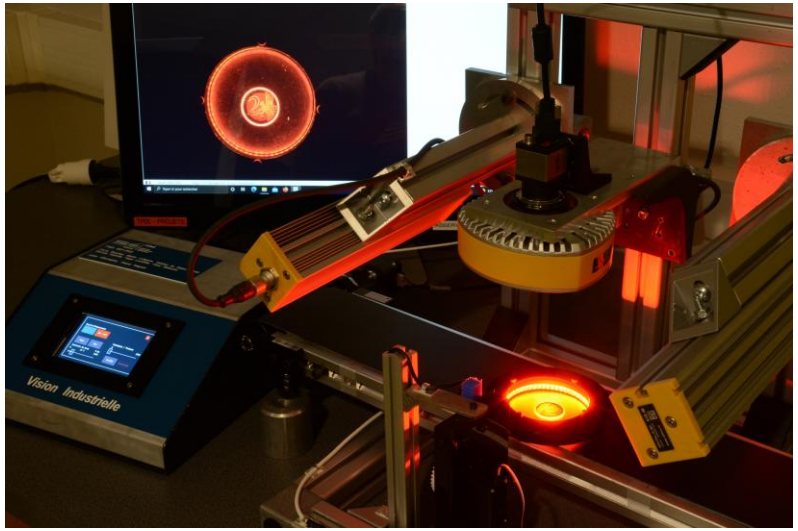
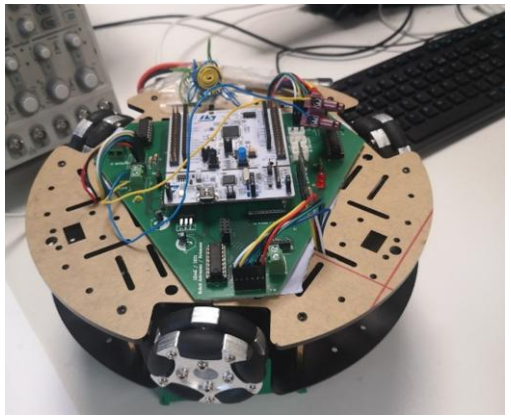
INSTITUT d'OPTIQUE GRADUATE SCHOOL | LEnsE Laboratoire d'Enseignement Expérimental

Interfaçage Numérique

Systèmes embarqués

Julien VILLEMEJANE





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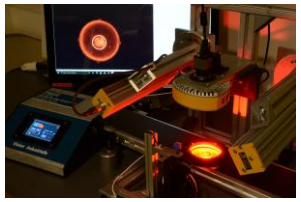
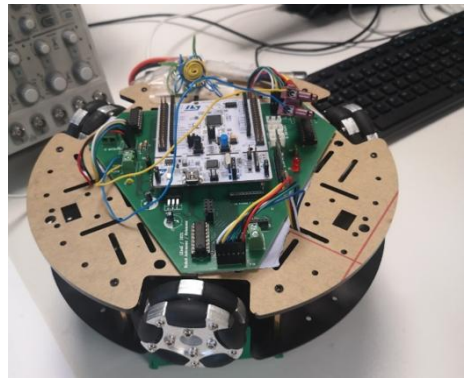
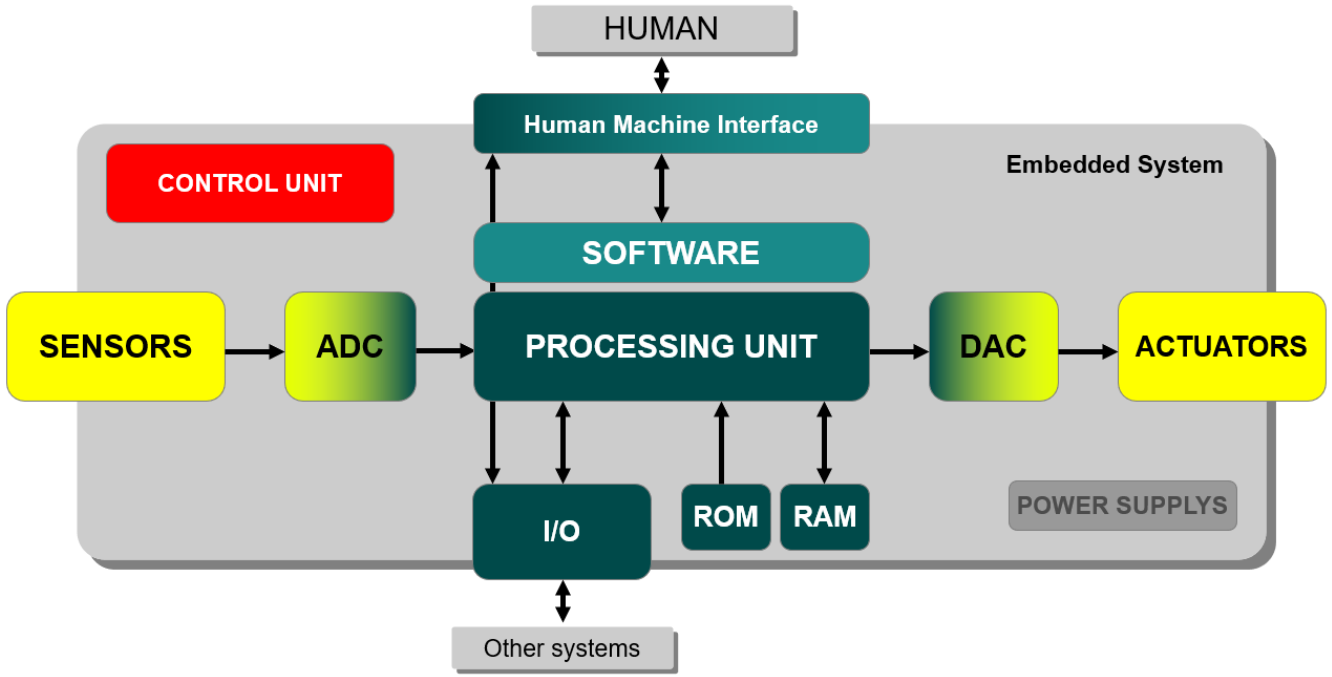


