

# Validation continue des exigences et de l'implémentation méthode et techniques

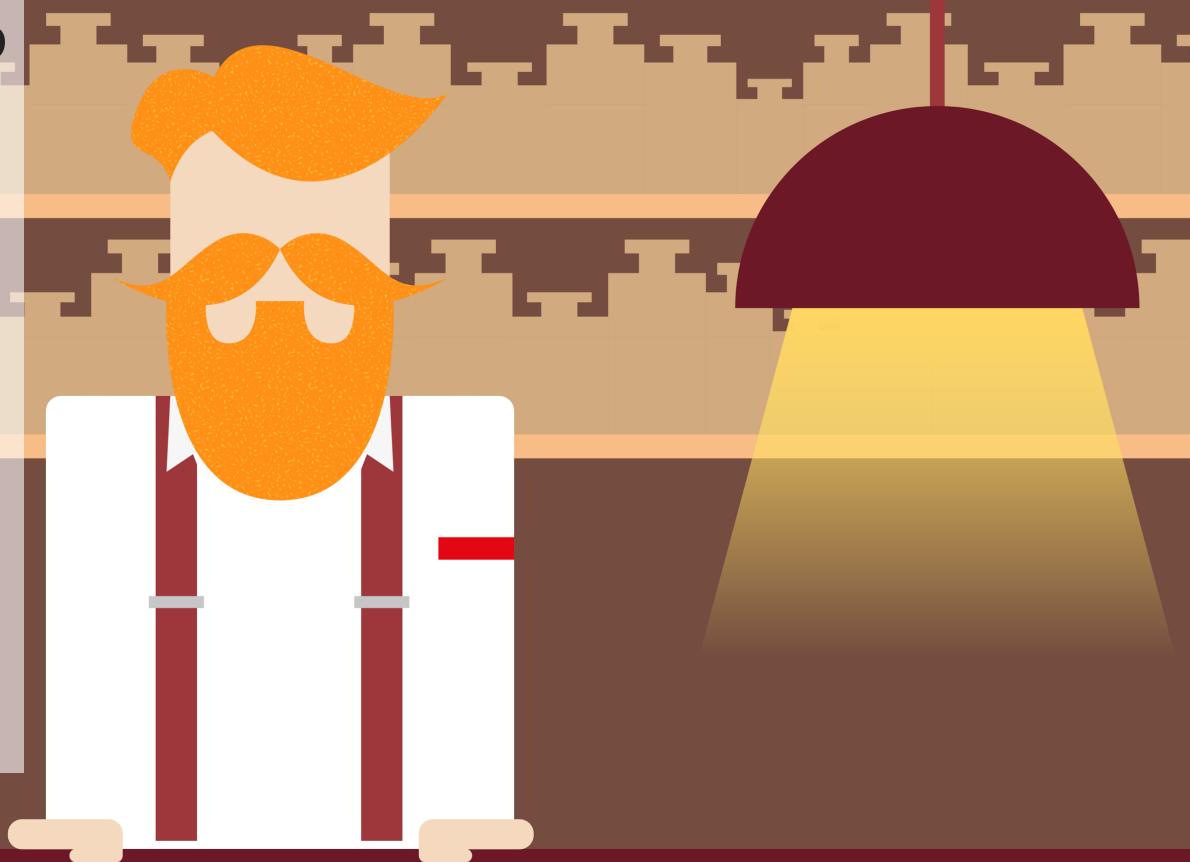
Mathieu Acher

Maître de Conférences

[mathieu.acher@irisa.fr](mailto:mathieu.acher@irisa.fr)

Test

A test engineer walks into  
a bar and



— Bill Sempf (@sempf)

A test engineer walks into  
a bar and

- orders a beer

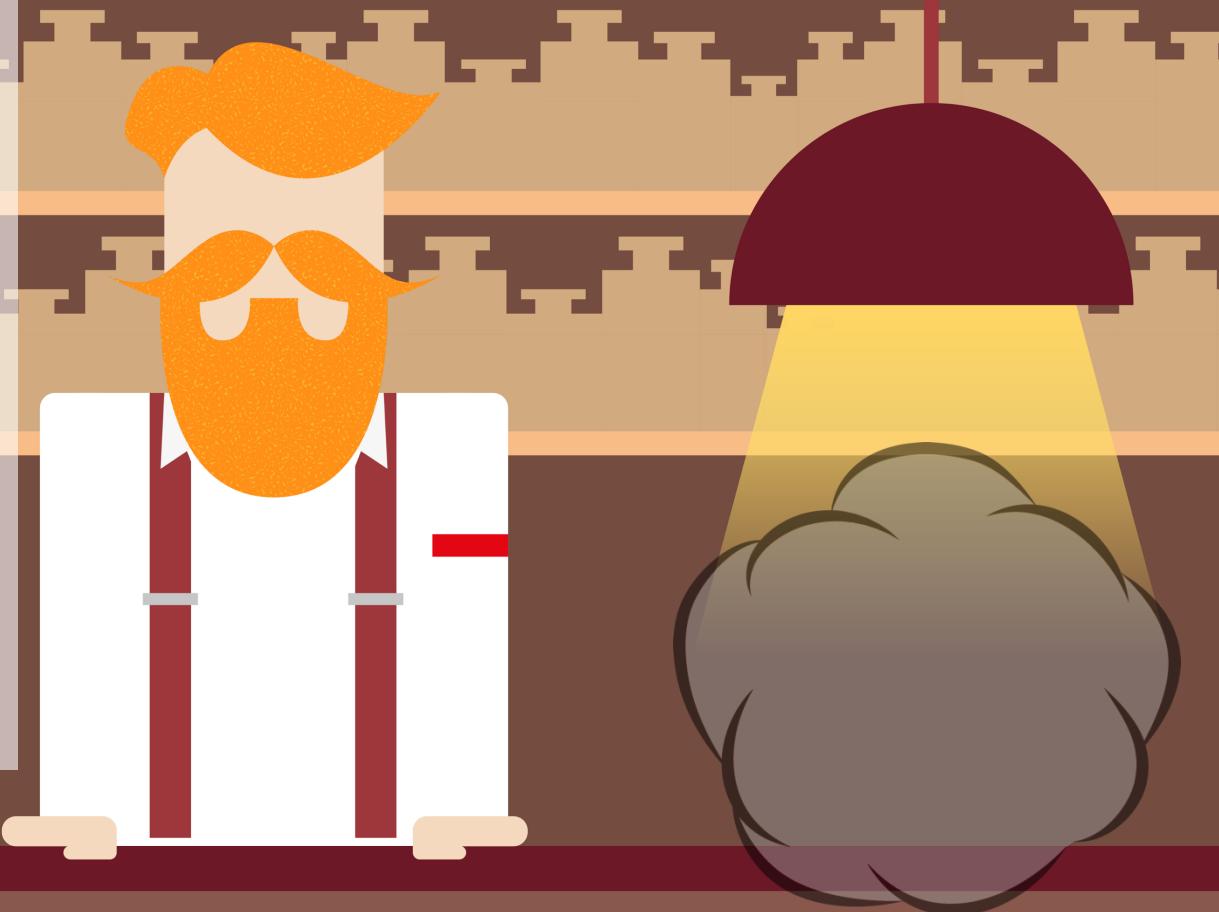
— Bill Sempf (@sempf)



A test engineer walks into  
a bar and

- orders a beer
- orders 0 beers

— Bill Sempf (@sempf)



A test engineer walks into  
a bar and

- orders a beer
- orders 0 beers
- orders 9999999 beers

— Bill Sempf (@sempf)

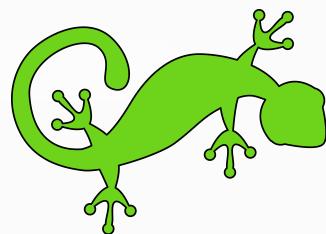
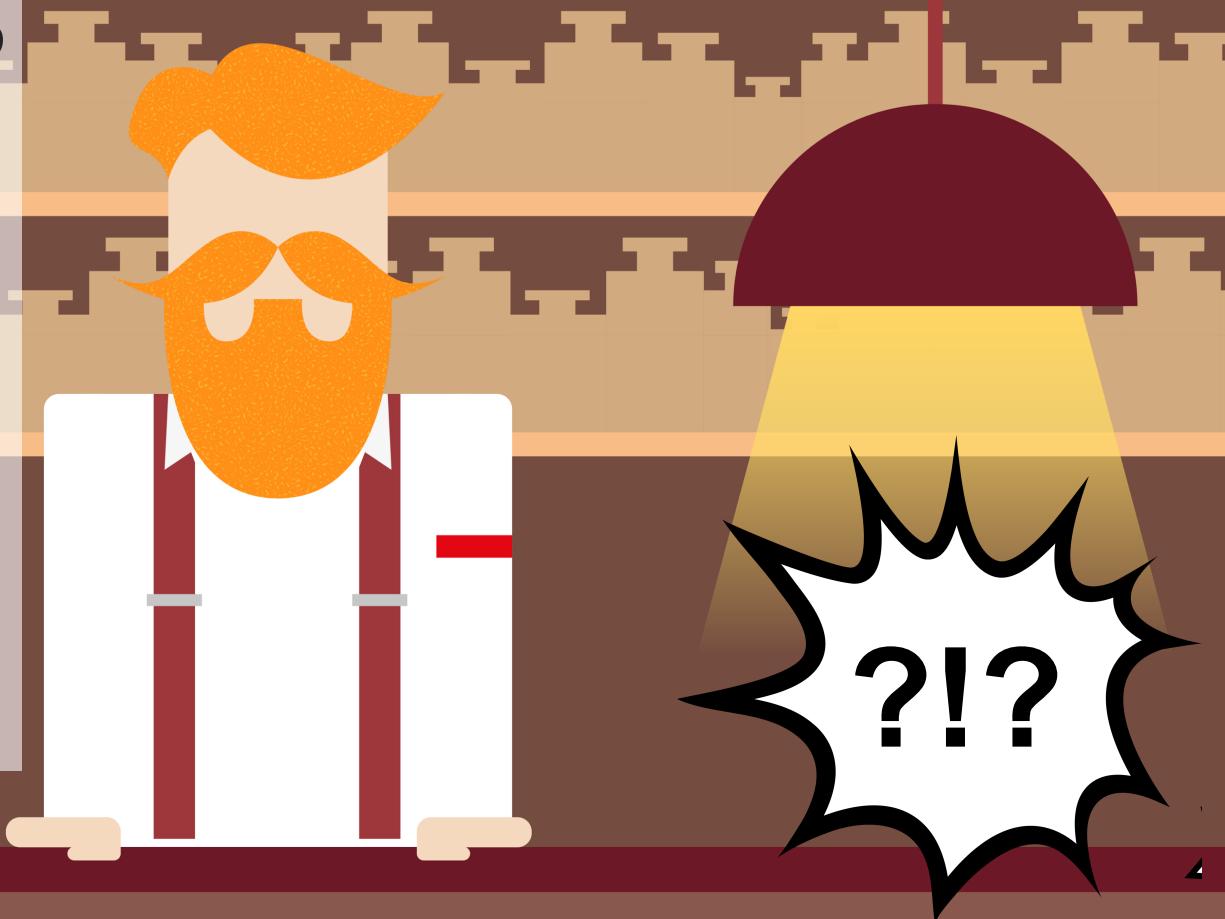
9,999,999



