

---

# **A Systems-Thinking Approach to Test Automation**

**Gerard Meszaros**

***Independent Consultant***

***CTO of FeedXL.Com***

**singapore2016@gerardm.com**

**These slides:**

**<http://singapore2016.testAutomationPatterns.com>**

# My Background

- Software developer
- Development manager
- Project Manager
- Software architect

*Embedded  
Telecom*

- OOA/OOD Mentor

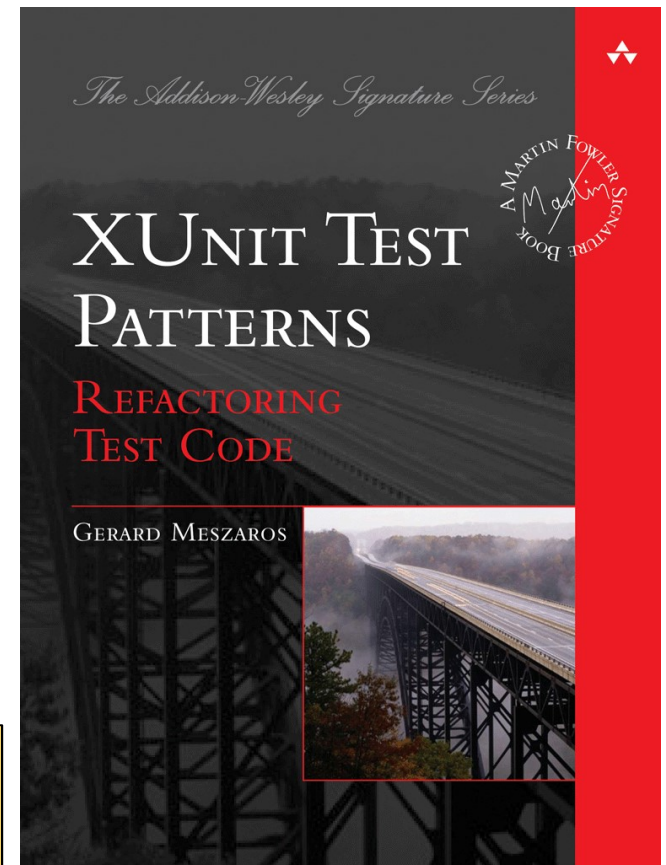
- Requirements (Use Case) Mentor
- XP/TDD Mentor

*I.T.*

- Agile PM Mentor

- Test Automation Consultant & Trainer
- Lean/Agile Coach/Consultant

*Product & I.T.*



**Gerard Meszaros**  
**singapore2016@gerardm.com**

# My Background

- Software developer
- Development manager
- Project Manager
- Software architect

*Embedded  
Telecom*

- OOA/OOD Mentor

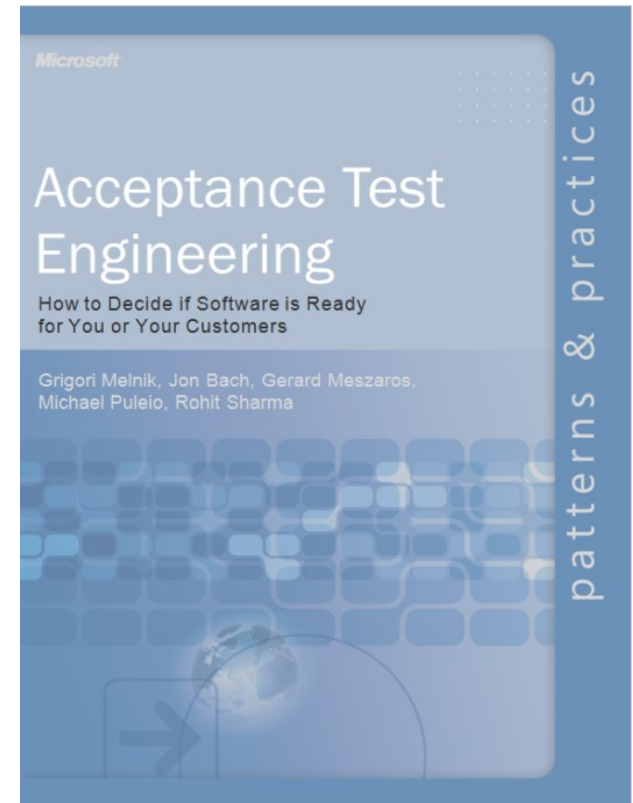
- Requirements (Use Case) Mentor
- XP/TDD Mentor

*I.T.*

- Agile PM Mentor

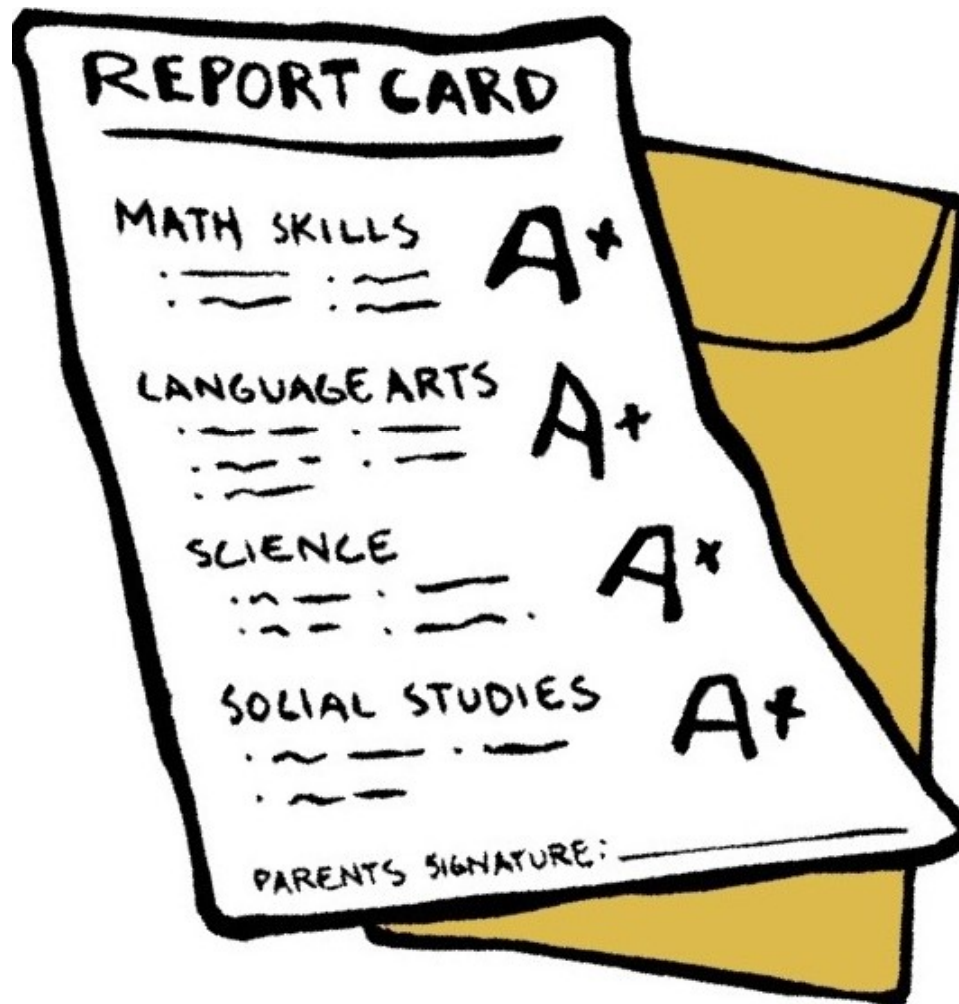
- Test Automation Consultant & Trainer
- Lean/Agile Coach/Consultant