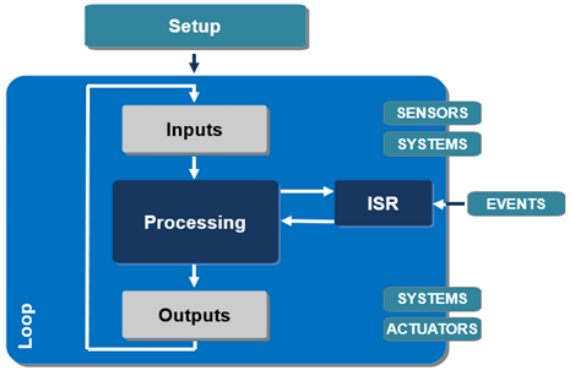
Systèmes embarqués

Spécificités d'un système embarqué

- regroupement d'un **système matériel** et d'un **logiciel**
- **architecture spécifique** / exécution d'un ensemble de tâches particulières
- réactif, autonome et en contact permanent avec son environnement







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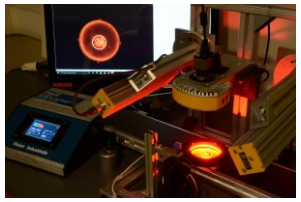
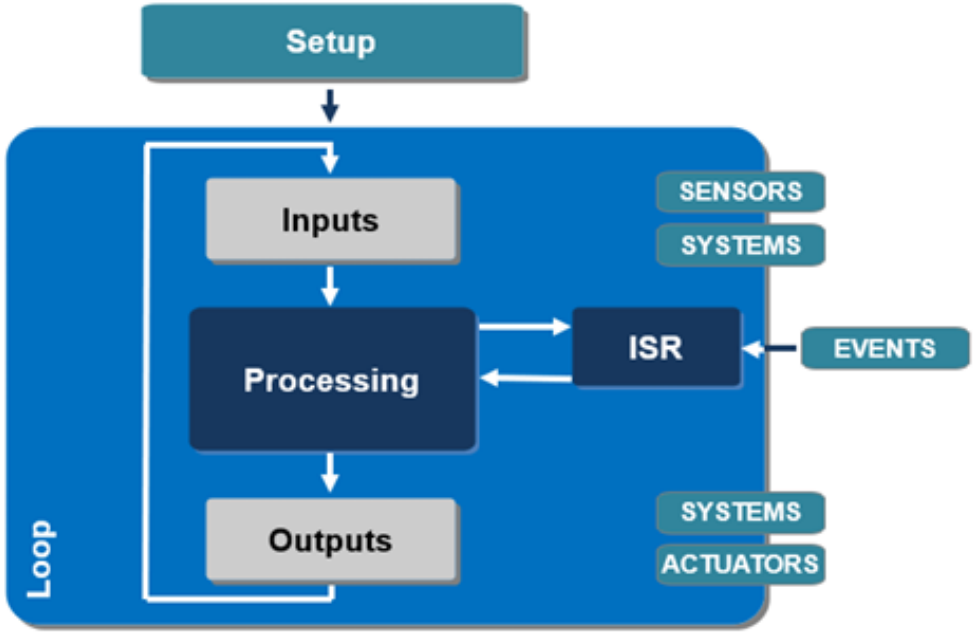
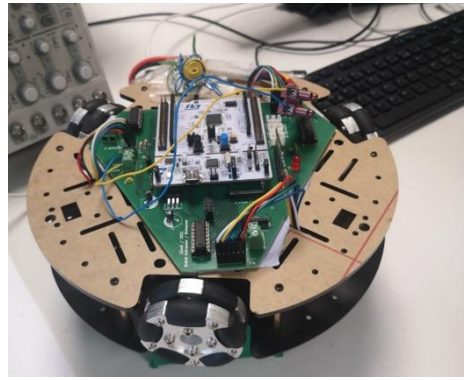
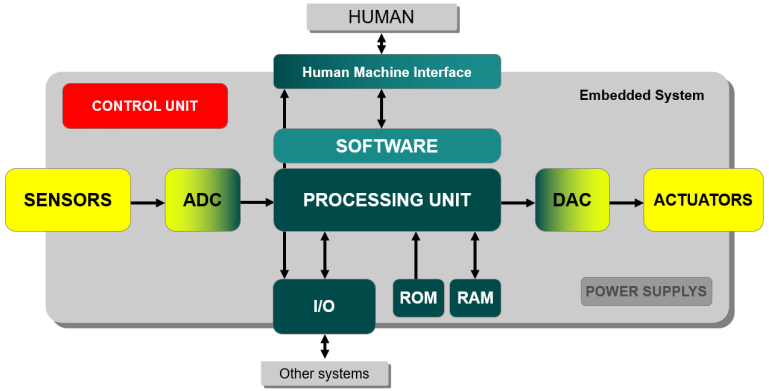