A test engineer walks into  
a bar and

- orders a beer
- orders 0 beers
- orders 9999999 beers
- orders a lizard

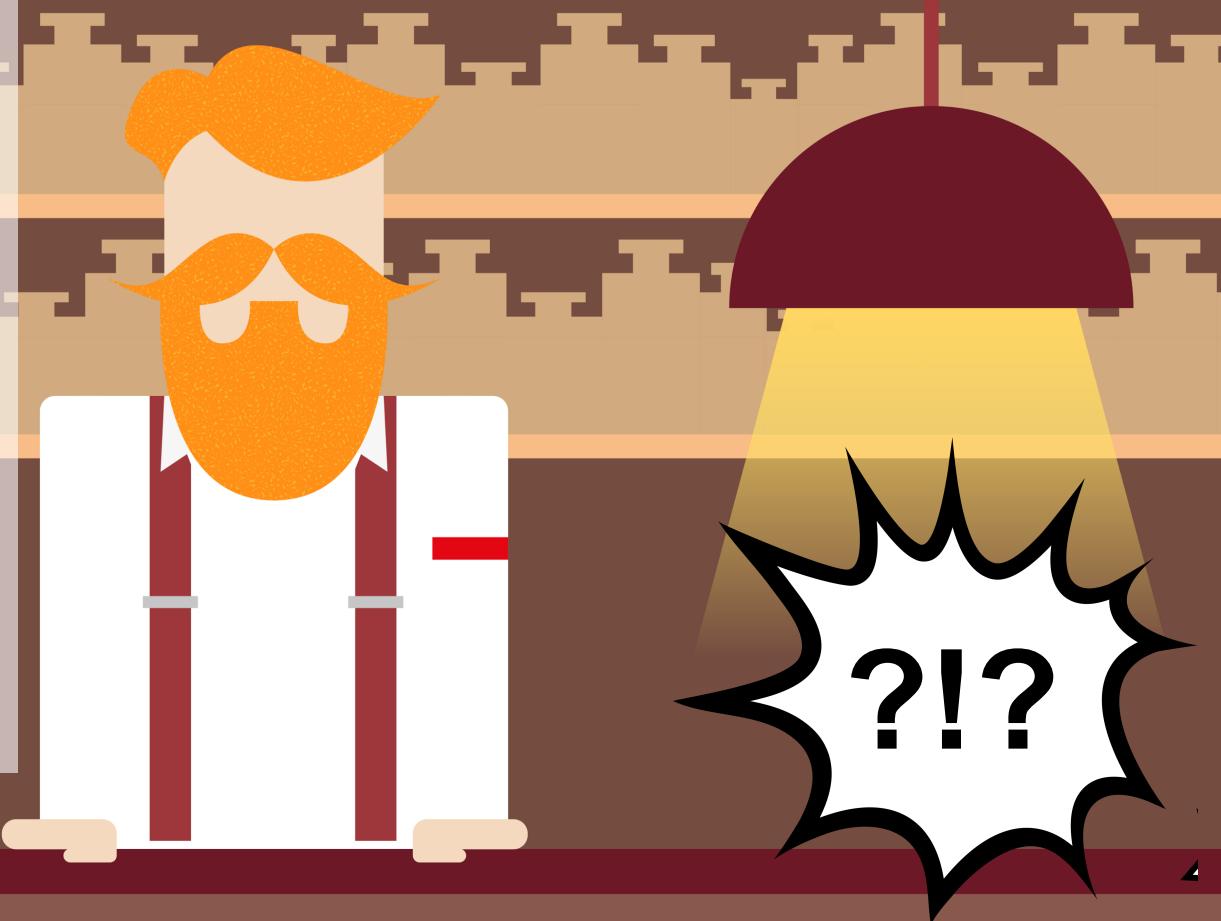
— Bill Sempf (@sempf)



A test engineer walks into  
a bar and

- orders a beer
- orders 0 beers
- orders 9999999 beers
- orders a lizard
- orders -1 beers

— Bill Sempf (@sempf)