*Product & I.T.*



**Gerard Meszaros**  
**singapore2016@gerardm.com**

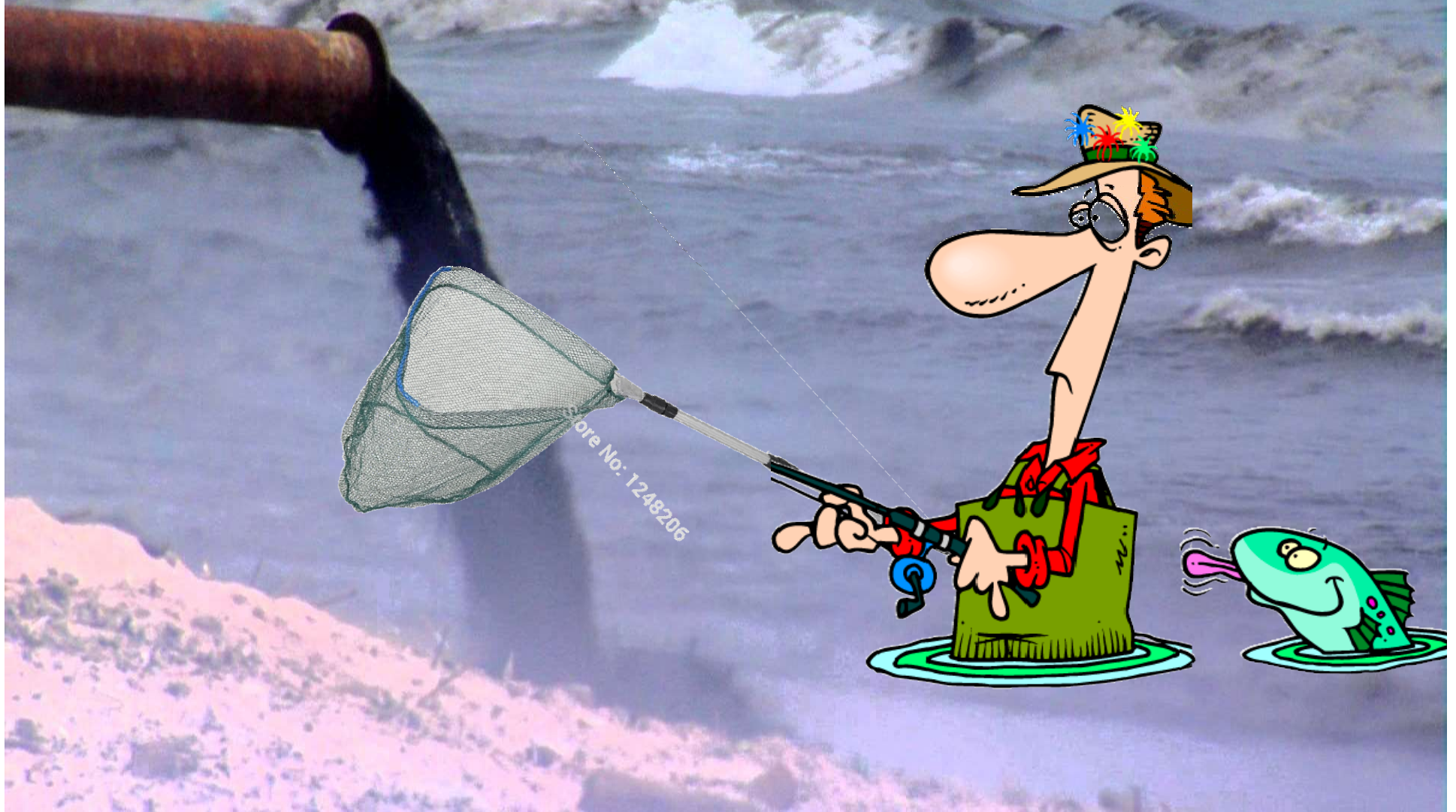
# Johnny's Report Card



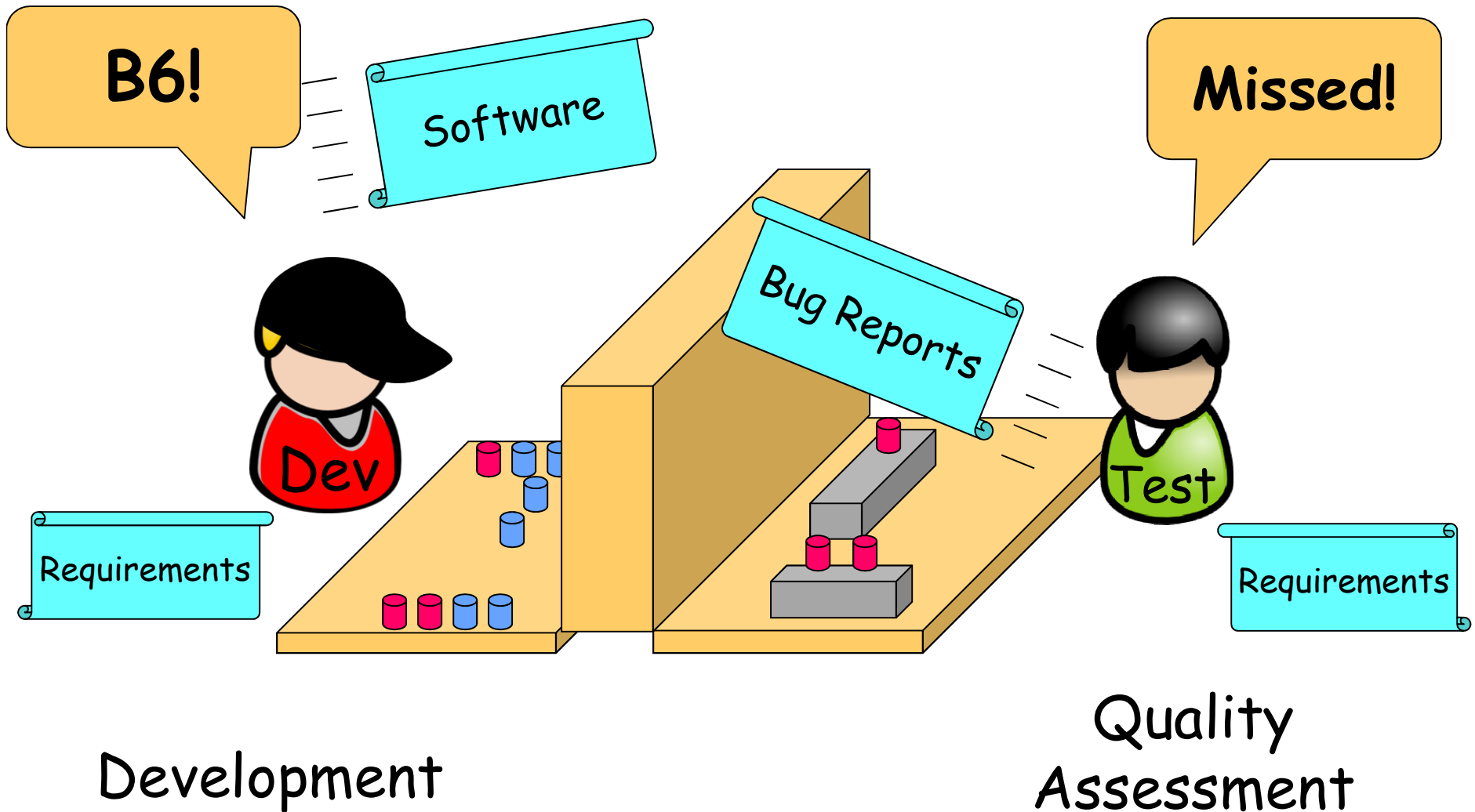
<http://fabulesslyfrugal.com/report-card-freebies-for-good-grades/>



# QA as Quality Assessment



# Test & Fix “Battleship”



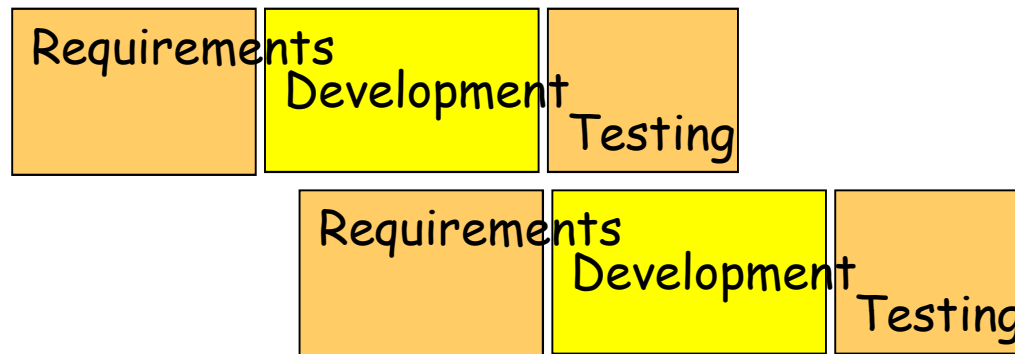
---

# The Agile Test Problem



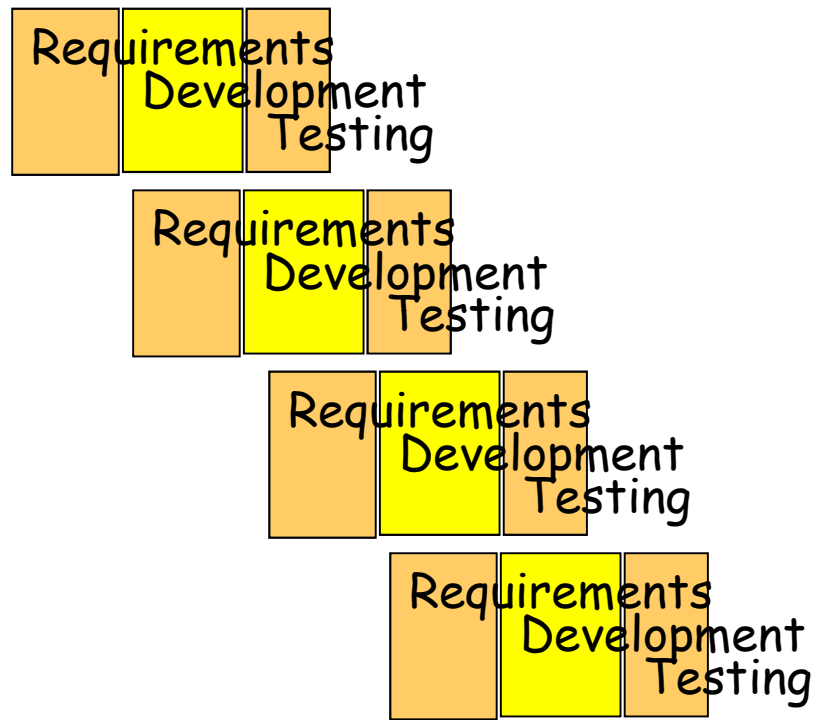
---

# The Agile Test Problem

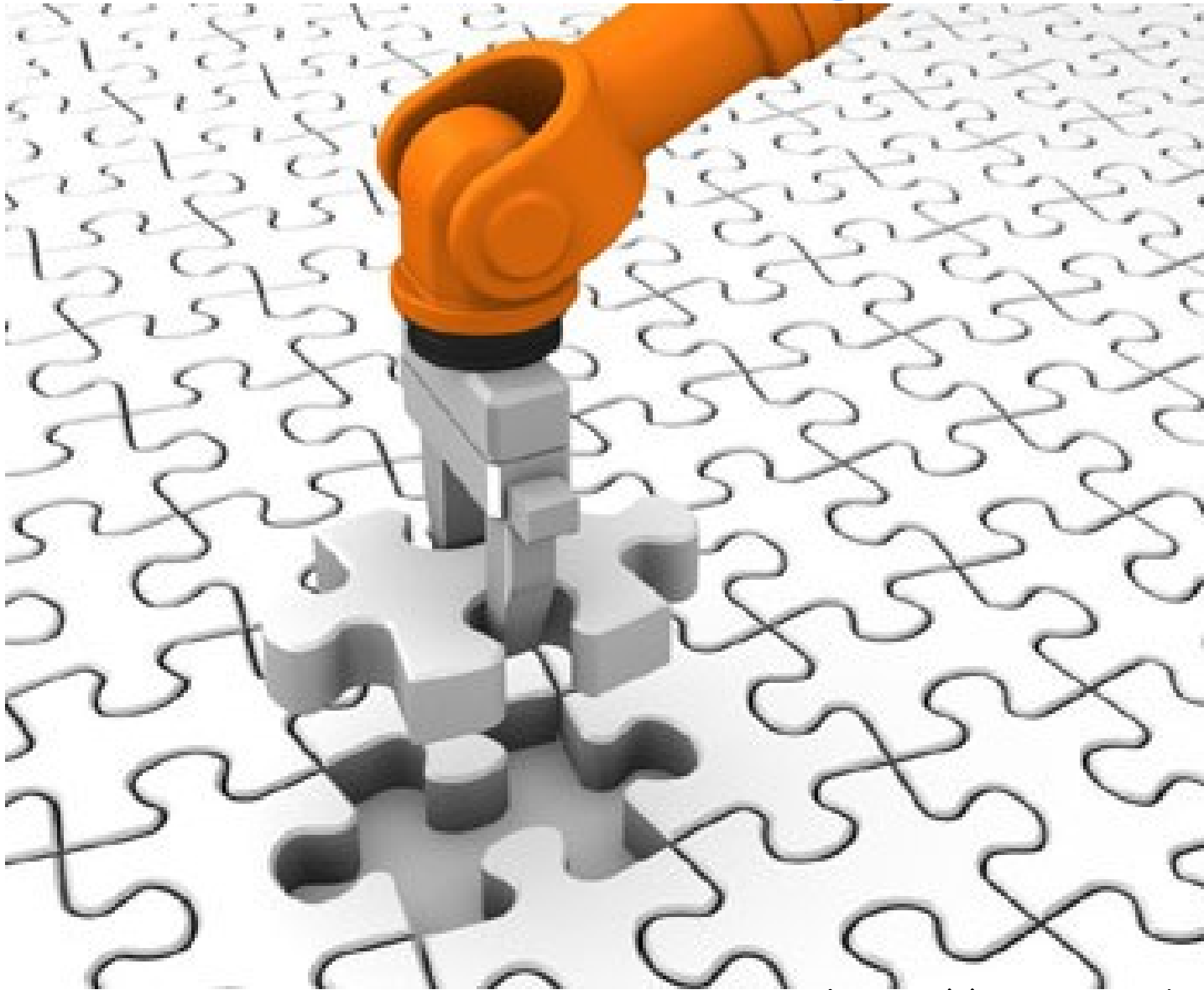




# The Agile Test Problem



# Some Automated Testing is Essential



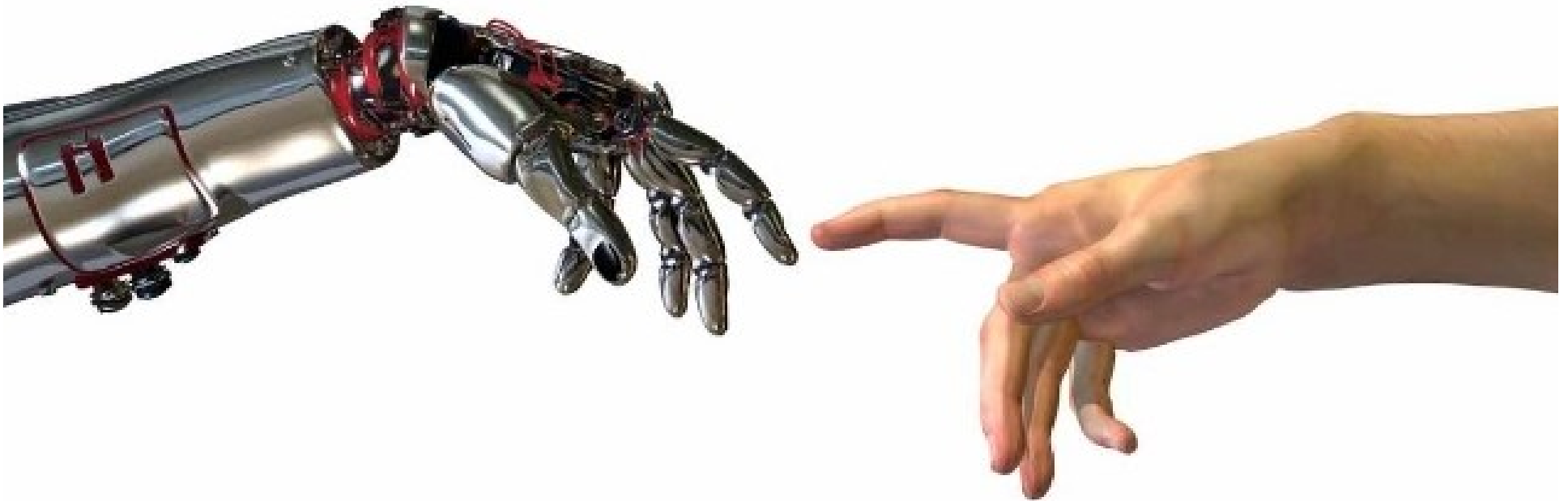
**AUTOMATION**  
**WILL NEVER**  
**REPLACE**  
**ME**



<http://www.etfile.com/blog/to-automate-or-not-to-automate-that-is-the-question/>

---

# ROBOTS empowering HUMANS



<http://www.slideshare.net/b2bSEO/robots-replacing-humans-automation>

# Value of Automated Tests

**Tests as Documentation**

**Faster regression testing**

**Faster feedback on impact of changes**

**Better coverage of data combinations**

**Test with data without seeing that confidential data**

**Provides more time for exploratory testing**

**Can be done off hours; reduces delay/resources**

**Writing tests helps us understand code better**

**Know when problem was introduced**

**Fast sanity checking**

**Performance or load testing**

**Setting up complex scenarios for manual/exploratory testing**

**Unit/module tests improve modularity design and API's**

**Help Business understand what we/they are asking for**

*Courtesy of participants of a tutorial*





A black and white portrait of Albert Einstein, showing his characteristic wild, white hair and mustache. He is looking directly at the camera with a serious expression. The background is dark.