Systèmes embarqués

Programmation d'un système embarqué







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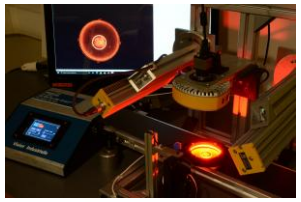
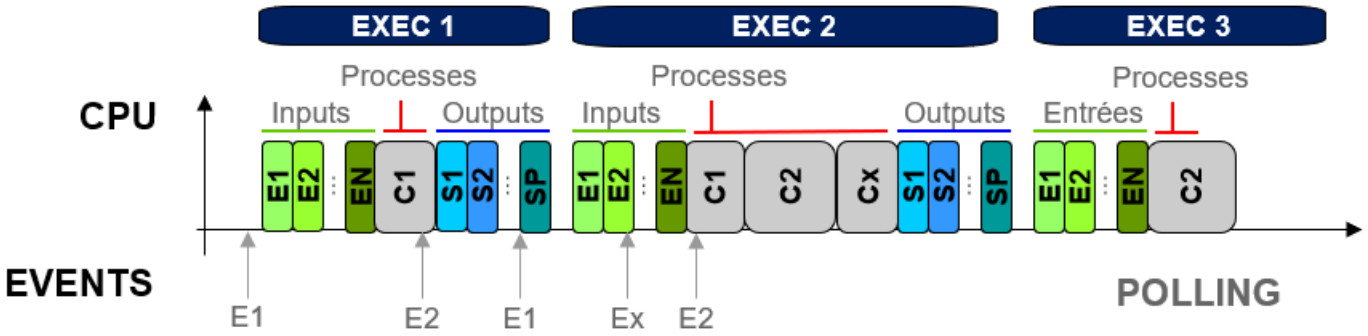
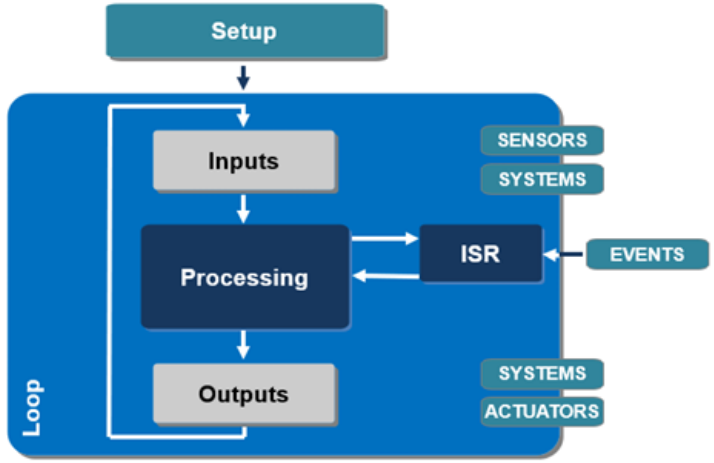
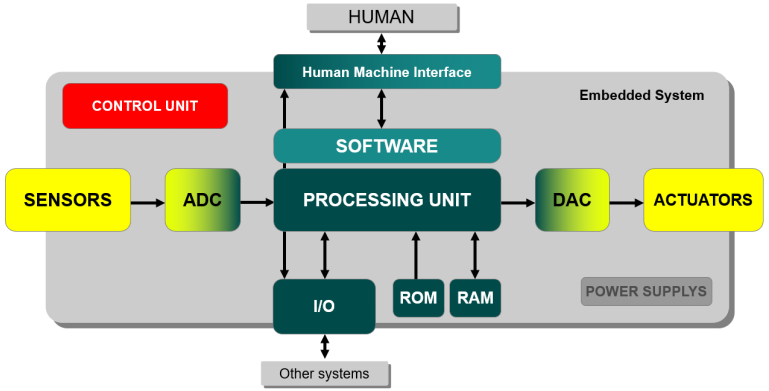