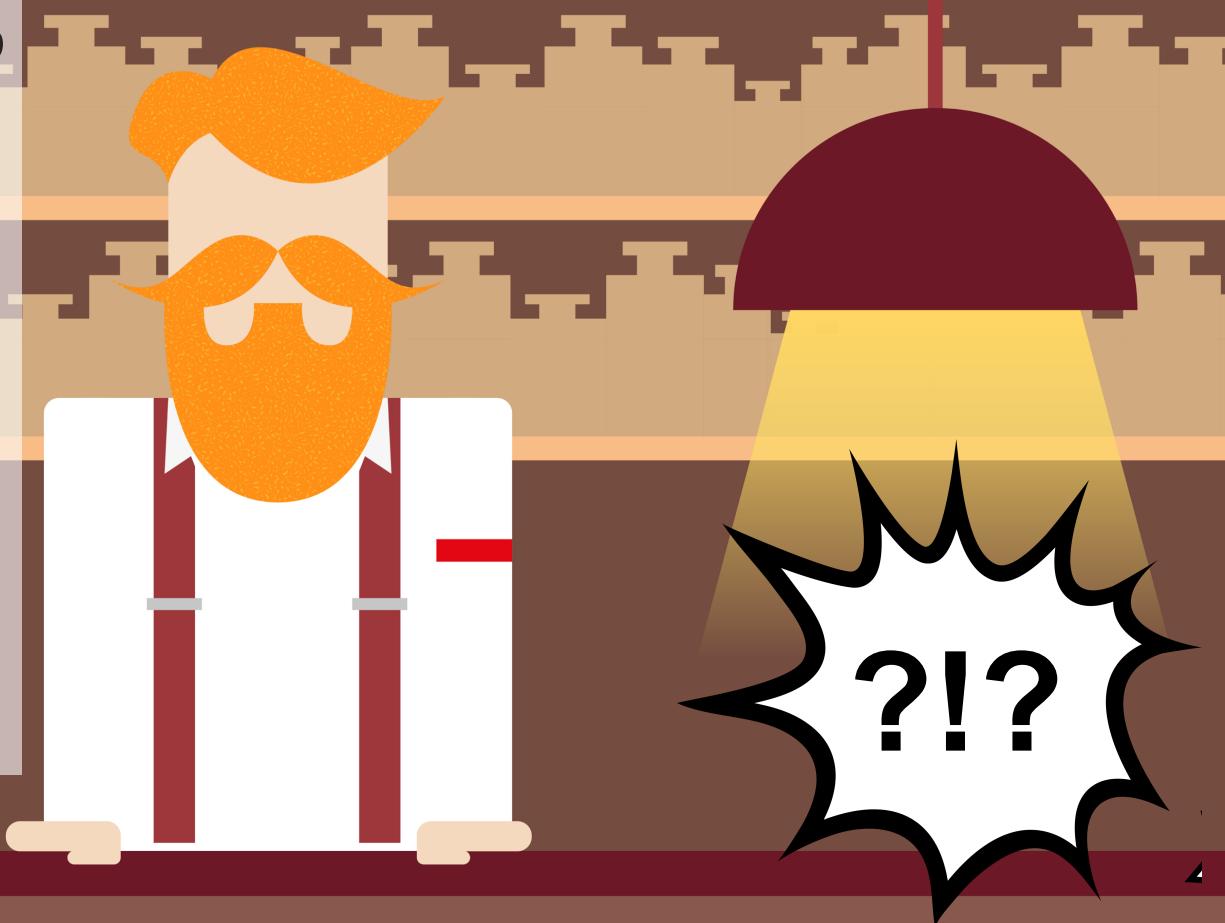


-1

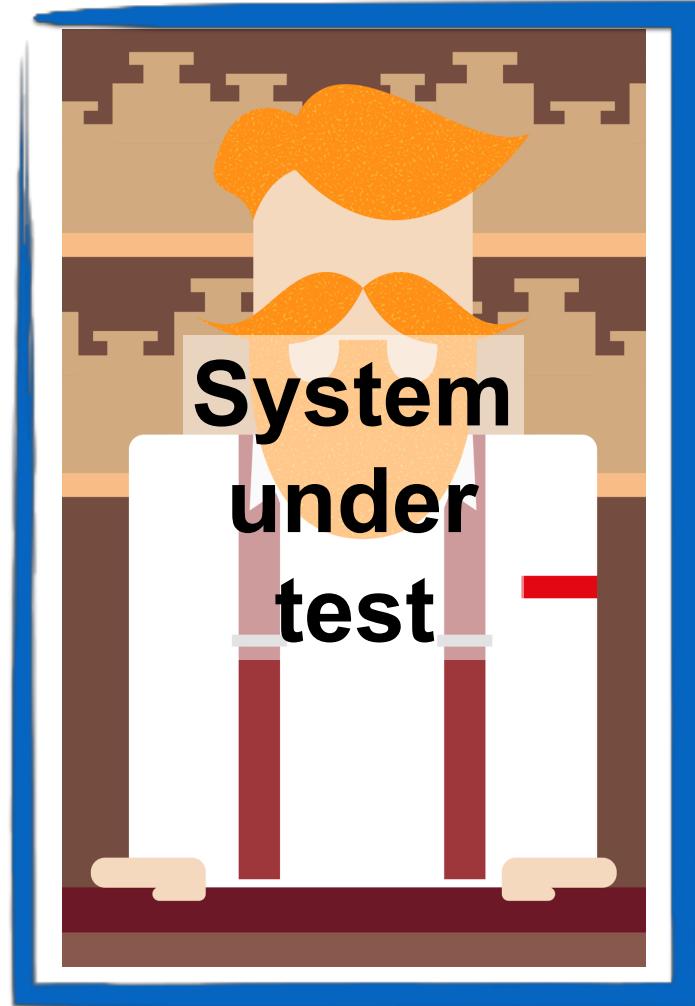
A test engineer walks into  
a bar and

- orders a beer
- orders 0 beers
- orders 9999999 beers
- orders a lizard
- orders -1 beers
- orders a "sfdeljknesv"

— Bill Sempf (@sempf)



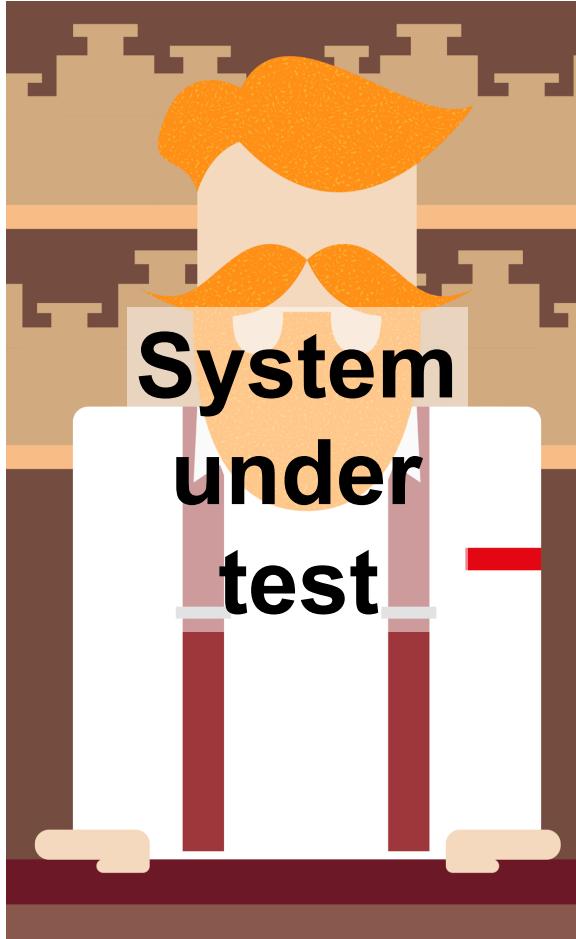
"sfdeljknesv"



**System  
under  
test**

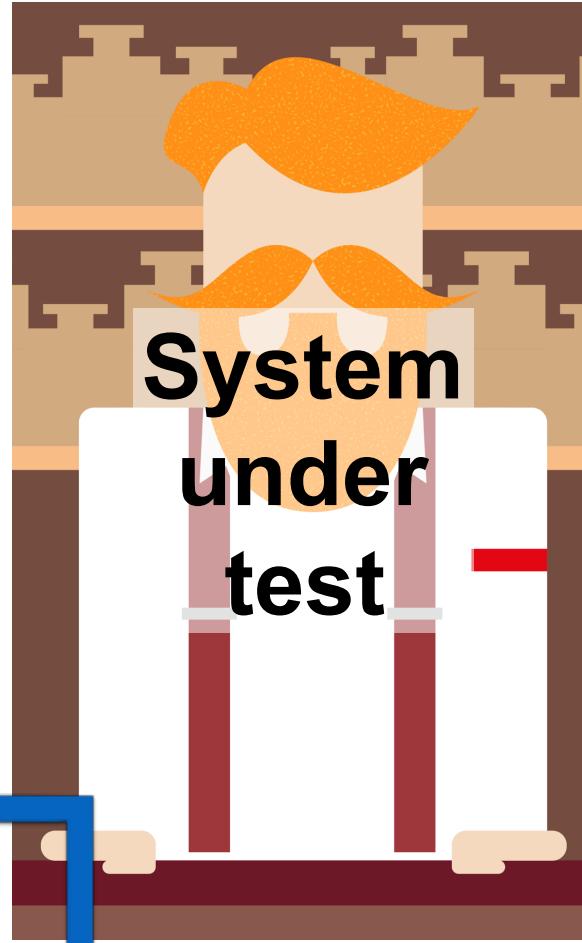


Specification





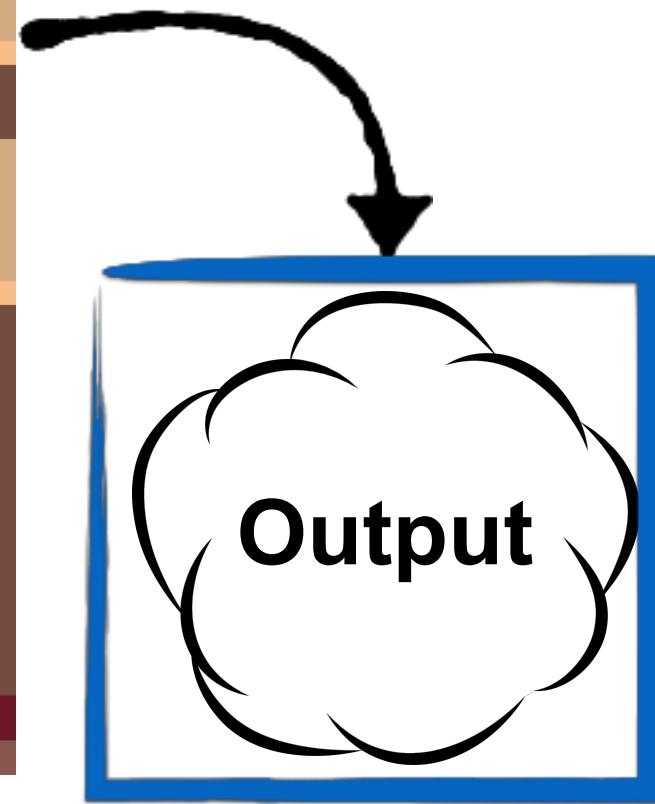
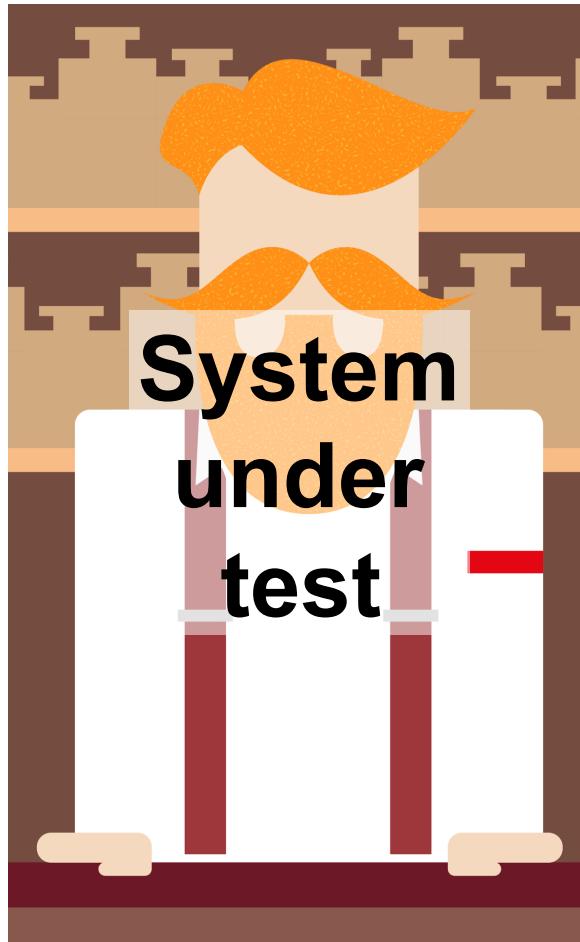
Specification