# Insanity:

Doing the same  
thing over and over  
again and expecting  
different results.

Albert Einstein

# Automated Tests are Just Code That Tests Other Code



## Who Tests This Code? Who Should Write This Code?

# The Toyota Way

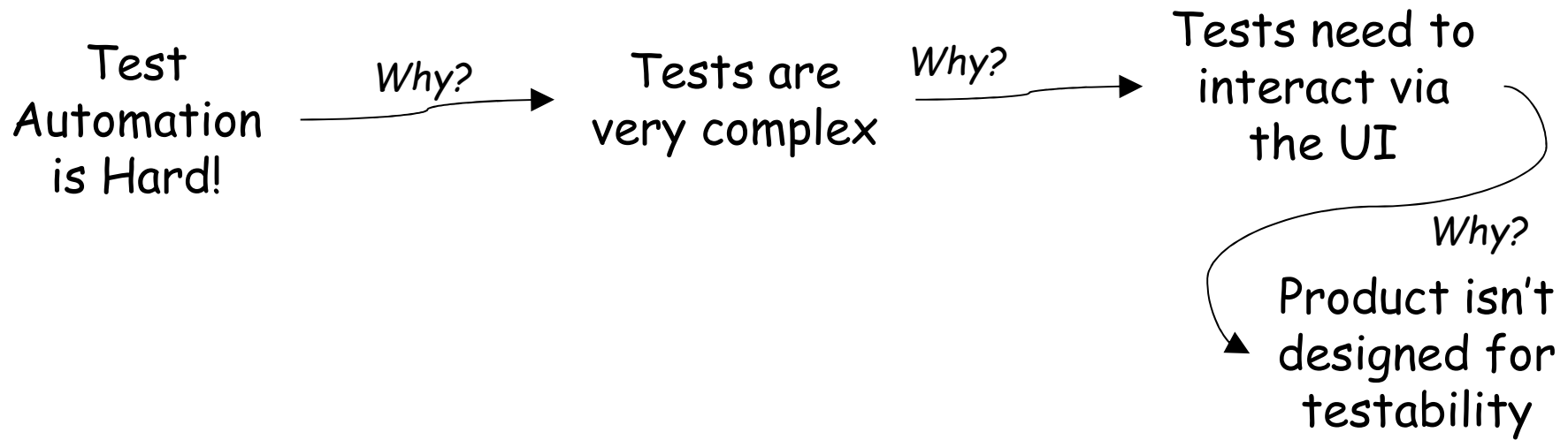


# 5 Why's

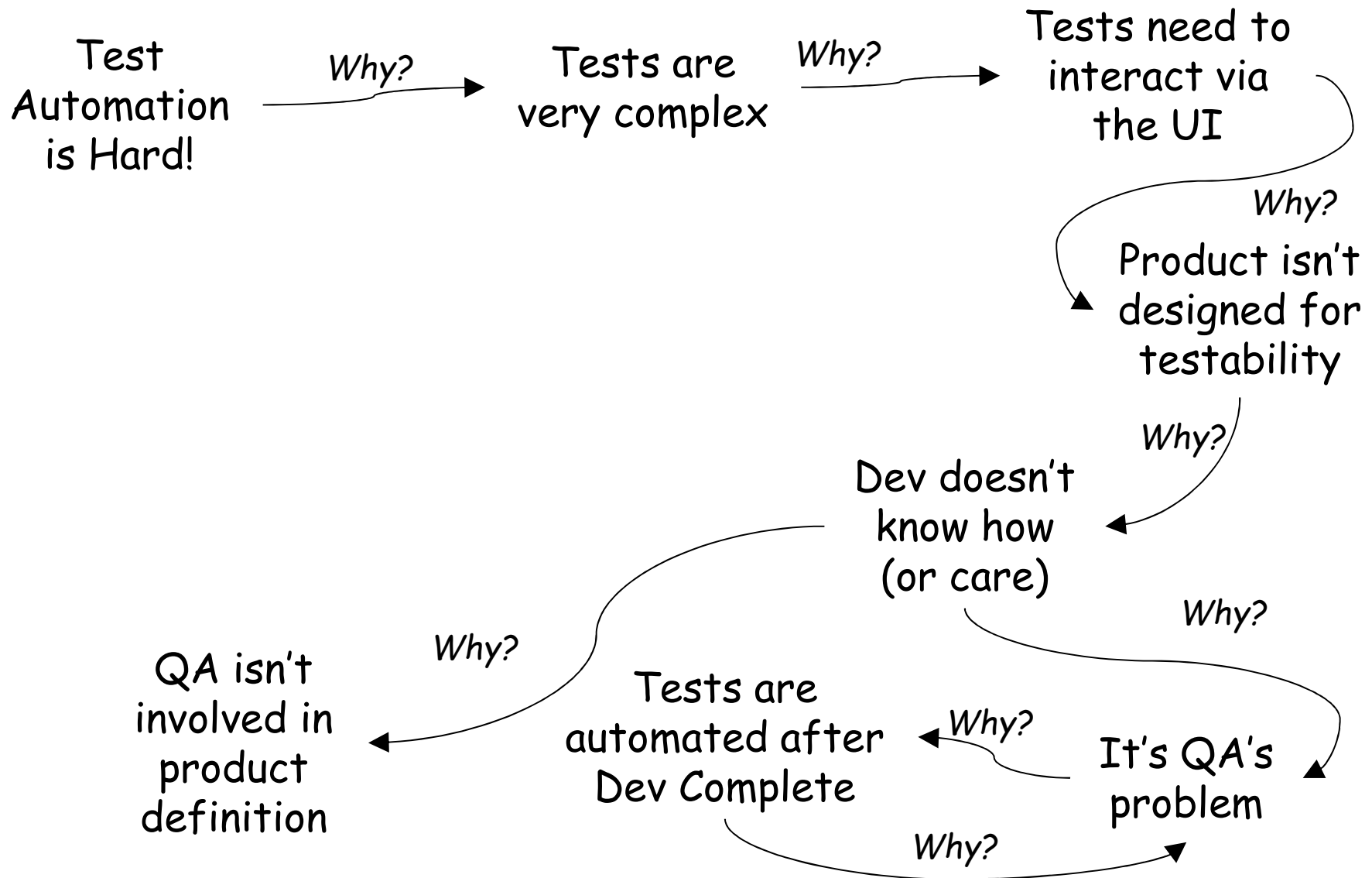


[www.123rf.com](http://www.123rf.com)