Systèmes embarqués

Programmation d'un système embarqué







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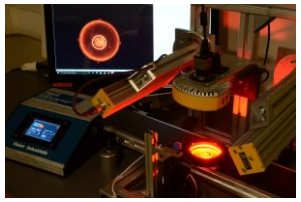
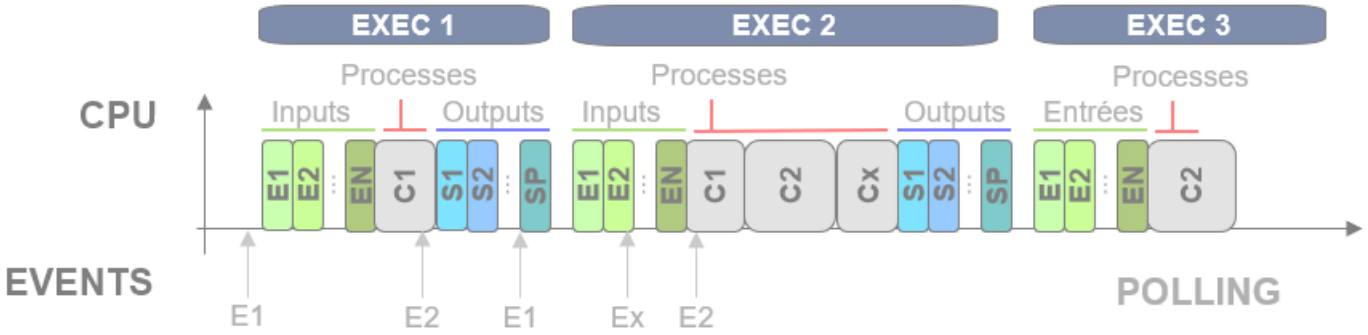
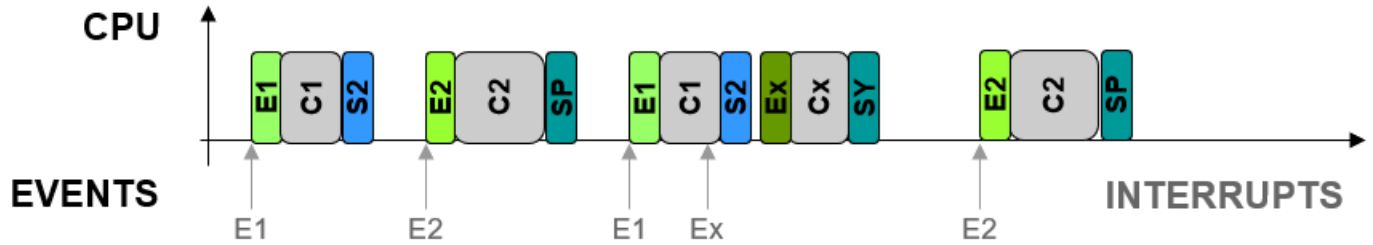
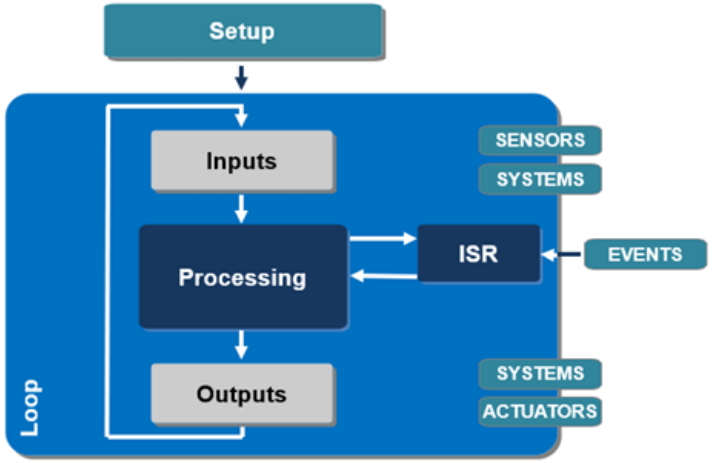


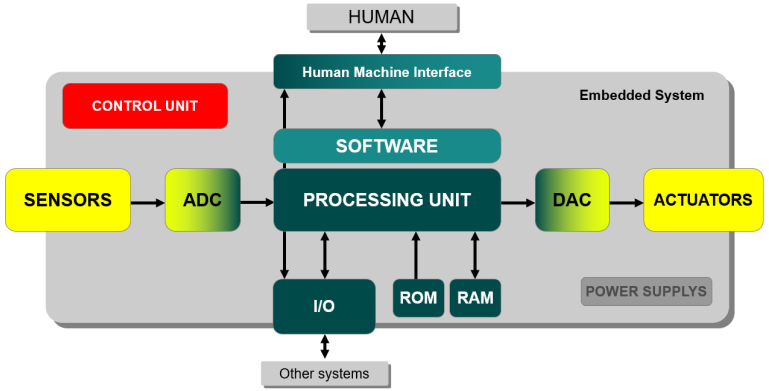
Systèmes embarqués

Programmation d'un système embarqué









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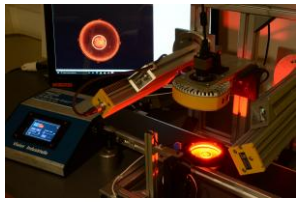
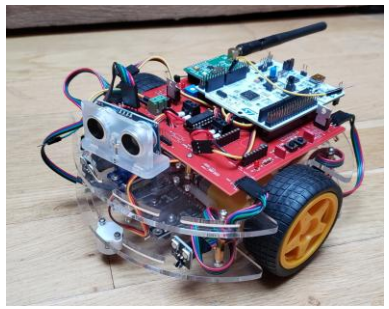
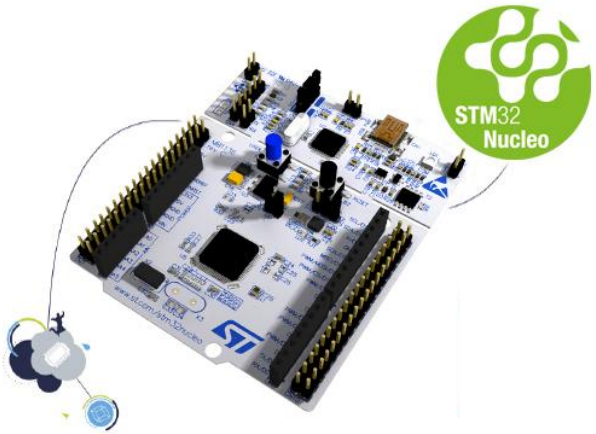


