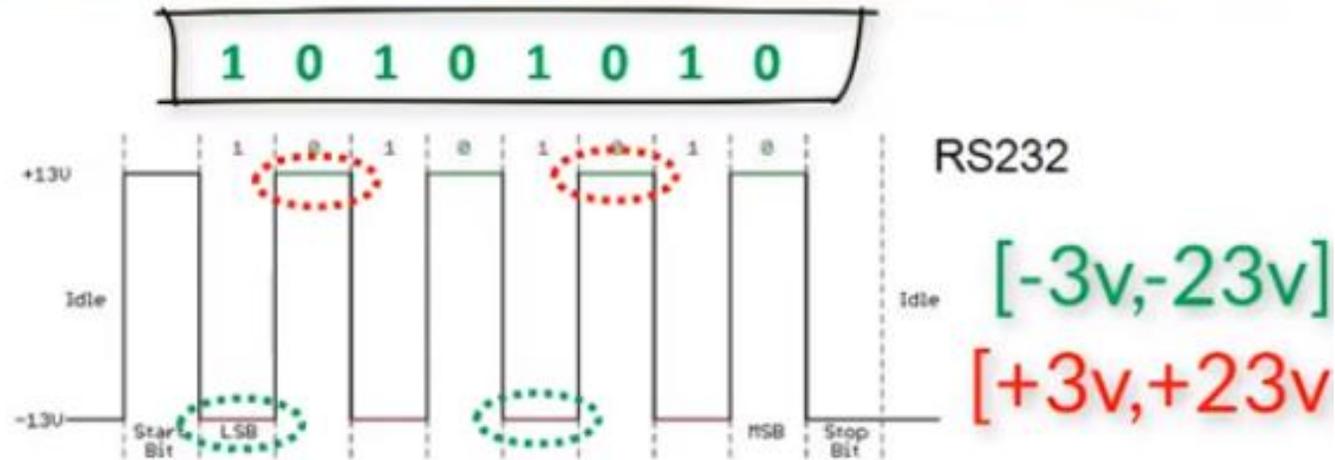
1 0 1 0 1 0 1 0



# Protocol UART

3

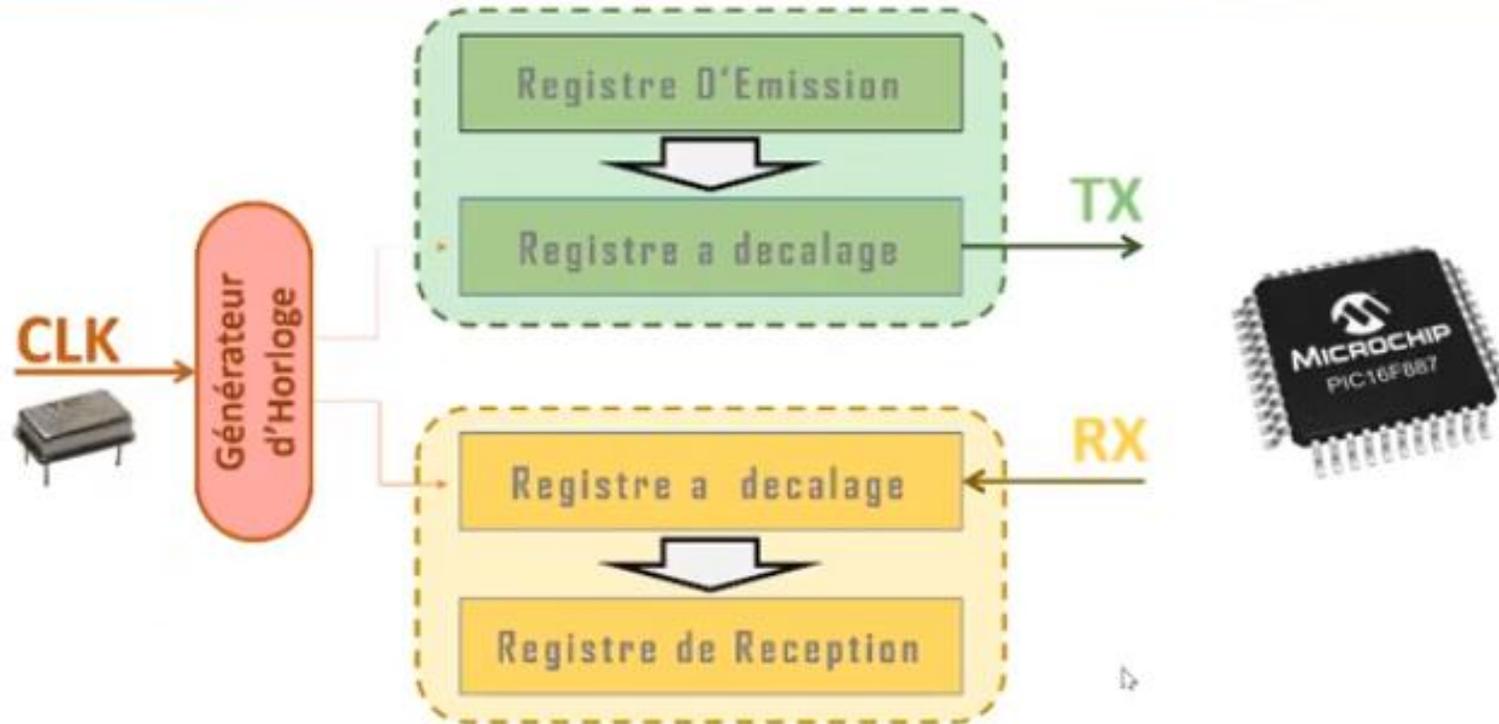
Niveaux Electriques



# Protocol UART

5

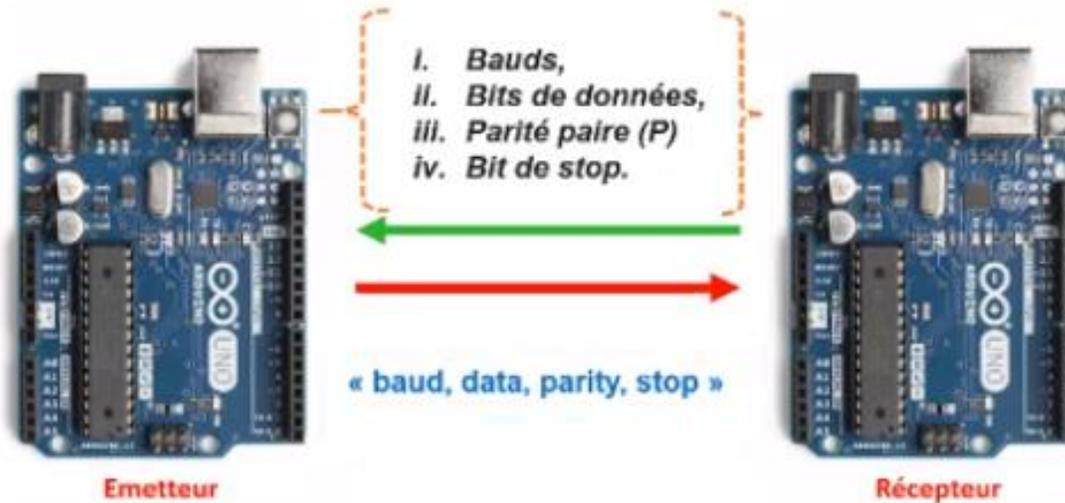
Schéma Bloc D'un Contrôleur UART



# Protocol UART

6

## Configuration De Base d'une Communication UART



Exemple: « 9600 712 »

Pr. Ahmed GAGA