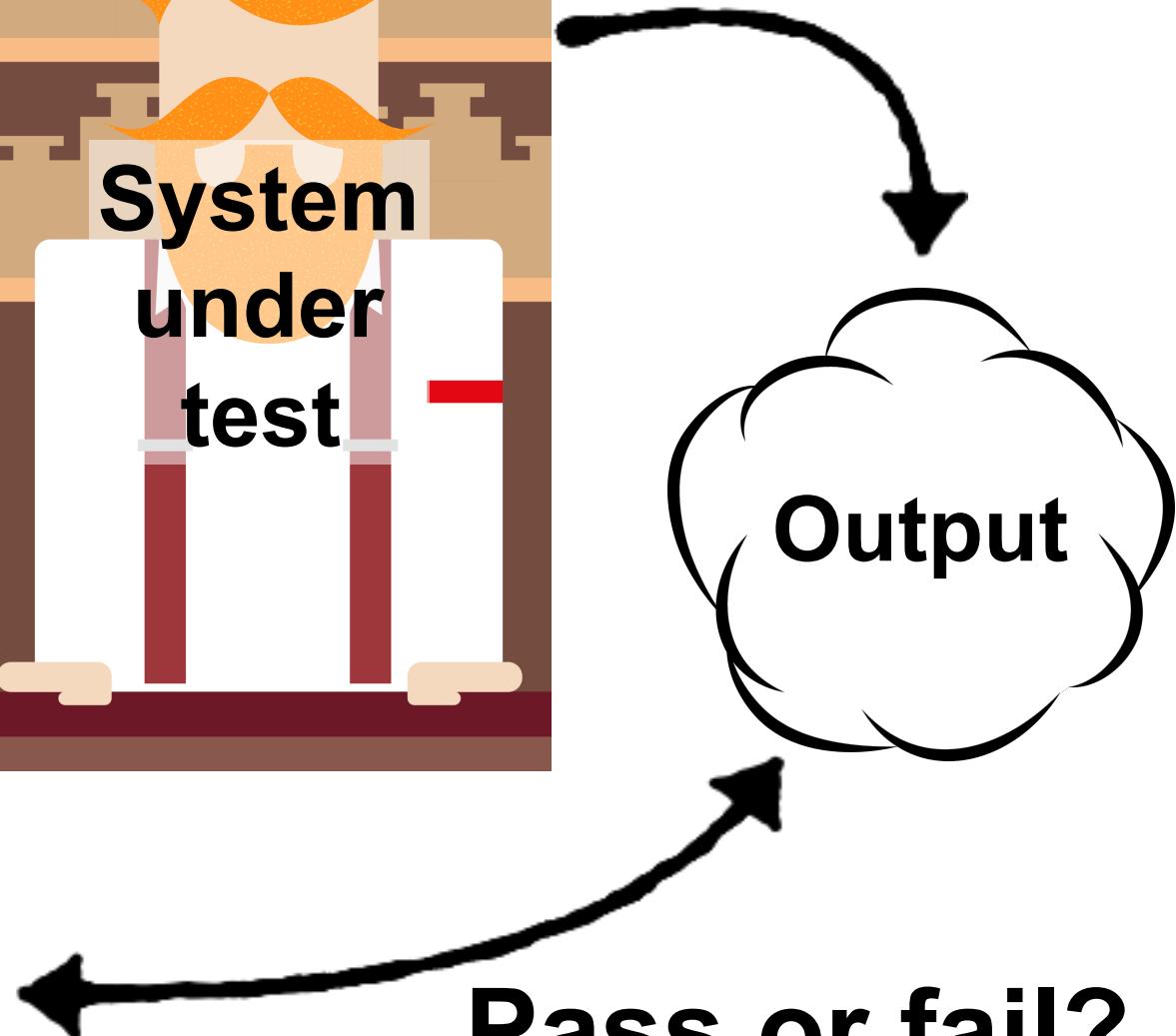
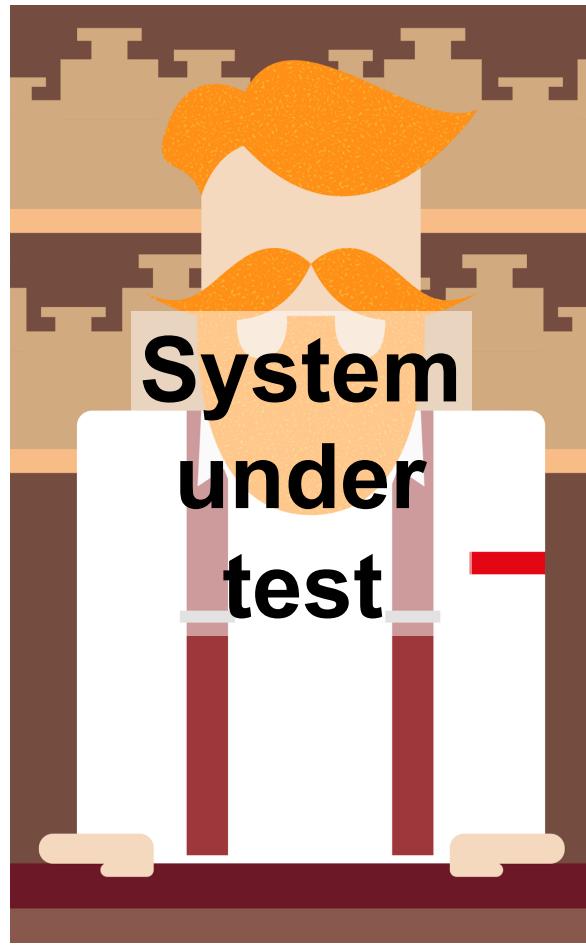


Test case



Specification

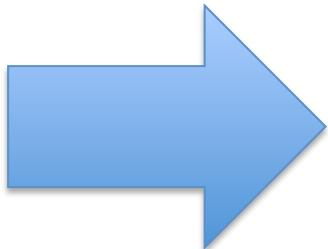
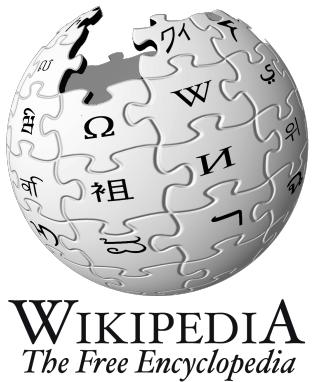




# Tests et projets

# Projet

CSV  
(Comma Separated  
Values)



Product	Image process...	Sensor format	Sensor type	Sensor manufac...	Megapixels	Focus points	Metering pixels	Viewfinder cov...
D3X	EXPPEED	Full-frame	CMOS	Sony	24.5	51	1005	100%
D2Xs	-	APS-C	CMOS	Sony	12.4	11	1005	100%
D2X	-	APS-C	CMOS	Sony	12.4	11	1005	100%
D1X	-	APS-C	CCD	Sony	5.3	5	1005	96%
D1	-	APS-C	CCD	Sony	2.66	5	1005	96%
D4S	EXPPEED 4	Full-frame	CMOS	Nikon	16.2	51	91000	100%
D4	EXPPEED 3	Full-frame	CMOS	Nikon	16.2	51	91000	100%
D3S	EXPPEED	Full-frame	CMOS	Nikon	12.1	51	1005	100%
D3	EXPPEED	Full-frame	CMOS	Nikon	12.1	51	1005	100%
D2Hs	-	APS-C	JETEL-BCAST	Nikon	4.1	11	1005	100%
D2H	-	APS-C	JETEL-BCAST	Nikon	4.1	11	1005	100%
D1H	-	APS-C	CCD	Sony	2.7	5	1005	96%
D810	EXPPEED 4	Full-frame	CMOS	Sony	36.5	51	91000	100%
D600	EXPPEED 3	Full-frame	CMOS	Sony	36.3	51	91000	100%
D700	EXPPEED	Full-frame	CMOS	Nikon	12.1	51	1005	96%
D700	EXPPEED 4	Full-frame	CMOS	Nikon	24.9	51	91000	100%
Df	EXPPEED 3	Full-frame	CMOS	Nikon	16.2	39	2016	100%

# Cycle de vie

- Valider l'implémentation (tester)
- Valider les exigences et l'implémentation à chaque itération
  - Sortie de “release” avec procédure de tests automatisée (git + Jenkins + Junit + PhantomJS)
  - Validation de chaque release avec le client
- Eliciter et modéliser les exigences/besoins avec le client

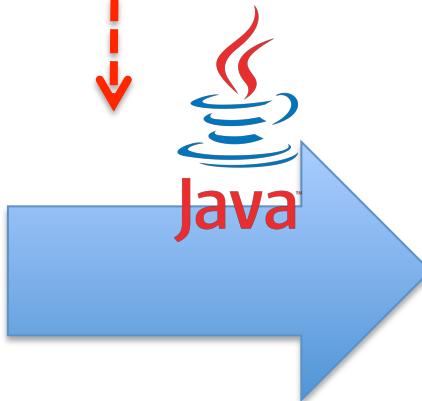
Valider l'implémentation  
(tests automatisés)

# Tests

## (sur les entrées)

## (sur la transformation)

(sur la sortie)