Systèmes embarqués / TP

Robot

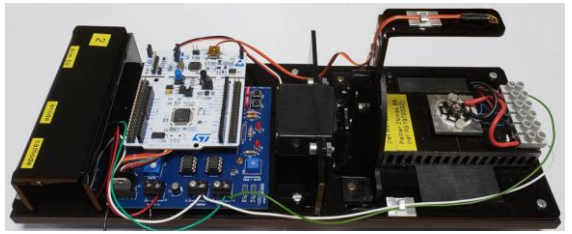
STM Nucleo | Robotique | Communication

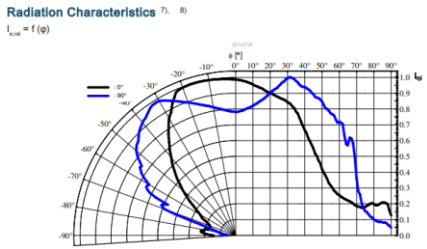




Rayonnement de LEDs

STM Nucleo | Protocole Série | LEDs Puissance





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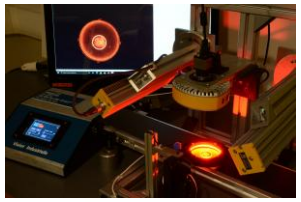
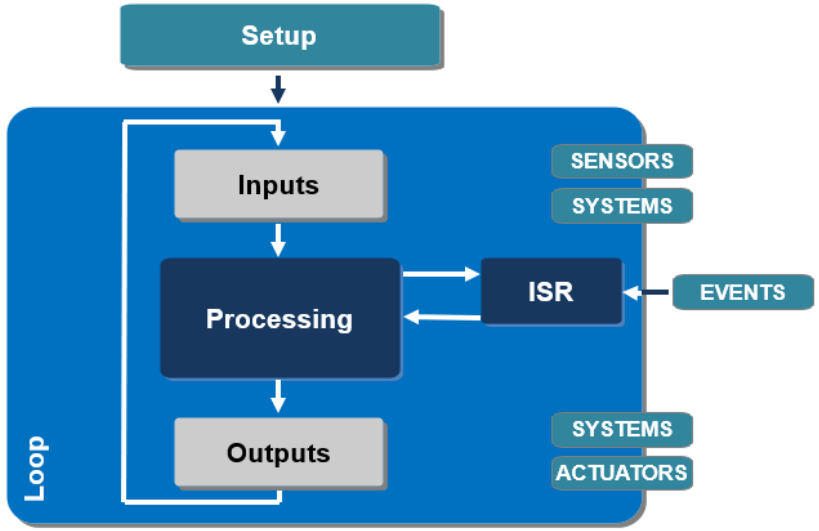
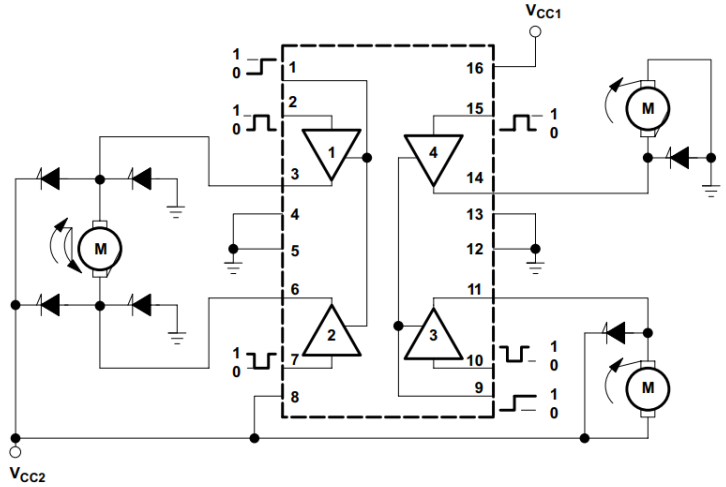


Systèmes embarqués / TP

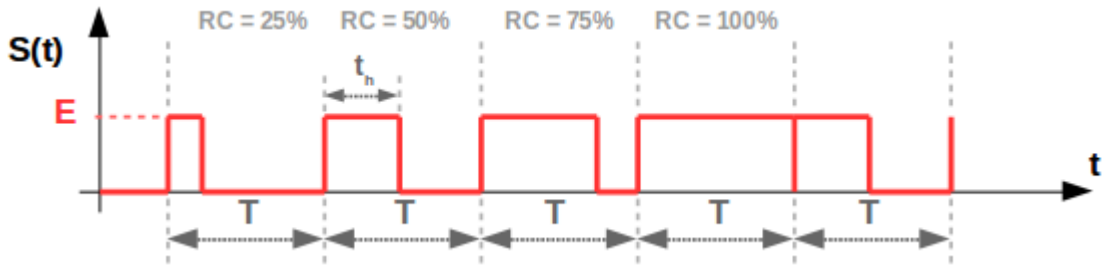
Interactions avec l'environnement



Pilotage d'un moteur



Principe de la modulation de largeur d'impulsions



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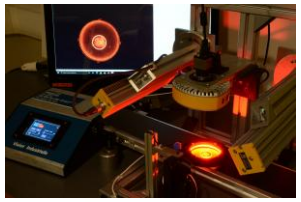
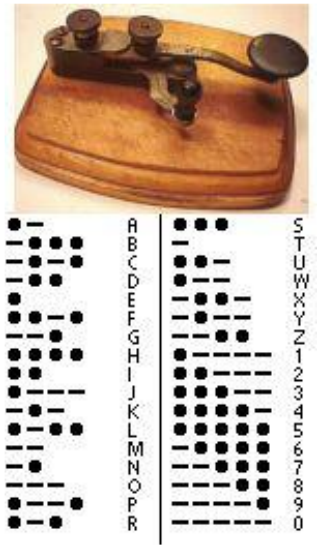