## 5 Why's of Test Automation Being Hard

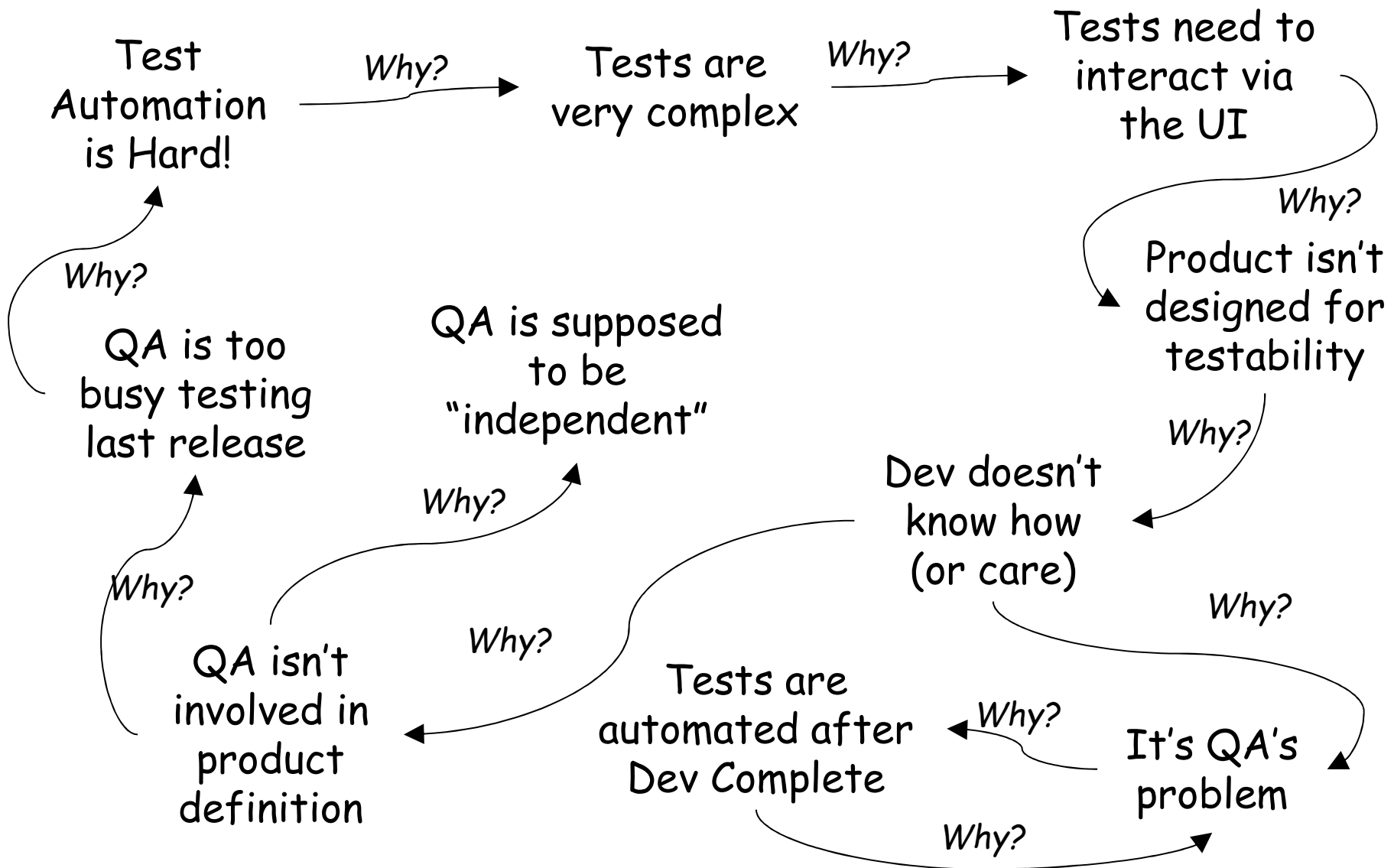


# 5 Why's of Test Automation Being Hard

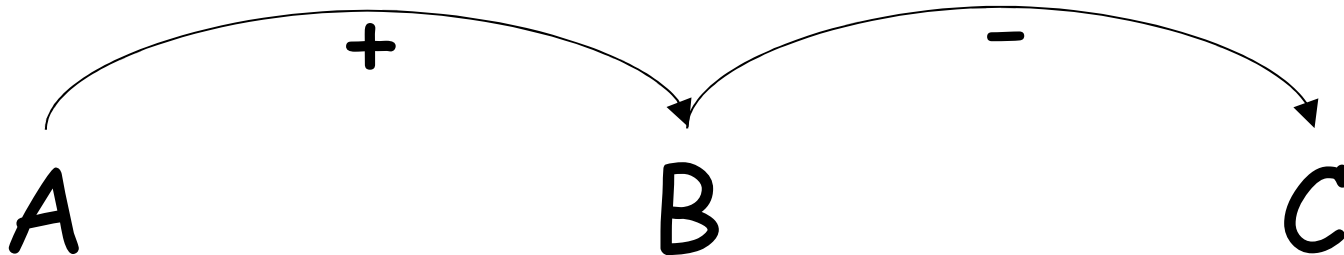




# 5 Why's of Test Automation Being Hard

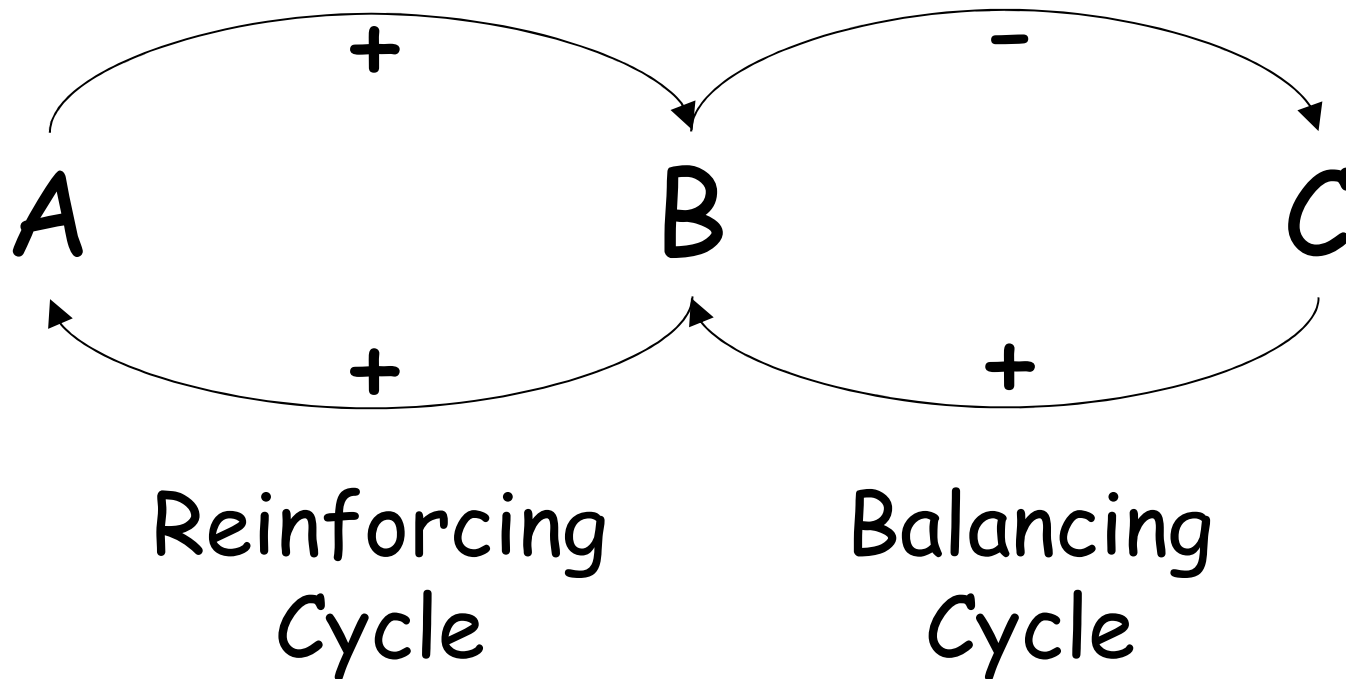


# Systems Thinking



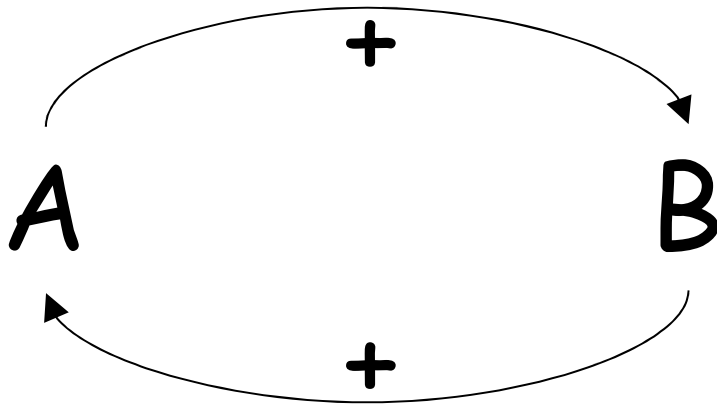
Notation:  
+ Increasing  
- Reducing

# Systems Thinking



Notation:  
+ Increasing  
- Reducing

# Systems Thinking

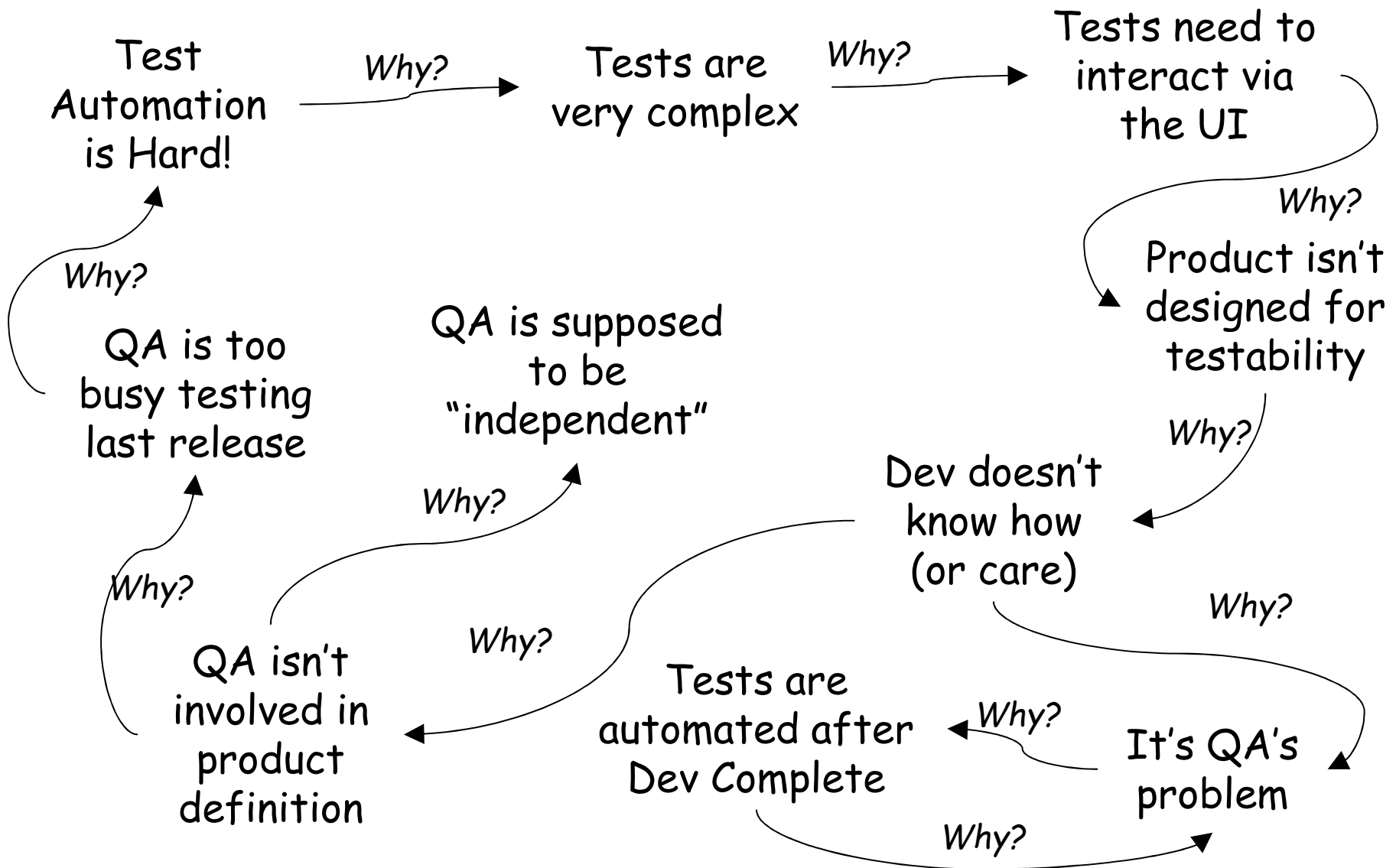


Vicious or  
Virtuous  
Cycle

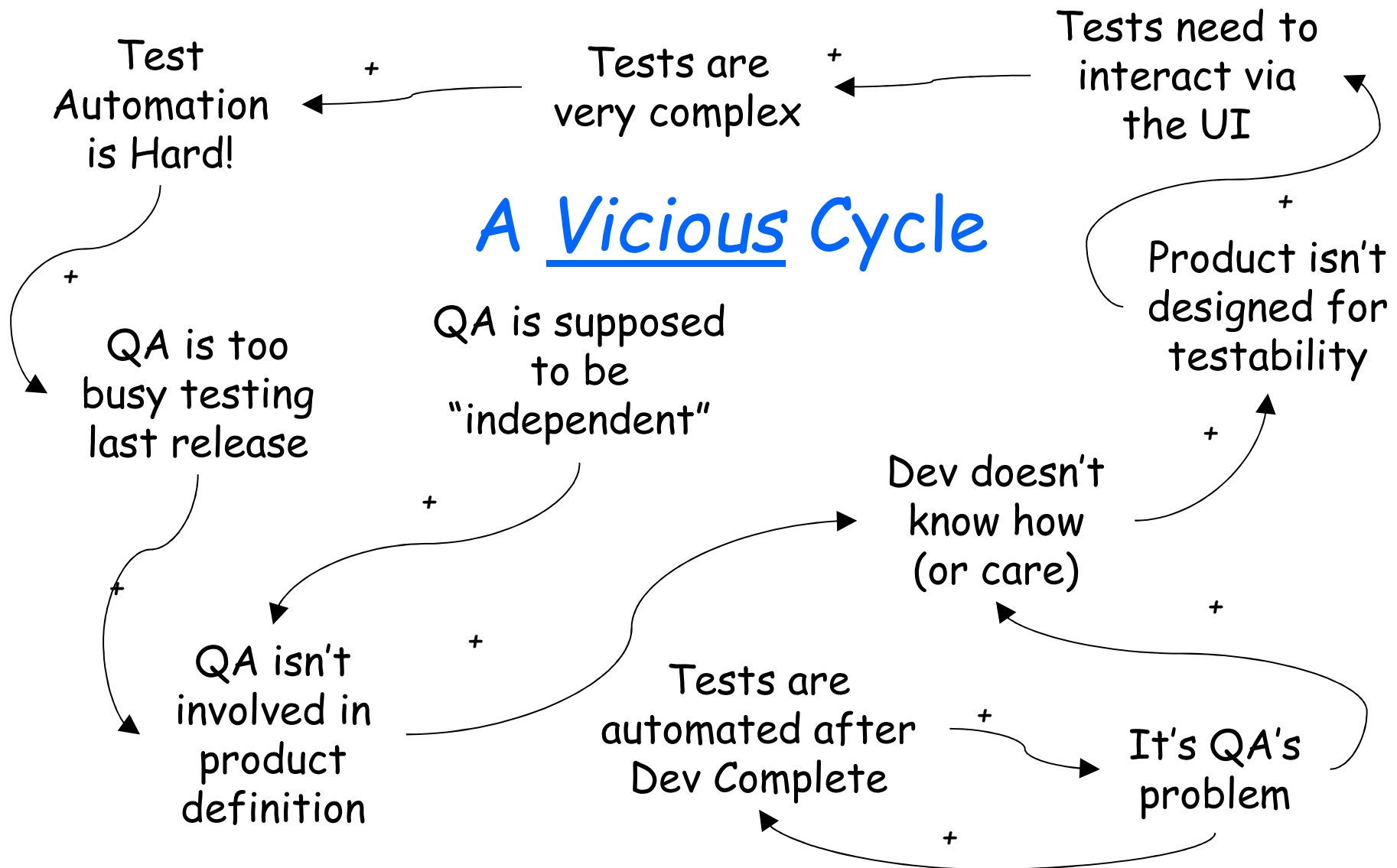
(Depending on  
whether A & B  
are  
good or bad)