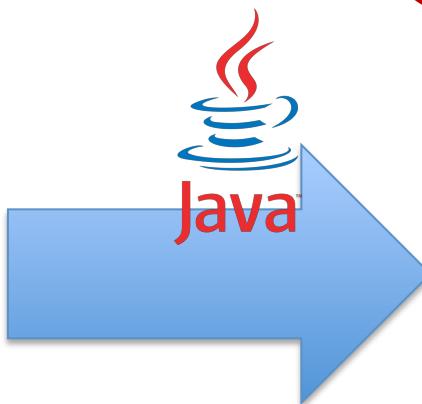
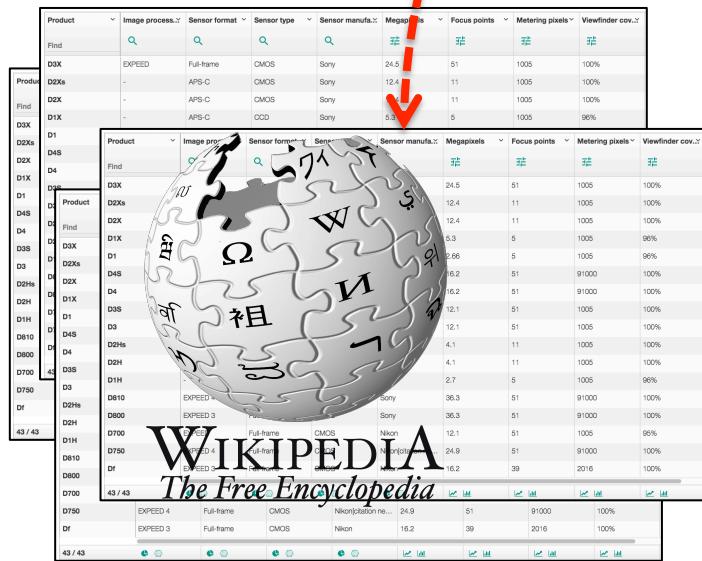


## example

# CSV

# Tests

## (sur les entrées)

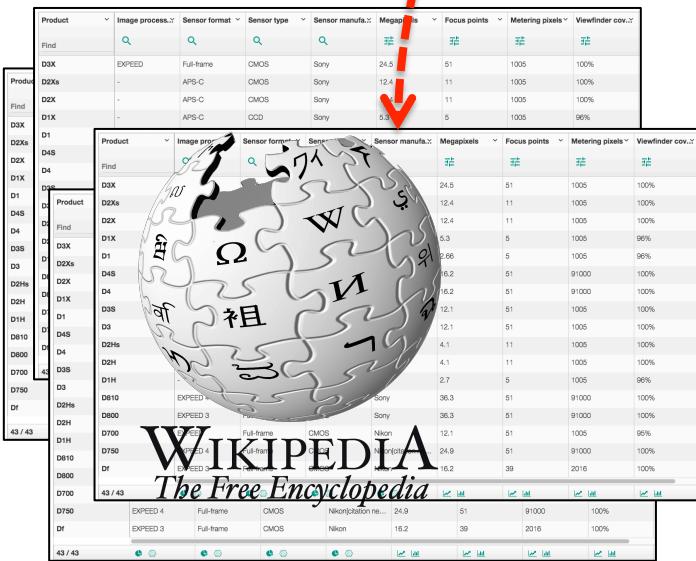


# example

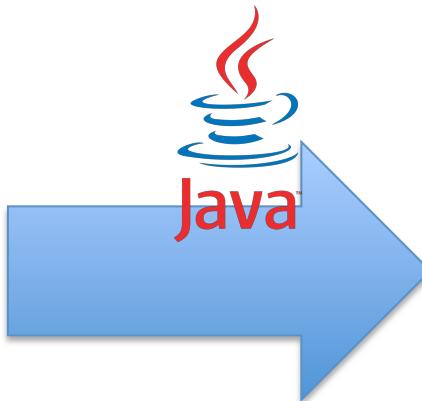
# CSV

# Tests

## (sur les entrées)



# RuntimeException....



## example

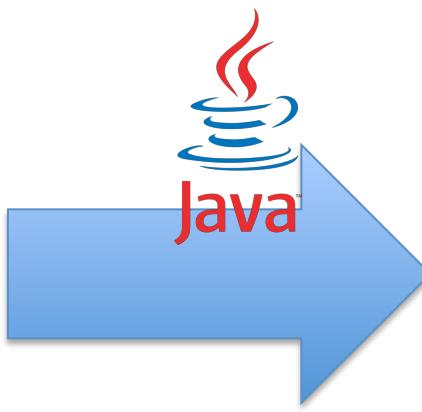
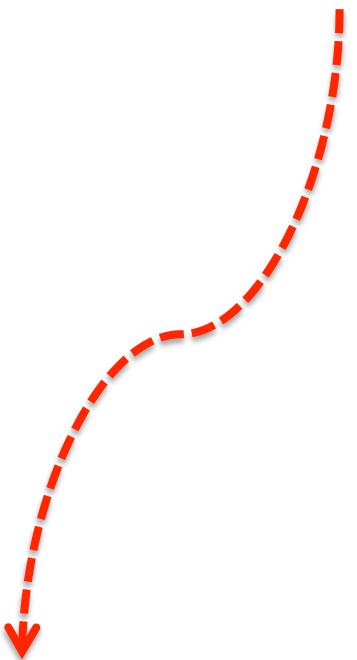
# CSV

# Tests

(sur les entrées)

Product	Image process.	Sensor format	Sensor type	Sensor manufac.	Megapixels	Focus points	Metering pixels	Viewfinder cov.
Find								
D3X	EXPEED	Full-frame	CMOS	Sony	24.5	51	1005	100%
D2Xs	-	APS-C	CMOS	-	-	11	1005	100%
D2X	-	APS-C	CMOS	-	-	5	1005	100%
D1X	-	APS-C	CCD	-	-	-	1005	99%
D1	-	-	-	-	-	-	1005	99%
D4S	EXPEED 4	Full-frame	CMOS	Sony	24.3	51	91000	100%
D4	EXPEED 3	Full-frame	CMOS	Sony	24.3	51	91000	100%
D3S	EXPEED	Full-frame	CMOS	Sony	24.3	51	1005	100%
D3	EXPEED	Full-frame	CMOS	Sony	24.3	51	1005	100%
D2Hs	-	-	-	-	-	-	1005	100%
D2H	-	-	-	-	-	-	1005	100%
D1H	-	-	-	-	-	-	1005	99%
D810	EXPEED 4	Full-frame	CMOS	Sony	36.4	51	91000	100%
D800	EXPEED 3	Full-frame	CMOS	Sony	36.4	51	91000	100%
D700	EXPEED	Full-frame	CMOS	Sony	24.3	51	1005	99%
D750	EXPEED 4	Full-frame	CMOS	Sony	24.3	51	91000	100%
Df	EXPEED 3	Full-frame	CMOS	Sony	39	2016	1005	100%

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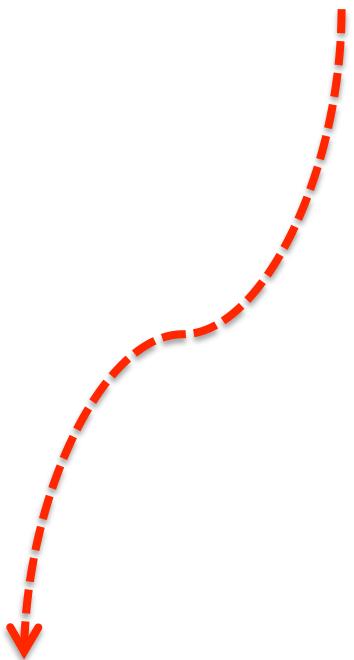
F1;f2; , ;  
“”.””.  
‘’’, ’,

# Tests

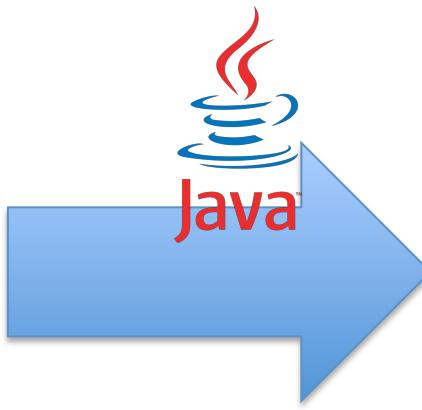
(sur les entrées)

Product	Image process.	Sensor format	Sensor type	Sensor manufac.	Megapixels	Focus points	Metering pixels	Viewfinder cov.
Find								
D3X	EXPEED	Full-frame	CMOS	Sony	24.5	51	1005	100%
D2Xs	-	APS-C	CMOS	-	-	11	1005	100%
D2X	-	APS-C	CCD	-	-	5	1005	100%
D1X	-	APS-C	CCD	-	-	5	1005	98%
D1	-	AF	CCD	-	-	5	1005	96%
D4S	EXPEED 4	Full-frame	CMOS	Sony	24.3	51	91000	100%
D4	EXPEED 3	Full-frame	CMOS	Sony	24.3	51	91000	100%
D3S	EXPEED	Full-frame	CMOS	Sony	24.3	51	91000	100%
D3	EXPEED	Full-frame	CMOS	Sony	24.3	51	91000	100%
D2Hs	-	Full-frame	CMOS	Sony	24.3	51	91000	100%
D2H	-	Full-frame	CMOS	Sony	24.3	51	91000	100%
D1H	-	Full-frame	CMOS	Sony	24.3	51	91000	100%
D810	EXPEED 4	Full-frame	CMOS	Sony	24.3	51	91000	100%
D800	EXPEED 3	Full-frame	CMOS	Sony	24.3	51	91000	100%
D700	EXPEED	Full-frame	CMOS	Sony	24.3	51	91000	98%
D750	EXPEED 4	Full-frame	CMOS	Sony	24.3	51	91000	100%
Df	EXPEED 3	Full-frame	CMOS	Sony	24.3	39	2016	100%