Systèmes embarqués / TP

Codage des informations

Table ASCII

	000	001	010	011	100	101	110	111
0000	NUL	DLE	SP	0	@	P	‘	p
0001	SOH	DC1	!	1	A	Q	a	q
0010	STX	DC2	“	2	B	R	b	r
0011	ETX	DC3	#	3	C	S	c	s
0100	EOT	DC4	$	4	D	T	d	t
0101	ENQ	NAK	%	5	E	U	e	u
0110	ACK	SYN	&	6	F	V	f	v
0111	BEL	ETB	’	7	G	W	g	w
1000	BS	CAN	(	8	H	X	h	x
1001	HT	EM	)	9	I	Y	i	y
1010	LF	SUB	*	:	J	Z	j	z
1011	VT	ESC	+	;	K	[	k	{
1100	FF	FS	,	¡	L	\	l	—
1101	CR	GS	-	=	M	]	m	}
1110	SO	RS	.	¿	N	^	n	~
1111	SI	US	/	?	O	_	o	DEL



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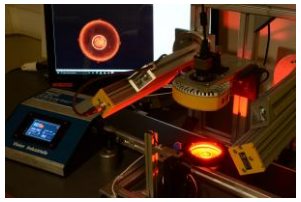


Systèmes embarqués / TP

Codage numérique des informations

Nombres entiers

Base 2 = 2 symboles

1001 =	1	+	0	+	0	+	1
	x		x		x		x
Rang	2^3		2^2		2^1		2^0
Puissance	3		2		1		0

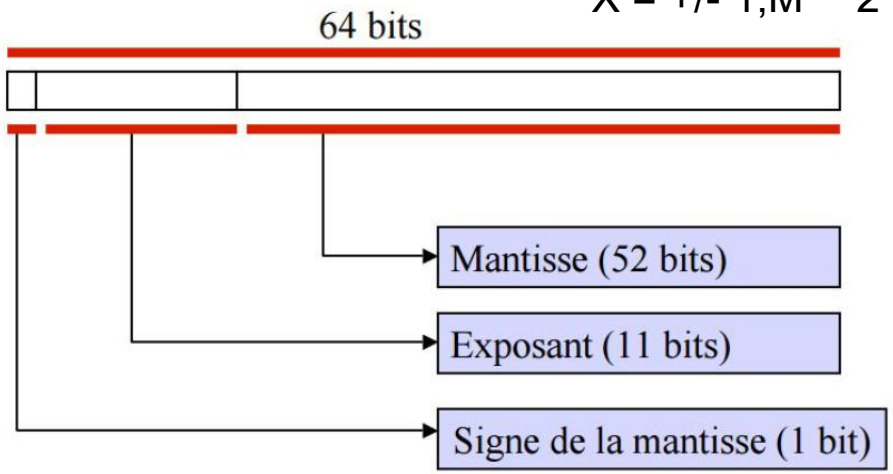
$(0011\ 1001)_2$ = **57**

Caractère ASCII

$(0011\ 1001)_2$ = '**9**'

Nombres réels (IEEE754)

$X = +/- 1,M * 2^e$



$(0..0\ 0011\ 1001)_{754/64b}$ = **2.81617… E-322**

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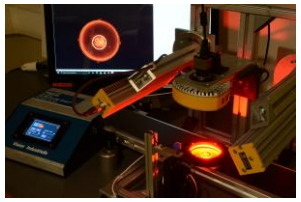
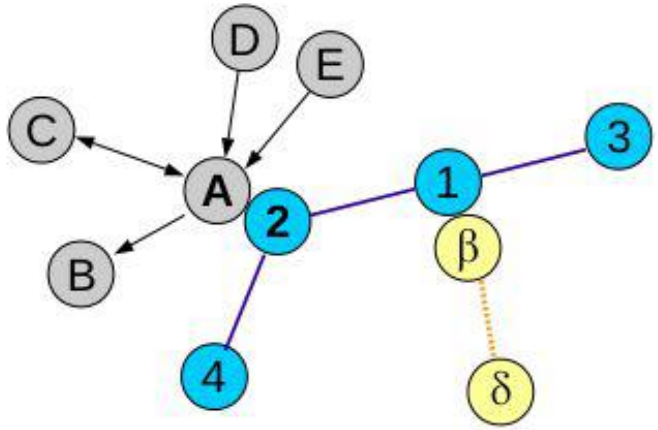
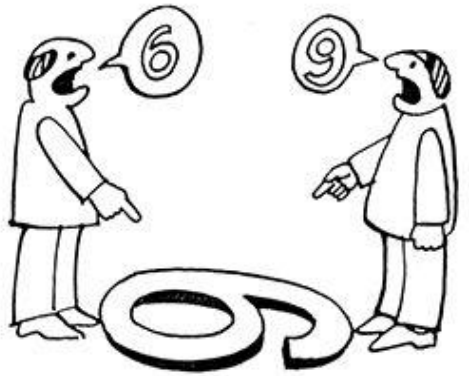