Notation:  
+ Increasing  
- Reducing

# 5 Why's of Test Automation Being Hard



# Test Automation – Systems Thinking Diagram





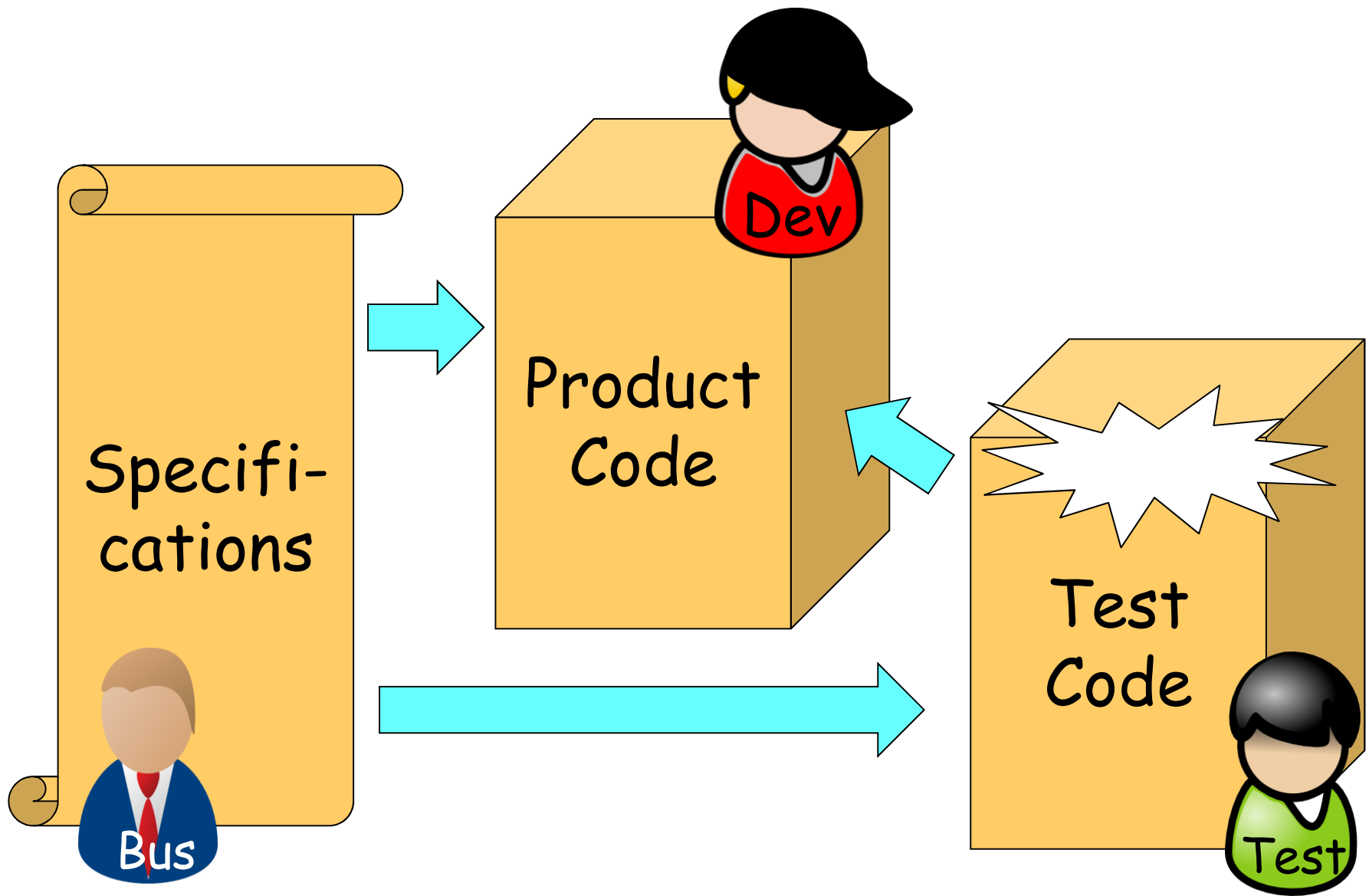
---

# Conway's Law

**The Architecture of System will resemble the Organization that Built it.**

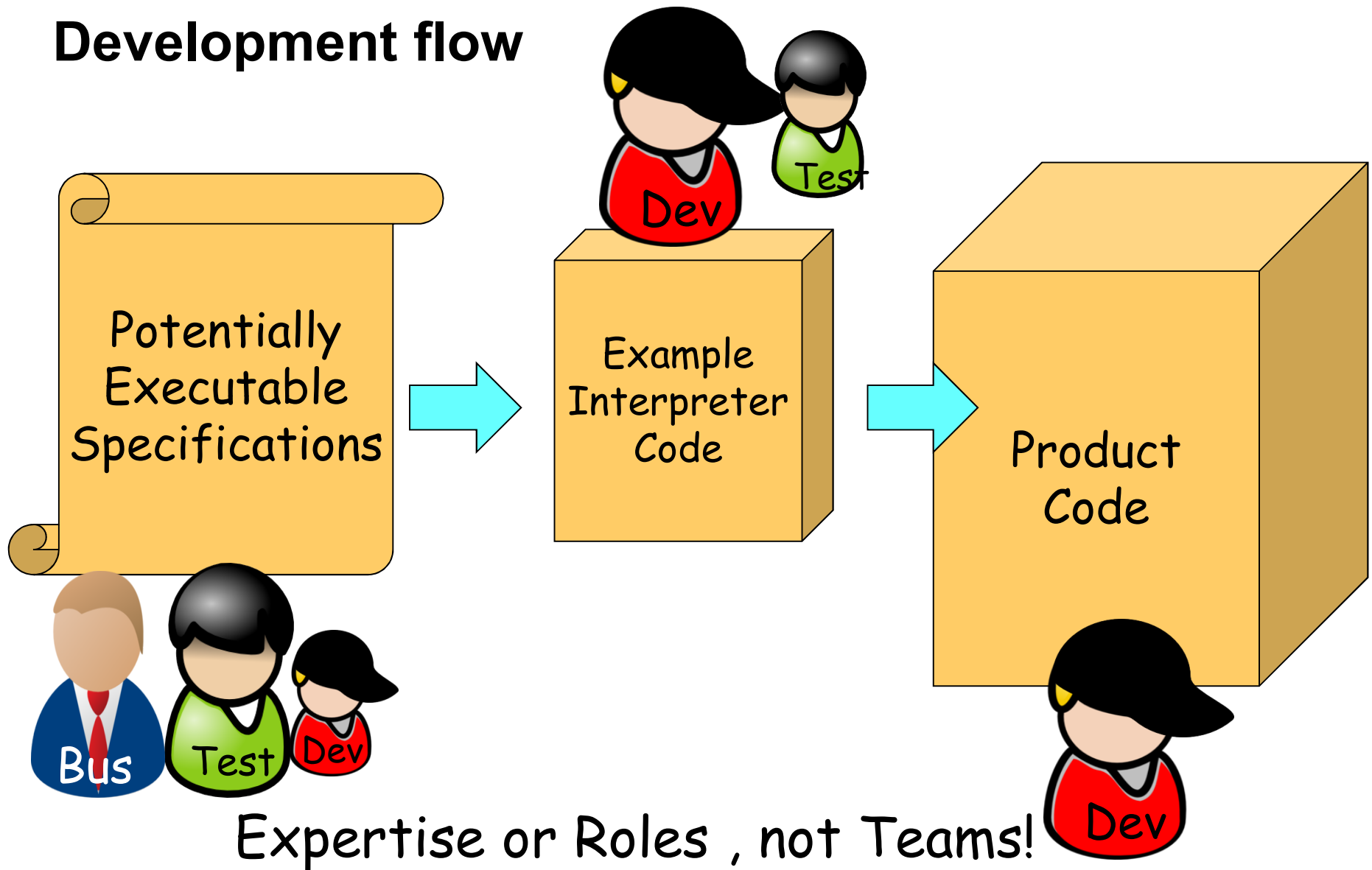


# Resulting Architecture



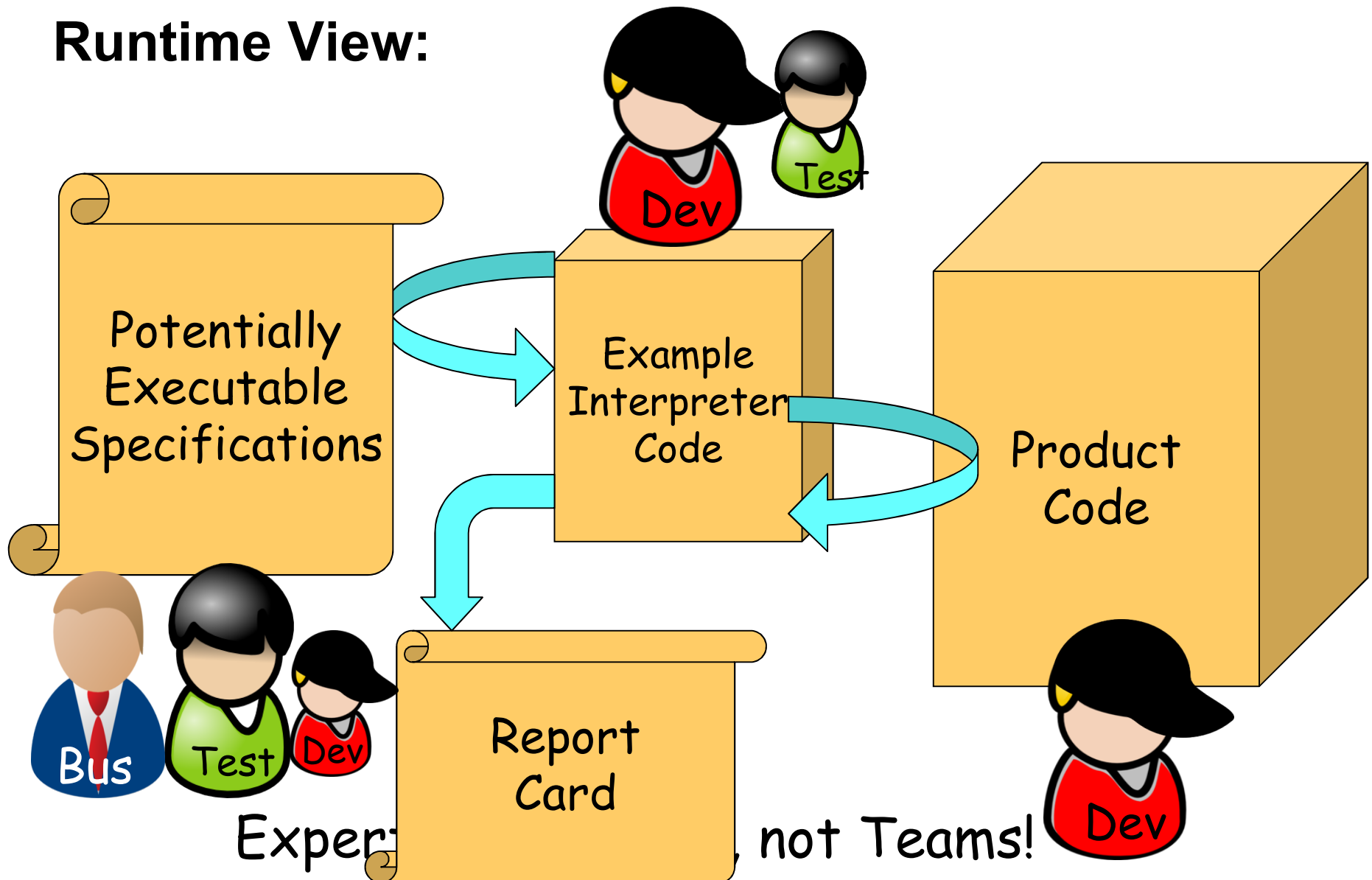
# Example-Driven Development

## Development flow



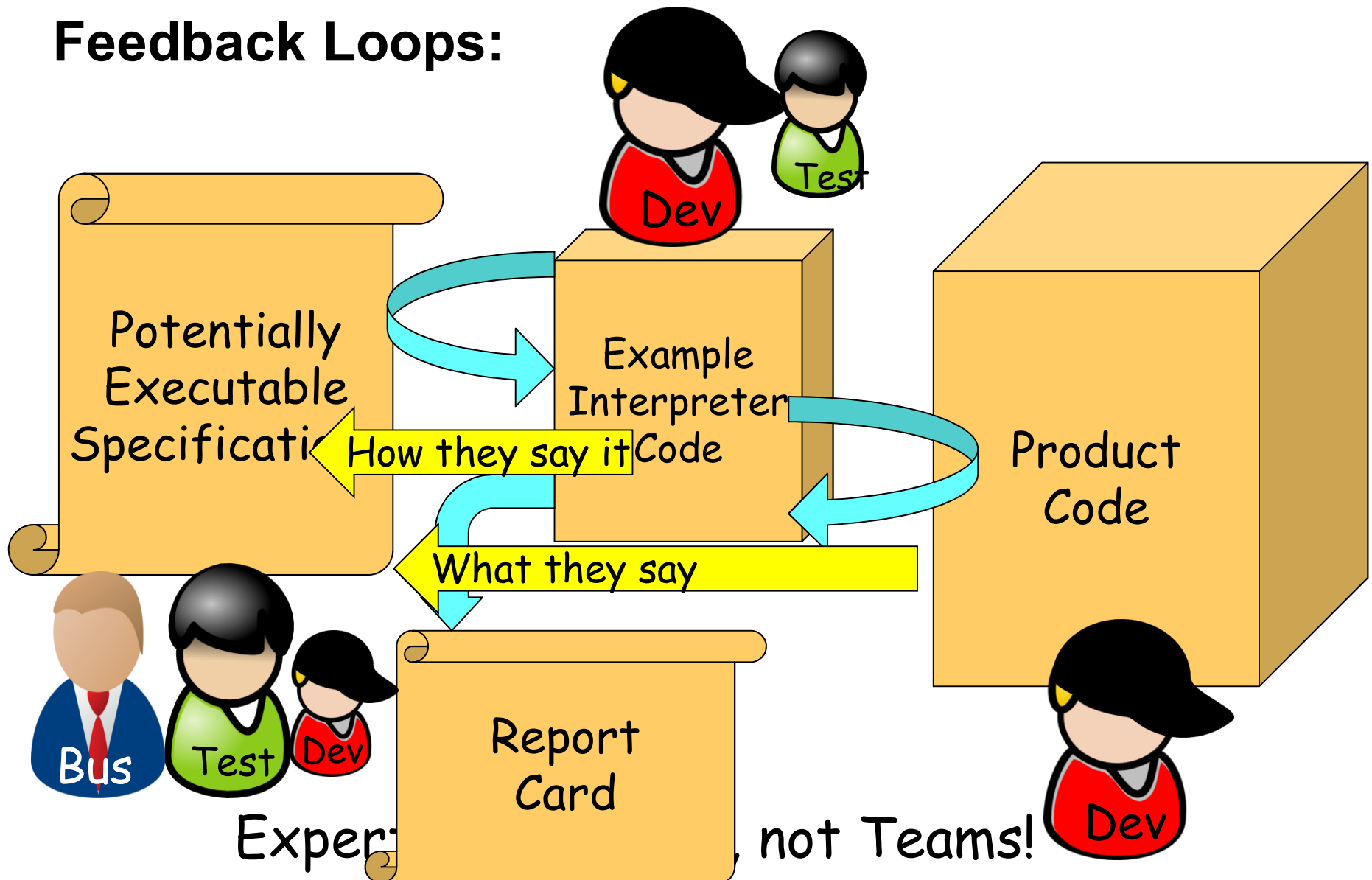
# Example-Driven Development

## Runtime View:



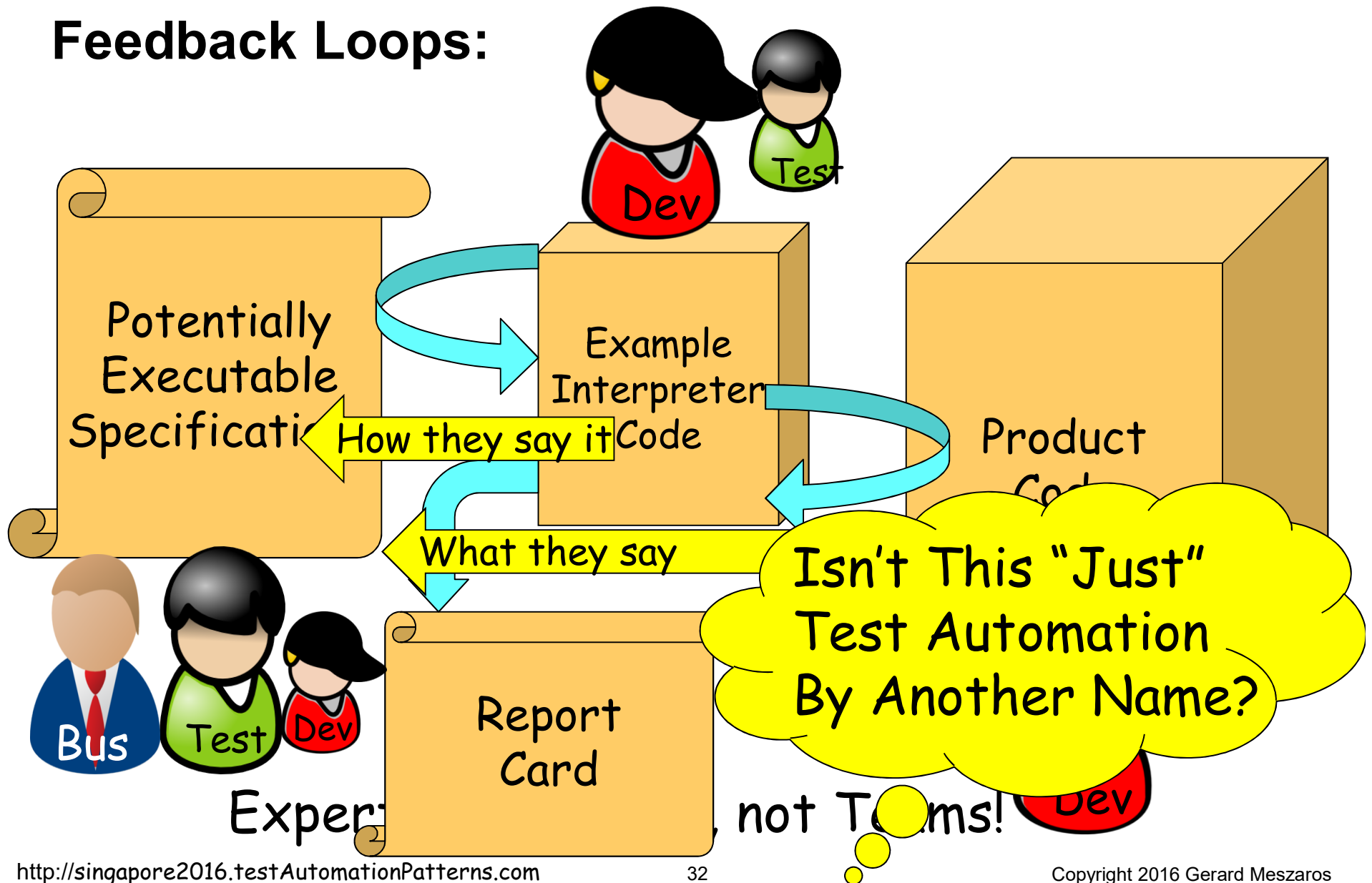
# Example-Driven Development

## Feedback Loops:



# Example-Driven Development

## Feedback Loops:





# Tests vs. Checks vs. Examples?

ref: <http://www.satisfice.com/blog/archives/856>



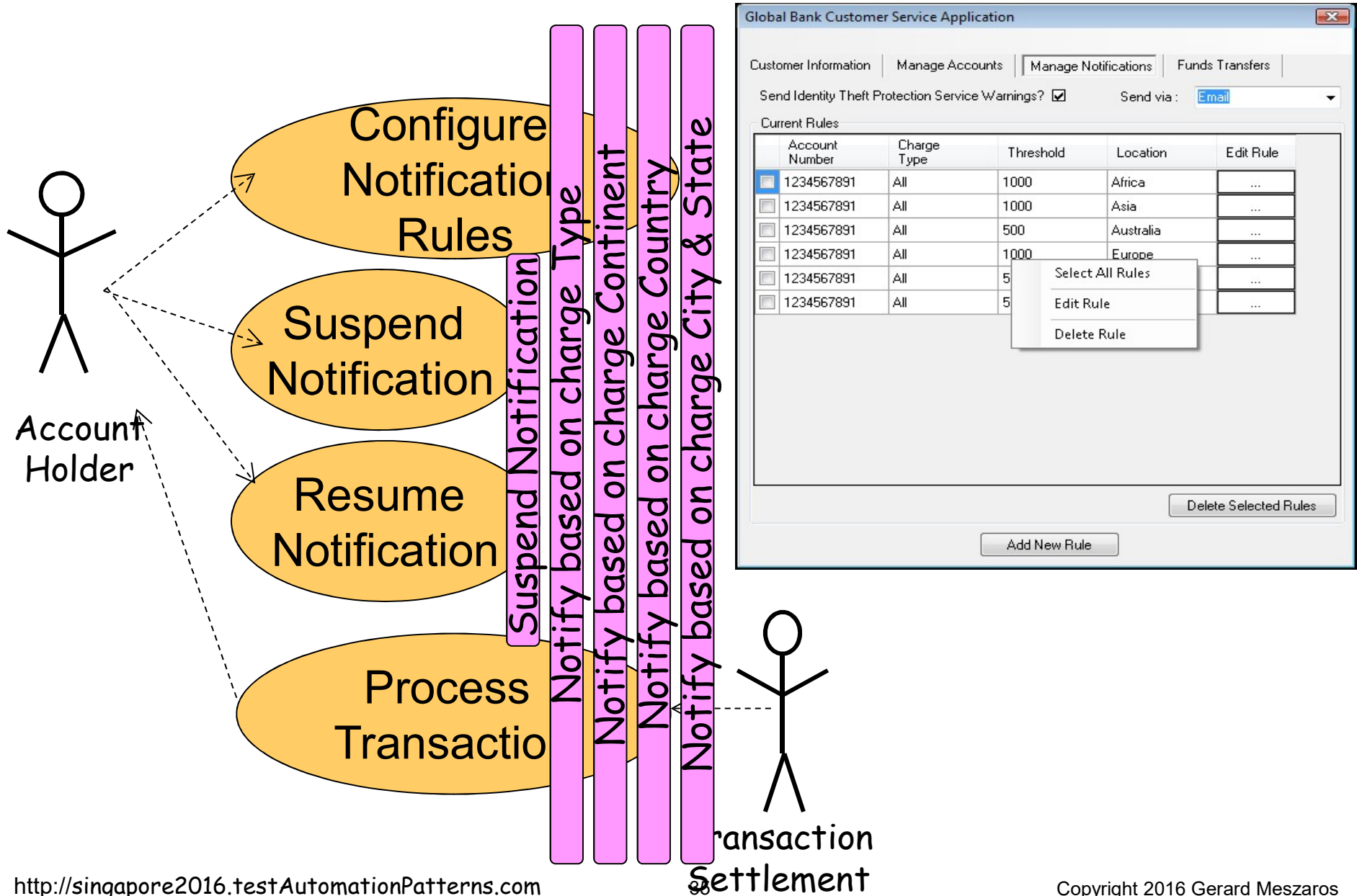
**EXAMPLE**

# Preparing Good Examples

**an example  
would be handy  
right about now**

**www.exampler.com**

# Example: Notifying of Bank Transactions



---

# Checking Notifications

- **Open MegaBank app**
- **Log in as “BobMa” with password \*\*\*\*\***
- **Click on “Manage Notifications” tab**
- **Click on “Add New Rule” button**
- **Select account “10035692877”**
- **Type “Default Rule” into field “rule name”**
- **Type “1000” into field “threshold amount”**
- **Click on “all transaction types” radio button**
- **Click on “all locations” radio button**
- **Click on “save changes” button**
- **...**
- **...**

Another  
attempt:

## Checking Notifications – 1/2

Customer	bobma	logs in
----------	-------	---------

System lists all available accounts for the authorized customer

account	type	notifications
10035692877	chequing	disabled
10035692890	savings	disabled
20010928892	credit line	disabled

Given:  
User and Accounts

When:  
Notification  
Rule is Configured

Customer sets notification threshold for	all	transactions from	all	locations to	\$10,000.00	on account	10035692877	via	email	to	bobma@live.com
------------------------------------------	-----	-------------------	-----	--------------	-------------	------------	-------------	-----	-------	----	----------------

ensure	No system messages	
ensure	System log contains	"Customer bobma set notification threshold for all transactions from all locations to \$10,000 on account 10035692877"

System lists all available accounts for the authorized customer

account	type	notifications
10035692877	chequing	enabled
10035692890	savings	disabled
20010928892	credit line	disabled

Notification settings for account 10035692877				
transaction type	location where initiated	threshold amount	via	address
all	all	\$10,000.00	email	bobma@live.com

Then:  
Notification Rule  
is Active



Another  
attempt:

## Checking Notifications – 2/2

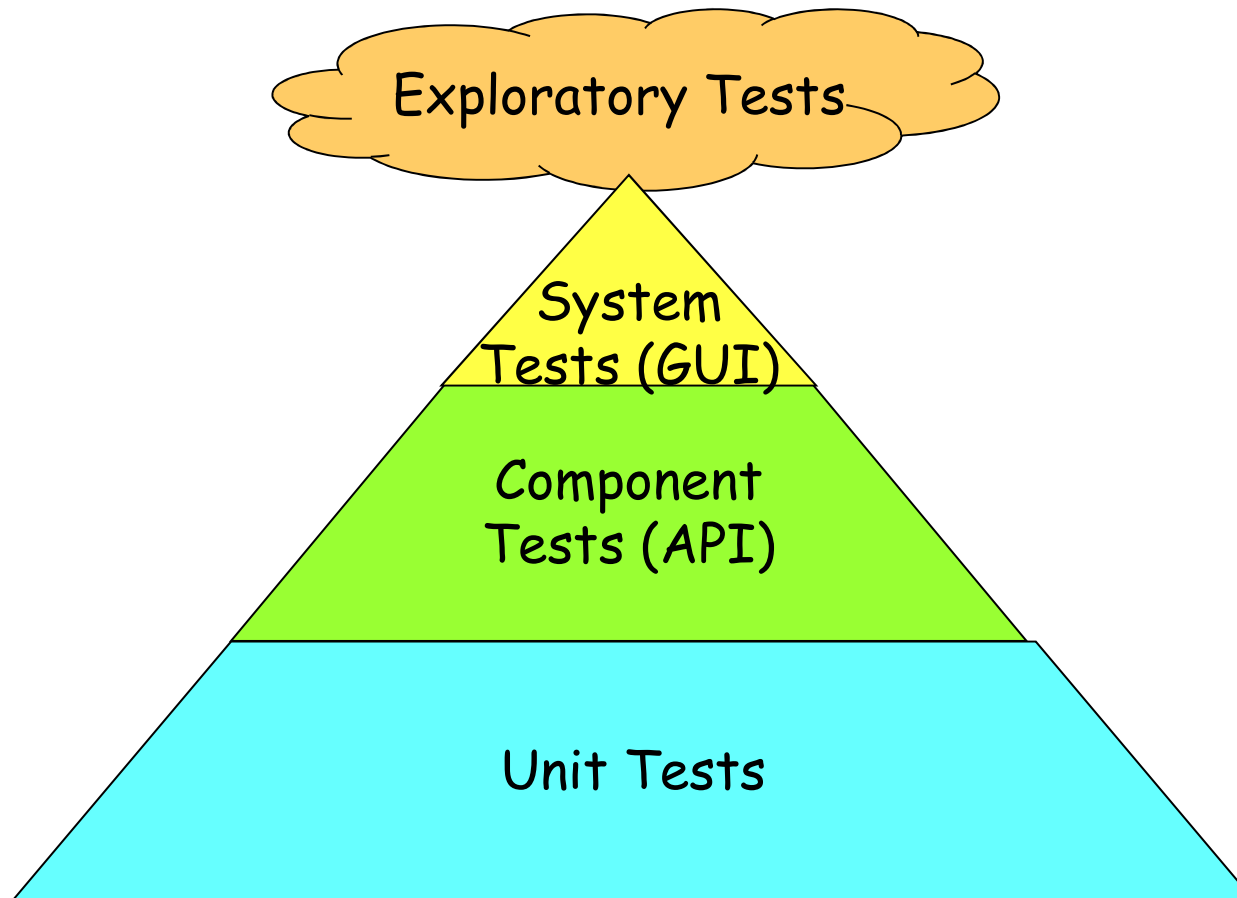
Time now is	9:30AM, 03/18/2008				
Bank processes	debit	to	10035692877	in the amount of	\$15,000.00
Bank processes	debit	to	10035692877	in the amount of	\$9,000.00
Bank processes	debit	to	10035692877	in the amount of	\$11,000.00
Bank processes	debit	to	20010928892	in the amount of	\$12,000.00
Bank processes	credit	to	10035692877	in the amount of	\$13,000.00
Bank processes	credit	to	10035692877	in the amount of	\$9,999.99
Bank processes	charge	to	10035692877	in the amount of	\$9,999.99
Bank processes	charge	to	10035692877	in the amount of	\$11,000.00

When: The  
Transactions to  
be processed

Then: Expected  
Notifications

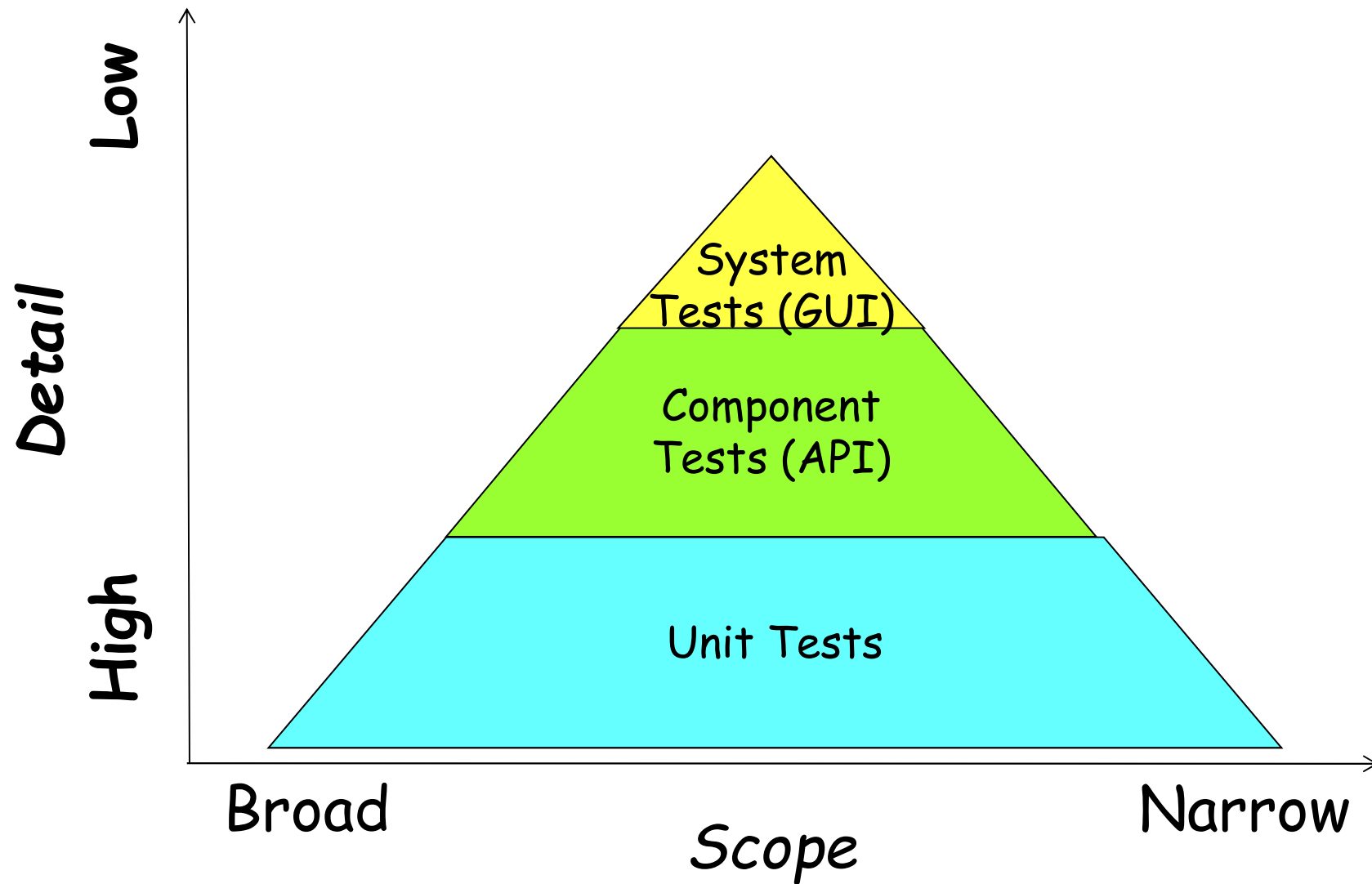
New notifications sent to customer	bobma				
type	account	timestamp	amount	via	address
debit	10035692877	9:30AM, 03/18/2012	\$15,000.00	email	bobma@live.com
debit	10035692877	9:30AM, 03/18/2012	\$11,000.00	email	bobma@live.com
credit	10035692877	9:30AM, 03/18/2012	\$13,000.00	email	bobma@live.com
charge	10035692877	9:30AM, 03/18/2012	\$11,000.00	email	bobma@live.com

# Test Automation Pyramid



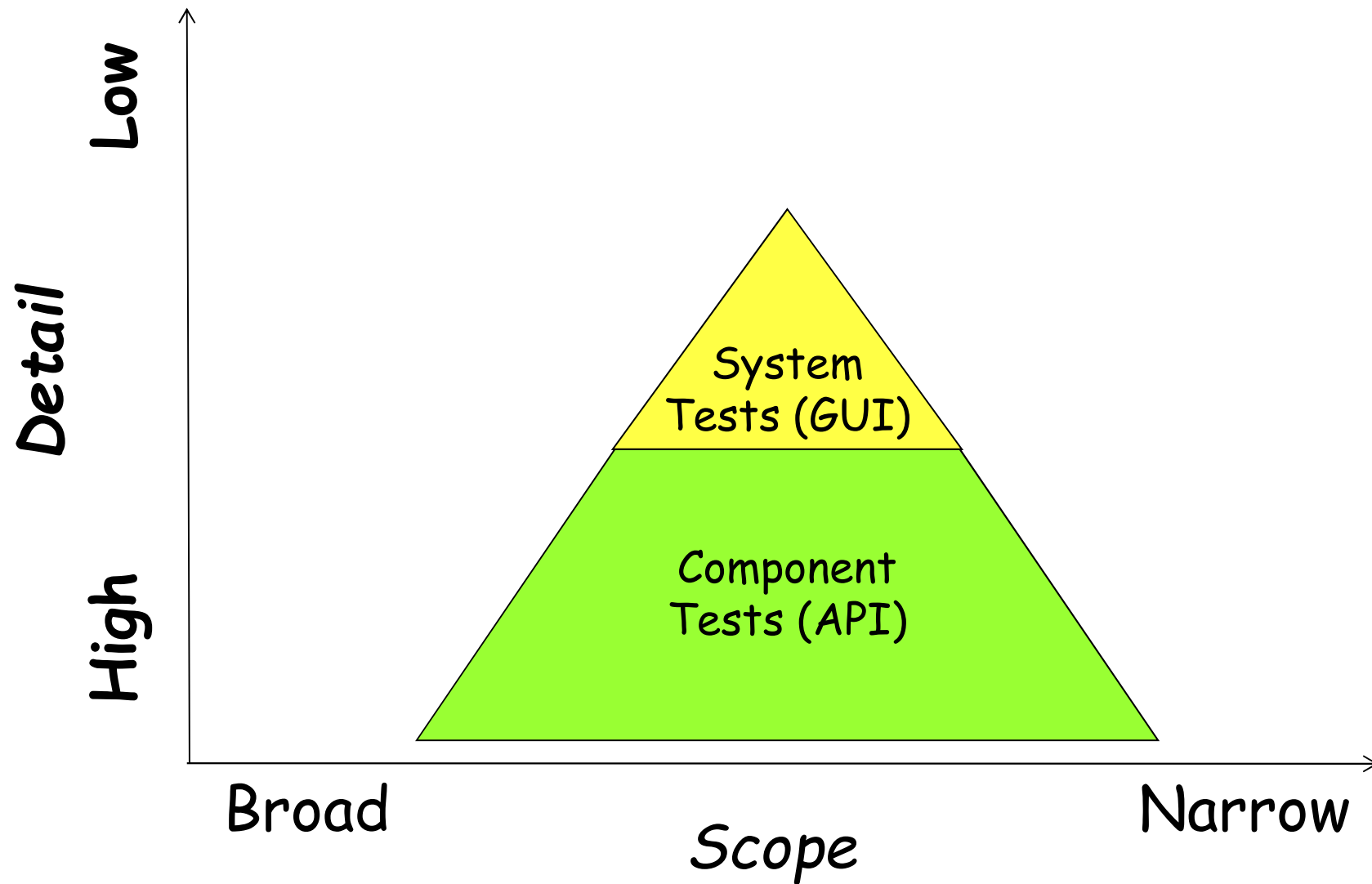
Pyramid originally proposed by Mike Cohn