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f1,f2,f3  
v11,v12,v13  
v21,v22,v23



example

CSV

# Manual testing is a terrible idea

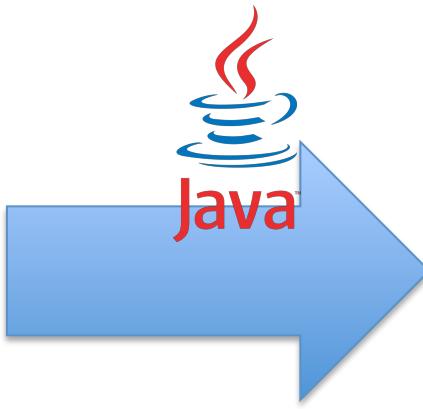
non reproducible; error-prone; time-consuming

Product	Image process.	Sensor format	Sensor type	Sensor manufa.	Megapixels	Focus points	Metering pixels	Viewfinder cov.
Find								
D3X	EXPED	Full-frame	CMOS	Sony	24.5	51	1005	100%
D2Xs	-	APS-C	CMOS	-	-	11	1005	100%
D2X	-	APS-C	CCD	-	-	5	1005	100%
D1X	-	APS-C	CCD	-	-	5	1005	98%
D1	-	AF	CCD	-	-	5	1005	96%
D4S	EXPED 4	Full-frame	CMOS	Sony	24.5	51	91000	100%
D4	EXPED 3	Full-frame	CMOS	Sony	24.5	51	91000	100%
D3S	EXPED	Full-frame	CMOS	Sony	24.5	51	91000	100%
D3	EXPED	Full-frame	CMOS	Sony	24.5	51	91000	100%
D2Hs	-	Full-frame	CMOS	Sony	24.5	51	1005	100%
D2H	-	Full-frame	CMOS	Sony	24.5	51	1005	100%
D1H	-	Full-frame	CMOS	Sony	24.5	51	1005	100%
D810	EXPED 4	Full-frame	CMOS	Sony	24.5	51	91000	100%
D800	EXPED 3	Full-frame	CMOS	Sony	24.5	51	91000	100%
D700	EXPED	Full-frame	CMOS	Sony	24.5	51	1005	98%
D750	EXPED 4	Full-frame	CMOS	Sony	24.5	51	91000	100%
Df	EXPED 3	Full-frame	CMOS	Sony	24.5	39	2016	100%

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f1,f2,f3  
v11,v12,v13  
v21,v22,v23



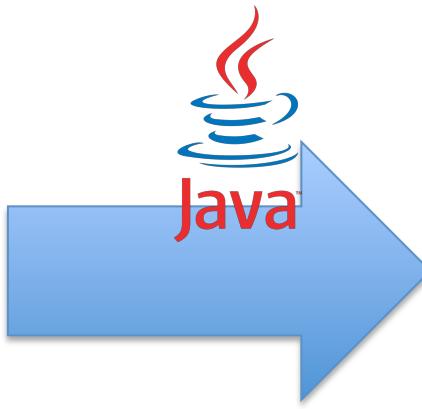
example

CSV

# You can start with some values/inputs and then (manually) observe

Product	Image process.	Sensor format	Sensor type	Sensor manufac.	Megapixels	Focus points	Metering pixels	Viewfinder cov.
Find								
D3X	EXPED	Full-frame	CMOS	Sony	24.5	51	1005	100%
D2Xs	-	APS-C	CMOS	-	-	11	1005	100%
D2X	-	APS-C	CCD	-	-	5	1005	100%
D1X	-	APS-C	CCD	-	-	5	1005	98%
D1	-	-	-	-	-	-	1005	96%
D4S	EXPED 4	Full-frame	CMOS	Sony	24.5	51	91000	100%
D4	EXPED 3	Full-frame	CMOS	Sony	24.5	51	91000	100%
D3S	EXPED	Full-frame	CMOS	Sony	24.5	51	91000	100%
D3	EXPED	Full-frame	CMOS	Sony	24.5	51	91000	100%
D2Hs	-	-	-	-	-	-	1005	100%
D2H	-	-	-	-	-	-	1005	100%
D1H	-	-	-	-	-	-	1005	100%
D810	EXPED 4	Full-frame	CMOS	Sony	24.5	51	91000	100%
D800	EXPED 3	Full-frame	CMOS	Sony	24.5	51	91000	100%
D700	EXPED	Full-frame	CMOS	Sony	24.5	51	91000	98%
D750	EXPED 4	Full-frame	CMOS	Sony	24.5	51	91000	100%
Df	EXPED 3	Full-frame	CMOS	Sony	24.5	39	2016	100%

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f1,f2,f3  
v11,v12,v13  
v21,v22,v23

example

CSV



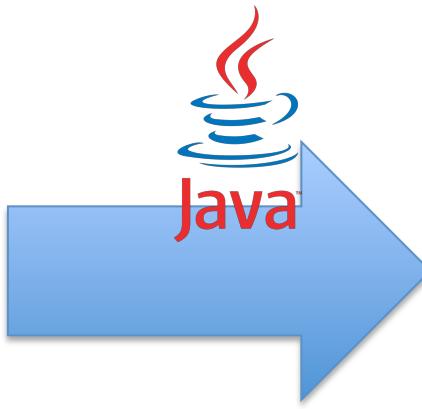
# But manual testing is a terrible idea

non reproducible; error-prone; time-consuming

Product	Image process.	Sensor format	Sensor type	Sensor manuf.	Megapixels	Focus points	Metering pixels	Viewfinder cov.
Find								
D3X	EXPED	Full-frame	CMOS	Sony	24.5	51	1005	100%
D2Xs	-	APS-C	CMOS			11	1005	100%
D2X	-	APS-C	CCD			11	1005	100%
D1X	-	APS-C	CCD			5	1005	98%
D1	-	AF	CCD				1005	96%
D4S	EXPED 4	Full-frame	CMOS	Sony	24.5	51	91000	100%
D4	EXPED 3	Full-frame	CMOS	Sony	24.5	51	91000	100%
D3S	EXPED	Full-frame	CMOS	Sony	24.5	51	1005	100%
D3	EXPED	Full-frame	CMOS	Sony	24.5	51	1005	100%
D2Hs	-	Full-frame	CMOS	Sony	24.5	51	1005	100%
D2H	-	Full-frame	CMOS	Sony	24.5	51	1005	100%
D1H	-	Full-frame	CMOS	Sony	24.5	51	1005	98%
D810	EXPED 4	Full-frame	CMOS	Sony	24.5	51	91000	100%
D800	EXPED 3	Full-frame	CMOS	Sony	24.5	51	91000	100%
D700	EXPED	Full-frame	CMOS	Sony	24.5	51	1005	98%
D750	EXPED 4	Full-frame	CMOS	Sony	24.5	51	91000	100%
Df	EXPED 3	Full-frame	CMOS	Sony	24.5	39	2016	100%

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43 / 43



f1,f2,f3  
v11,v12,v13  
v21,v22,v23

example

CSV



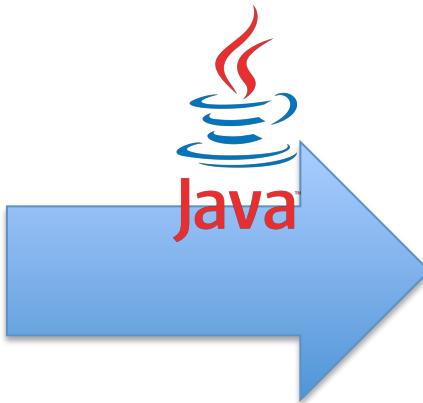
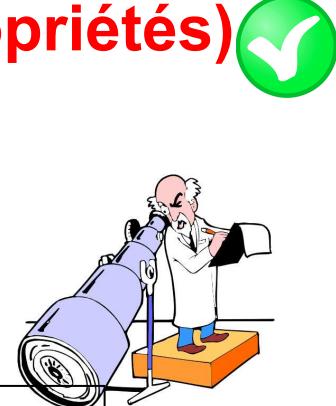
Whenever you are tempted to type something into a print statement or a debugger expression, write it as a test instead.