Systèmes embarqués / TP

Transmission numérique d'informations





coach-didier-vairac-pradel.fr

Nécessité d'un support physique de communication

RÉSEAU

Nécessité de règles de discussion

PROTOCOLE

- Vitesse
- Direction
- Topologie
- Codage

Nécessité d'interconnections

PASSERELLE

Dessinateur.biz

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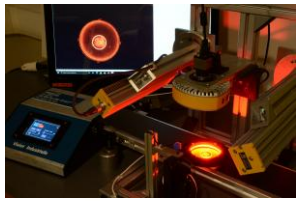
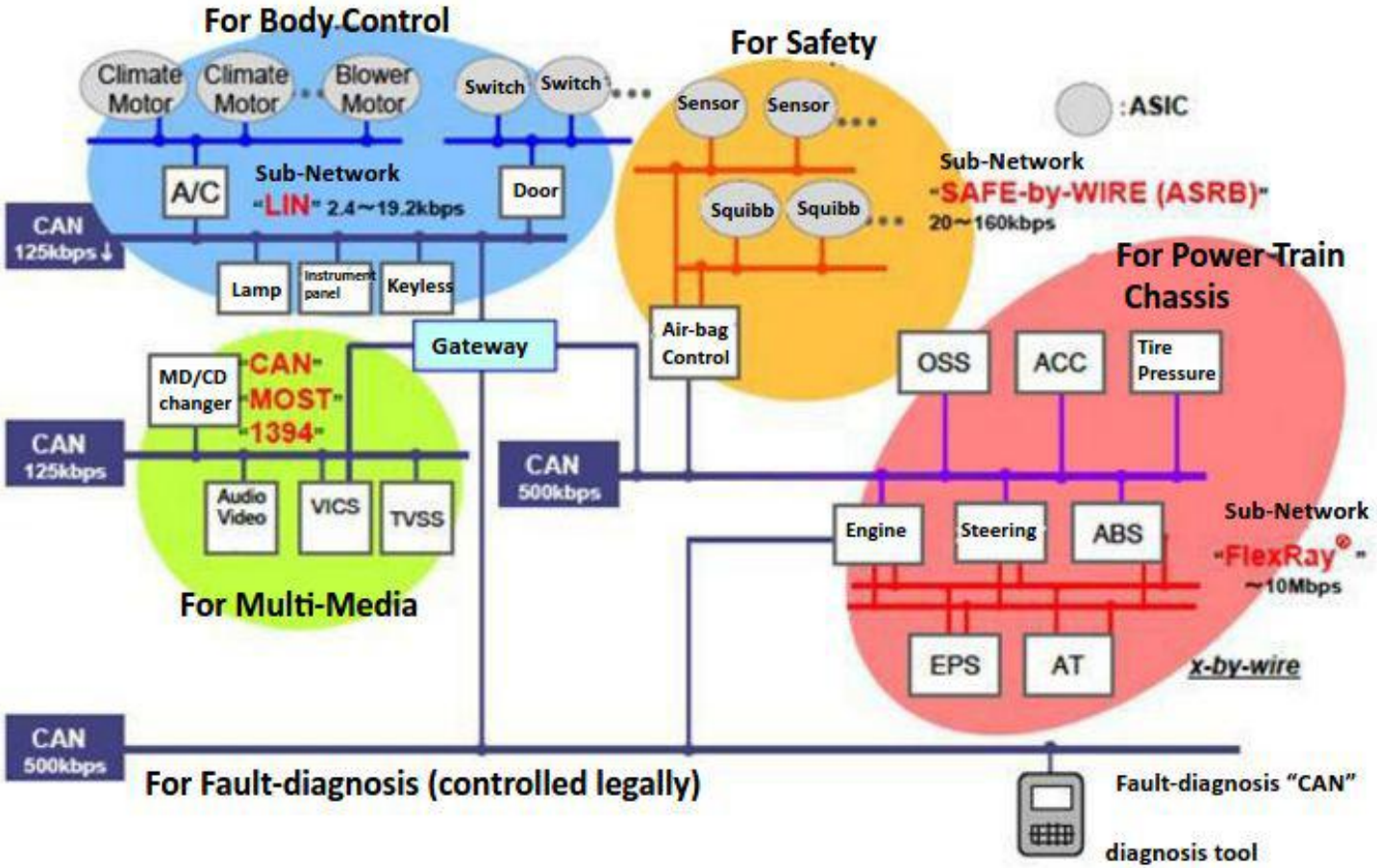
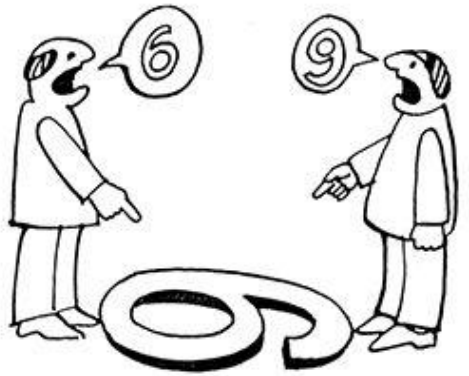


Systèmes embarqués / TP

Transmission numérique d'informations



The source: Renesas Electronics Corporation (Japan)



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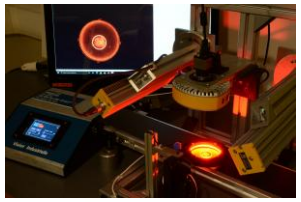
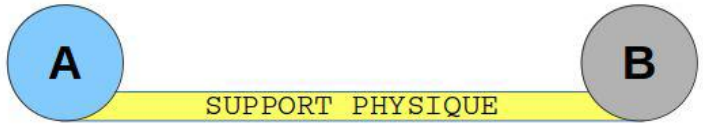


Systèmes embarqués / TP

Transmission numérique d'informations

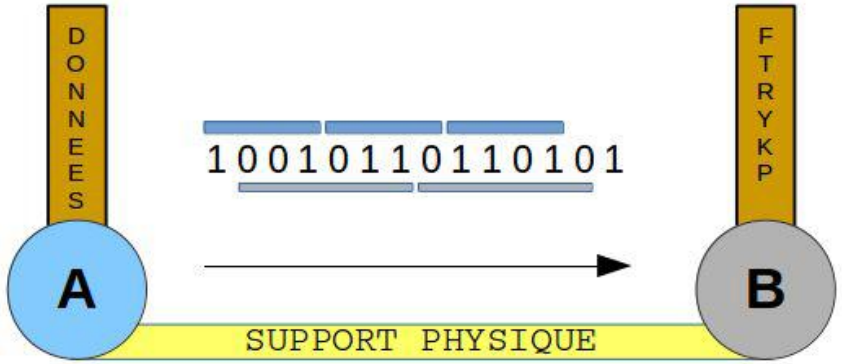
- **Transmission de bas niveau**



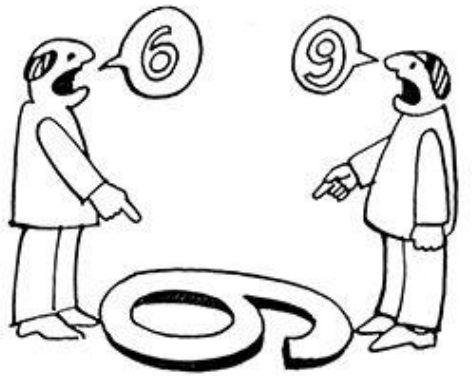
- *Paire torsadée*
- *Câble coaxial*
- *Fibre optique*
- *Ondes EM*

- *Bande-Passante*

- **Données à transmettre**



- *Synchronisation*
- *Débit*
- *Codage*



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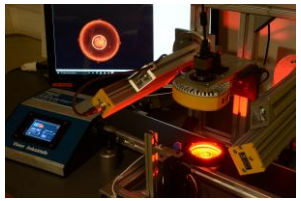


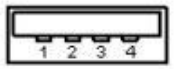
Systèmes embarqués / TP

Transmission numérique d'informations

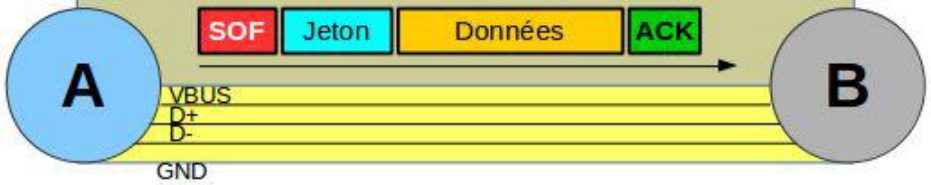
- **Protocole USB / Universal Serial Bus**
  - *Bus / Série / Full Duplex / Asynchrone / Maitre-Esclave adressable*
  - *Débit : < 5 Gbits/s – Distance : < 10 m*

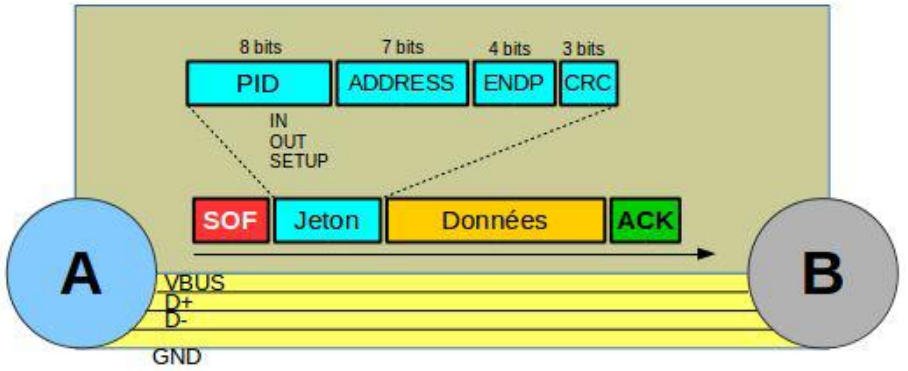
- *Point à point*
- *Mise en oeuvre*

- *Haut débit*
- *Alimentation (500 mA)*



- *Paquet SOF : Start of Frame – 125 us en HighSpeed*
- *Paquet Jeton : Type d'information, sens, adresse hote*
- *Paquet Données : données utiles*
- *Paquet ACK : acquittement*





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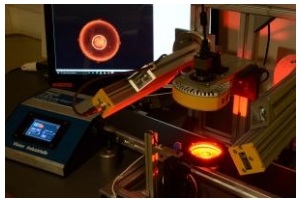

Systèmes embarqués / TP

Transmission numérique d'informations

- **Protocole Ethernet**
  - *Paire Torsadée / Série / Full Duplex / Asynchrone*
  - *Débit : < 1 Gbits/s – Distance : < 100 m*
  - *Fonctionnement par adressage MAC*