# Tests

## (sur les entrées)

# Observer par des assertions (vérification de propriétés)



f1,f2,f3  
v11,v12,v13  
v21,v22,v23

## example

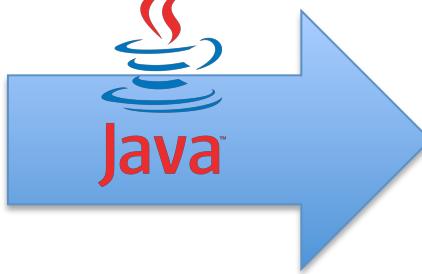
# CSV

# Tests automatisés

## (sur les entrées)

Product	Image process.	Sensor format	Sensor type	Sensor manufa..	Megapixels	Focus points	Metering pixels	Viewfinder cov. (%)		
Find										
D3X	EXPEED	Full-frame	CMOS	Sony	24.5	51	1005	100%		
D2Xs	-	APS-C	CMOS	Sony	12.4	11	1005	100%		
D2X	-	APS-C	CMOS	Sony	12.4	11	1005	100%		
D3X	D1X	APS-C	CCD	Sony	5.8	5	1005	98%		
D2Gs	D1	Product	Image proc..	Sensor form..	Sensor type	Sensor manufa..	Megapixels	Focus points	Metering pixels	Viewfinder cov. (%)
D4S	D2	Find								
D1X	D3	D1	D3X	D2Xs	D1	D1	24.5	51	1005	100%
D4S	D4	D2	D2Xs	D1	D3X	D2	12.4	11	1005	100%
D4	D5	D3	D2Xs	D1	D4S	D3	12.4	11	1005	100%
D3	D3S	D2	D2Xs	D1	D4S	D2	5.3	5	1005	98%
D2Hs	D2Hs	D1	D1X	D4S	D3S	D2	2.66	5	1005	98%
D2H	D2H	D1	D1X	D4S	D3S	D2	5.2	51	91000	100%
D1H	D1H	D1	D3S	D4S	D3S	D2	16.2	51	91000	100%
D800	D800	D1	D3	D4S	D3S	D2	12.1	51	1005	100%
D10	D10	D2	D2Hs	D4S	D3S	D2	12.1	51	1005	100%
D800	D800	D2	D2Hs	D4S	D3S	D2	4.1	11	1005	100%
D700	D700	D3	D2Hs	D4S	D3S	D2	4.1	11	1005	100%
D750	D750	D3	D1H	D4S	D3S	D2	2.7	5	1005	98%
Df	Df	D4	D1H	D4S	D3S	D2	36.3	51	91000	100%
D2Hs	D2Hs	D4	D1H	D4S	D3S	D2	36.3	51	91000	100%
D800	D800	D4	D1H	EXPEED 3	D4S	D2	12.1	51	1005	100%
D1H	D1H	D5	D1H	EXPEED 3	D4S	D2	2.7	5	1005	98%
D750	D750	D5	D1H	EXPEED 3	D4S	D2	36.3	51	91000	100%
Df	Df	D750	D1H	EXPEED 3	D4S	D2	12.1	51	91000	100%
D750	D750	D750	D1H	EXPEED 3	D4S	D2	12.1	39	2016	100%
Df	Df	D750	D1H	EXPEED 4	D4S	D2	24.9	51	91000	100%
Df	Df	D750	D1H	EXPEED 4	D4S	D2	16.2	39	2016	100%

(sur la transformation)



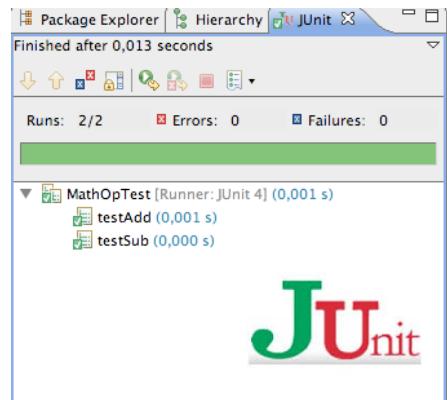
**(sur la sortie)**

f1,f2,f3  
v11,v12,v13  
v21,v22,v23

## example

**CSV**

# Tests automatisés



```
// Tests adding a product to the cart.
public void testProductAdd() {
    Product book = new Product("Refactoring", 53.95)
    _bookCart.addItem(book);

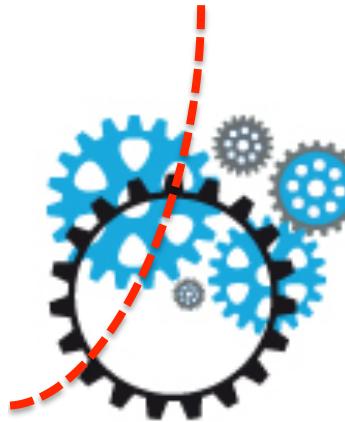
    assertTrue(_bookCart.contains(book));

    double expected = 23.95 + book.getPrice();
    double current = _bookCart.getBalance();

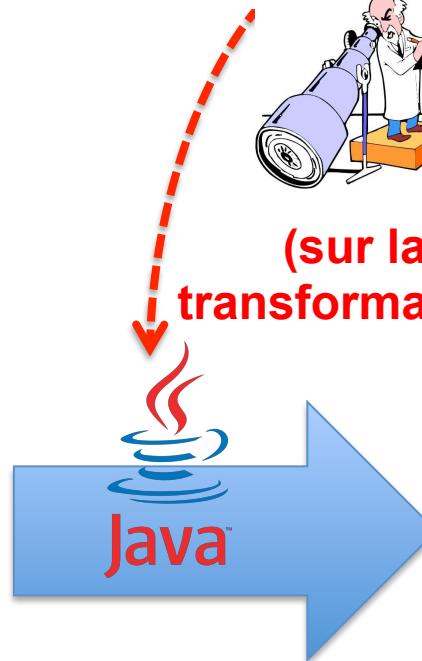
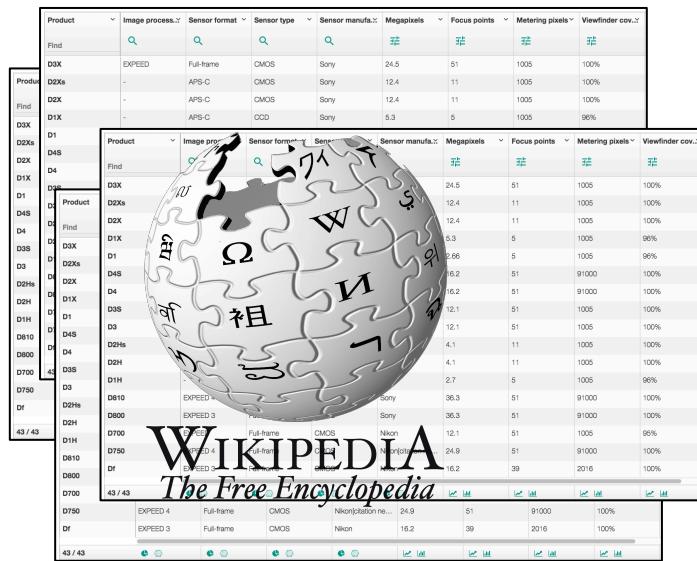
    assertEquals(expected, current, 0.0);

    int expectedCount = 2;
    int currentCount = _bookCart.getItemCount();

    assertEquals(expectedCount, currentCount);
```



# (sur la transformation



f1,f2,f3  
v11,v12,v13  
v21,v22,v23

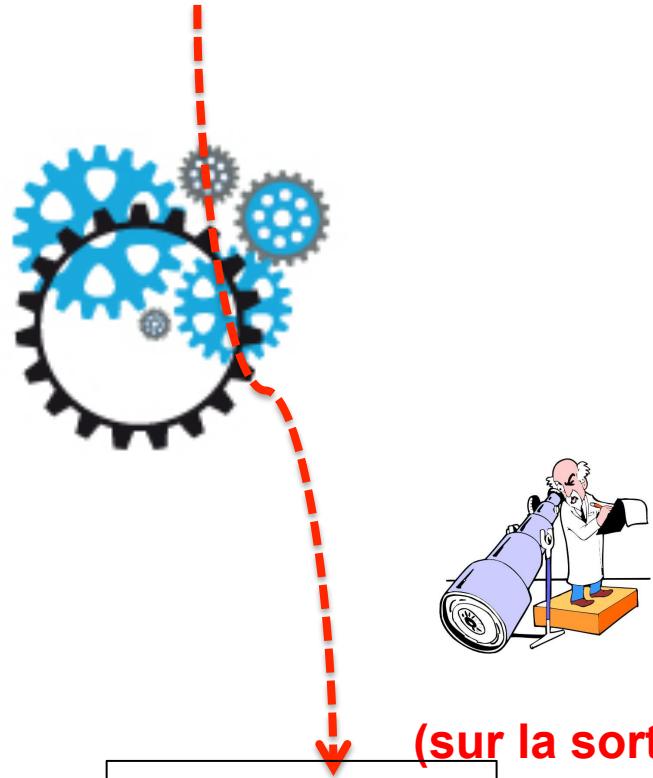
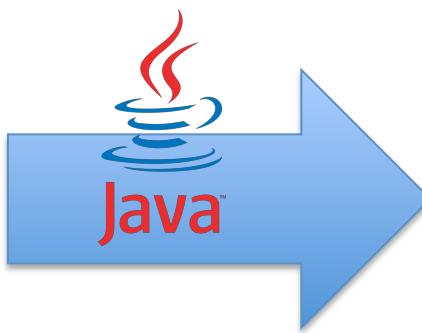
## example

# CSV

# Tests automatisés

## (sur les entrées)

Product	Image process.	Sensor format	Sensor type	Sensor manuf.	Megapixels	Focus points	Metering pixels	Viewfinder cov.
Find								
D3X	EXPEED	Full-frame	CMOS	Sony	24.5	51	1005	100%
D2Xs	-	APS-C	CMOS	Sony	12.4	11	1005	100%
D2X	-	APS-C	CMOS	Sony	-	11	1005	100%
D1X	-	CCD	Sony	-	5.8	5	1005	96%
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(sur la sortie)

f1,f2,f3  
v11,v12,v13  
v21,v22,v23

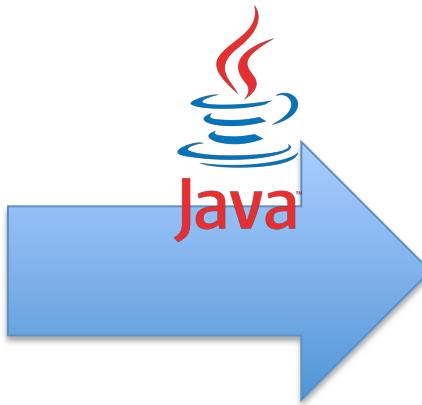
## example

# CSV

# Tests automatisés

**(concevoir un ensemble de données en  
“input” pertinent pour le test et couvrant  
un maximum de cas)**

(vérifier des assertions « génériques » ou bien produire la sortie attendue puis comparaison aka « diff »)



f1,f2,f3  
v11,v12,v13  
v21,v22,v23

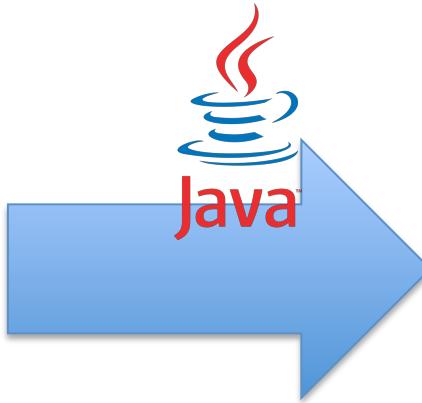
## example

## CSV

# Tests automatisés

# NE PAS TESTER VOTRE SOLUTION SUR UNE SEULE MATRICE!

(vérifier des assertions « génériques » ou bien produire la sortie attendue puis comparaison aka « diff »)

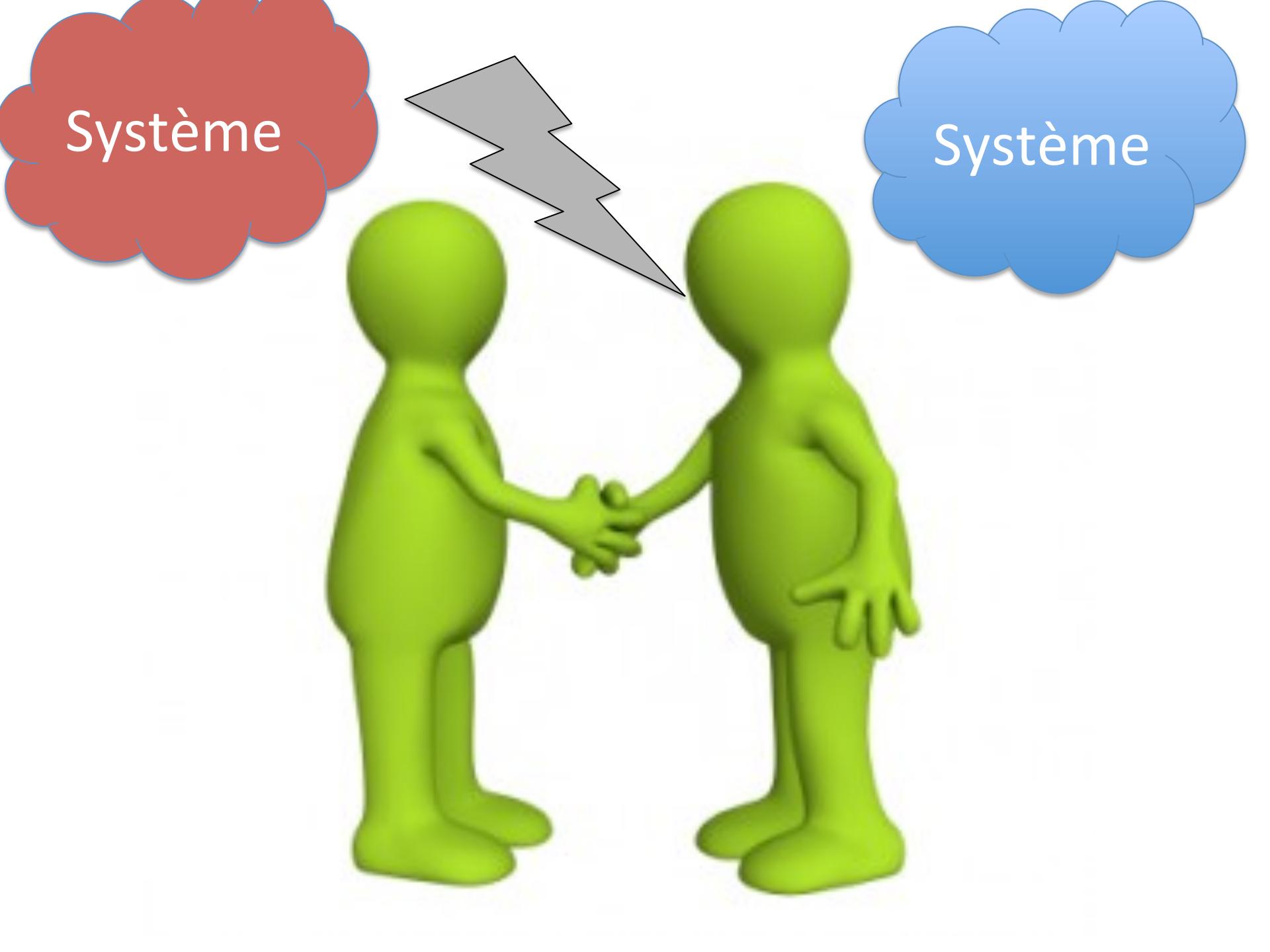


f1,f2,f3  
v11,v12,v13  
v21,v22,v23

## example

# CSV

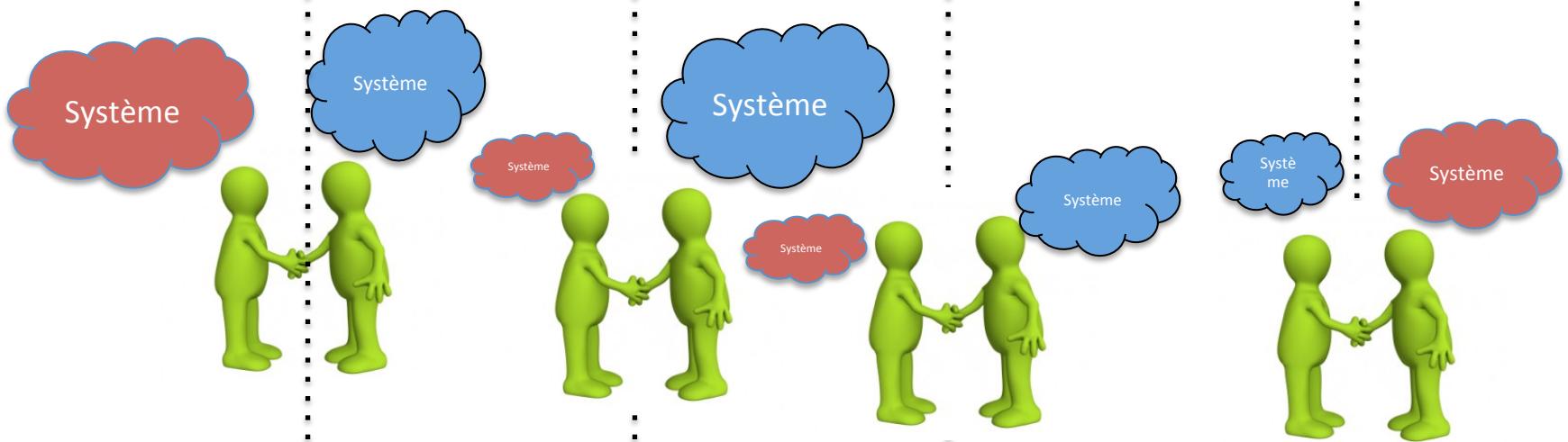
Tests et projets  
(bis, discussions)



Système

Système

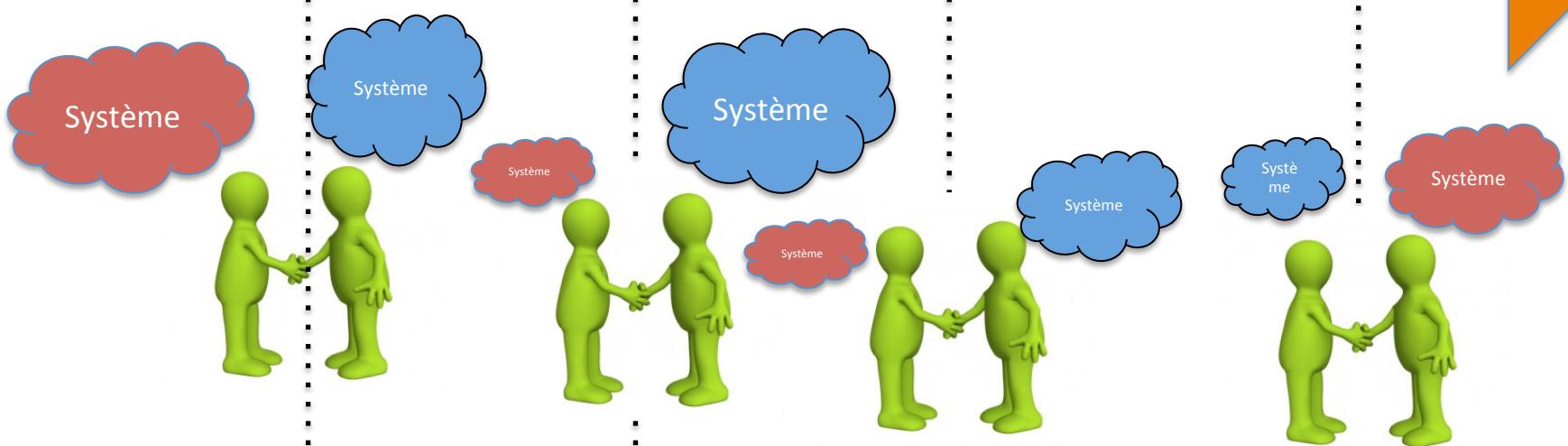
# EX (exigences; cahier des charges)



**Valider à chaque itération avec le client: montrer les modèles, expliquer les choix technologiques, etc.**

# EX (exigences; cahier des charges)

# SP (sprints; implémentation)



**Valider à chaque itération avec le client: montrer les exigences et l'implémentation (le « produit » en action)**

# Multi-Tools and Languages