# Behavior Specification at Right Level

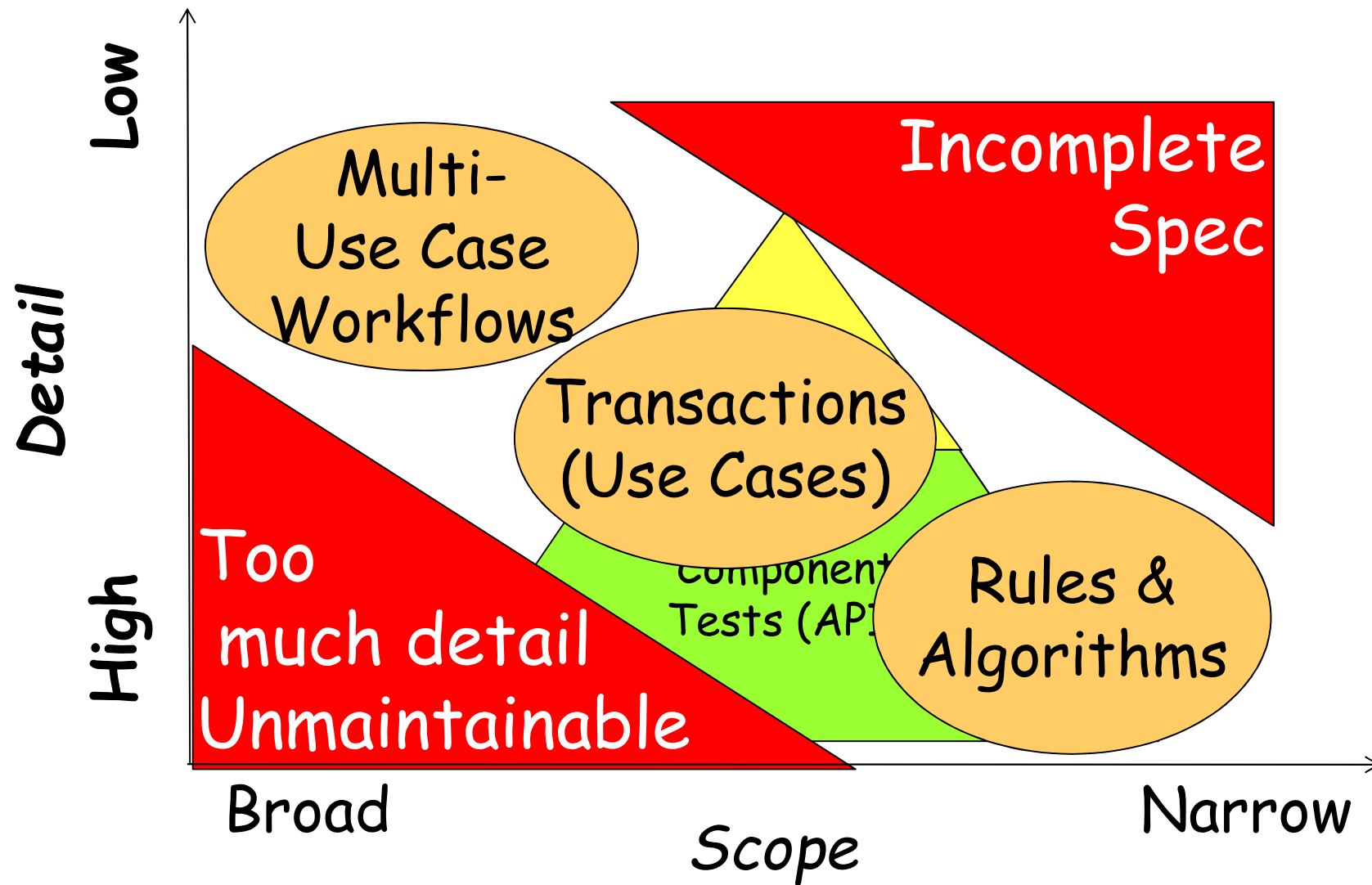




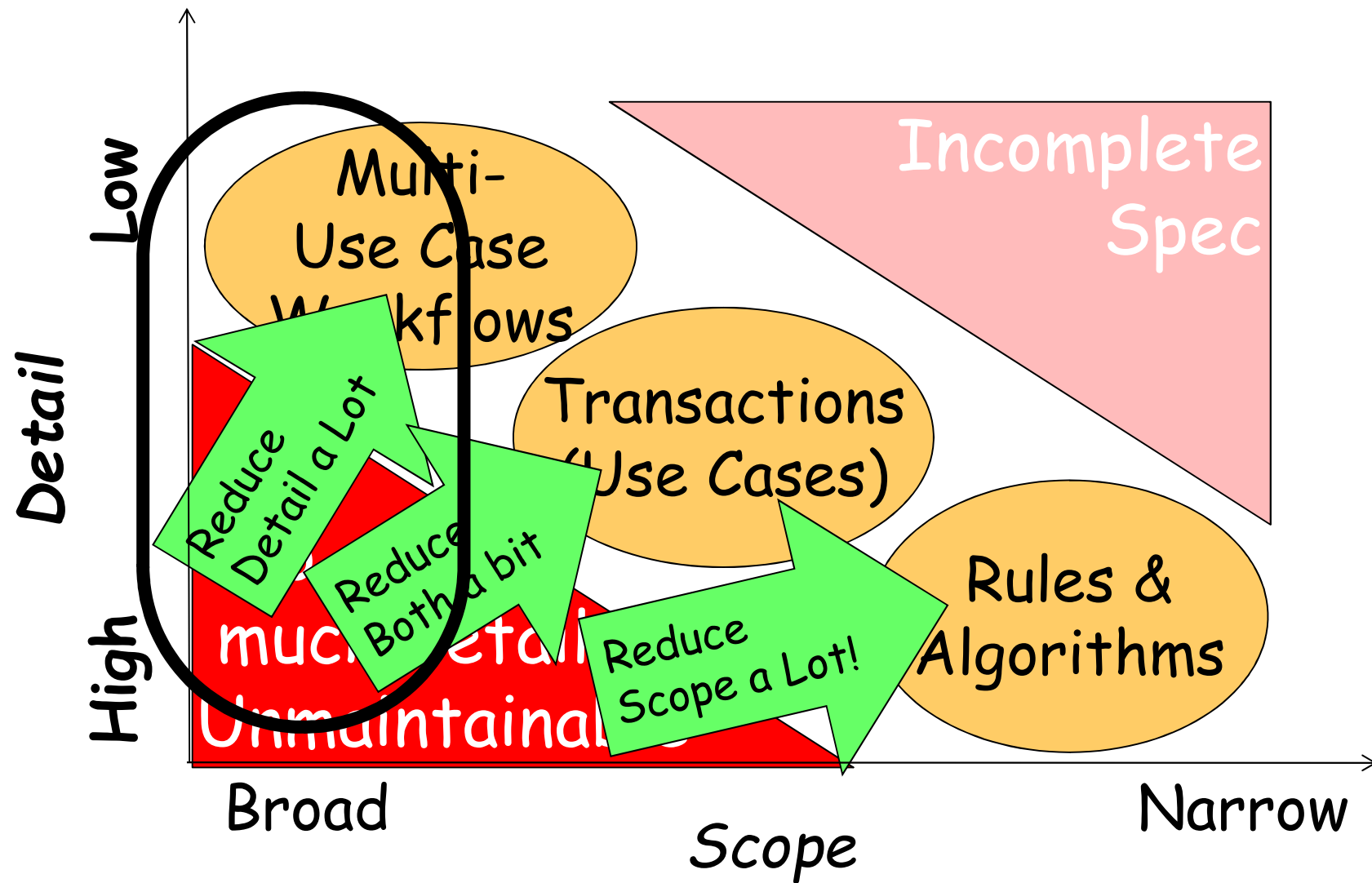
# Behavior Specification at Right Level



# Behavior Specification at Right Level



# Changing Level of Abstraction/Detail



# Refactoring Workflow Example

Customer	bobma	logs in
----------	-------	---------

System lists all available accounts for the authorized customer		
account	type	notifications
10035692877	chequing	disabled
10035692890	savings	disabled
20010928892	credit line	disabled

Given:  
User and Accounts

When:  
Notification  
Rule is Configured

Customer sets notification threshold for	all	transactions from	all	locations to	\$10,000.00	on account	10035692877	via	email	to	bobma@live.com
------------------------------------------	-----	-------------------	-----	--------------	-------------	------------	-------------	-----	-------	----	----------------

ensure	No system messages	
ensure	System log contains	Customer bobma set notification threshold for all transactions from all locations to \$10,000 on account 10035692877"

System lists all available accounts for the authorized customer		
account	type	notifications
10035692877	chequing	enabled
10035692890	savings	disabled
20010928892	credit line	disabled

Notification settings for account 10035692877					
transaction type	location where initiated	threshold amount	via	address	
all	all	\$10,000.00	email	bobma@live.com	

Then:  
Notification Rule  
is Active

# Refactoring Workflow Example

Customer sets notification threshold for	all	transactions from	all	locations to	\$10,000.00	on account	10035692877	via	email	to	bobma@live.com
------------------------------------------	-----	-------------------	-----	--------------	-------------	------------	-------------	-----	-------	----	----------------

"If it isn't essential to conveying the essence of the behavior, it is essential to not include it."

# Refactoring Workflow Example

Time now is	9:30AM, 03/18/2008				
Bank processes	debit	to	10035692877	in the amount of	\$15,000.00
Bank processes	debit	to	10035692877	in the amount of	\$9,000.00
Bank processes	debit	to	10035692877	in the amount of	\$11,000.00
<del>Bank processes</del>	<del>debit</del>	<del>to</del>	<del>20010928892</del>	<del>in the amount of</del>	<del>\$12,000.00</del>
<del>Bank processes</del>	<del>credit</del>	<del>to</del>	<del>10035692877</del>	<del>in the amount of</del>	<del>\$13,000.00</del>
<del>Bank processes</del>	<del>credit</del>	<del>to</del>	<del>10035692877</del>	<del>in the amount of</del>	<del>\$9,999.99</del>
<del>Bank processes</del>	<del>charge</del>	<del>to</del>	<del>10035692877</del>	<del>in the amount of</del>	<del>\$9,999.99</del>
<del>Bank processes</del>	<del>charge</del>	<del>to</del>	<del>10035692877</del>	<del>in the amount of</del>	<del>\$11,000.00</del>

When: The Transactions to be processed

Then: Expected Notifications

New notifications sent to customer	bobma				
type	account	timestamp	amount	via	address
debit	10035692877	9:30AM, 03/18/2012	\$15,000.00	email	bobma@live.com
debit	10035692877	9:30AM, 03/18/2012	\$11,000.00	email	bobma@live.com
<del>credit</del>	<del>10035692877</del>	<del>9:30AM, 03/18/2012</del>	<del>\$13,000.00</del>	<del>email</del>	<del>bobma@live.com</del>
<del>charge</del>	<del>10035692877</del>	<del>9:30AM, 03/18/2012</del>	<del>\$11,000.00</del>	<del>email</del>	<del>bobma@live.com</del>



# Refactoring Workflow Example

Time now is	9:30AM, 03/18/2008				
Bank processes	debit	to	10035692877	in the amount of	\$15,000.00
Bank processes	debit	to	10035692877	in the amount of	\$9,000.00
Bank processes	debit	to	10035692877	in the amount of	\$11,000.00

New notifications sent to customer	bobma				
type	account	timestamp	amount	via	address
debit	10035692877	9:30AM, 03/18/2012	\$15,000.00	email	bobma@live.com
debit	10035692877	9:30AM, 03/18/2012	\$11,000.00	email	bobma@live.com

# Refactoring Workflow Example

Customer sets notification threshold for	all	transactions from	<del>all</del>	<del>locations to</del>	\$10,000.00	on account	10035692877	<del>via email to bobma</del>
------------------------------------------	-----	-------------------	----------------	-------------------------	-------------	------------	-------------	-------------------------------

Time now is	9:30AM, 03/18/2008				
Bank processes	debit	to	10035692877	in the amount of	\$15,000.00
Bank processes	debit	to	10035692877	in the amount of	\$9,000.00
Bank processes	debit	to	10035692877	in the amount of	\$11,000.00

New notifications sent to customer		bobma			
type	account	timestamp	amount	via	address
debit	10035692877	9:30AM, 03/18/2012	\$15,000.00	<del>email</del>	<del>bobma@live.com</del>
debit	10035692877	9:30AM, 03/18/2012	\$11,000.00	<del>email</del>	<del>bobma@live.com</del>



# Refactoring Workflow Example

Given:  
User &  
Thresholds

Time now is	9:00AM, 03/18/2008				
Customer	bobma	sets notification threshold to	\$10,000.00	for <b>all</b> transactions	to 10035692877

Time now is	9:30AM, 03/18/2008				
Bank processes	dedit	to	10035692877	in the amount of	<b>\$15,000.00</b>
Bank processes	debit	to	10035692877	in the amount of	<b>\$9,000.00</b>
Bank processes	dedit	to	10035692877	in the amount of	<b>\$11,000.00</b>

When:  
Transactions  
Are Processed

New notifications sent to customer	bobma		
type	account	timestamp	amount
dedit	10035692877	9:30AM, 03/18/2008	<b>\$15,000.00</b>
dedit	10035692877	9:30AM, 03/18/2008	<b>\$11,000.00</b>

Then:  
We Expect  
Notifications

# Refactoring Workflow Example

Given:  
User &  
Thresholds

Time now is	9:00AM, 03/18/2008			
Customer	bobma	sets notification threshold to	\$10,000.00	for all transactions to 10035692877

Time now is	9:30AM, 03/18/2008			
Bank processes	debit	to 10035692877	in the amount of	\$15,000.00
Bank processes	debit	to 10035692877	in the amount of	\$9,000.00
Bank processes	credit	to 10035692877	in the amount of	\$11,000.00
Bank processes	debit	to 9991113333	in the amount of	\$11,000.00

When:  
Transactions  
Are Processed

New notifications sent to customer		bobma		
type		account	timestamp	amount
debit		10035692877	9:30AM, 03/18/2008	\$15,000.00
credit		10035692877	9:30AM, 03/18/2008	\$11,000.00

Then:  
We Expect  
Notifications

# Refactoring Workflow Example

Given:  
User &  
Thresholds

Time now is	9:00AM, 03/18/2008			
Customer	bobma	sets notification threshold to	\$10,000.00	for all transactions to 10035692877

Time now is	9:30AM, 03/18/2008			
Bank processes	debit	to 10035692877	in the amount of	\$15,000.00
Bank processes	debit	to 10035692877	in the amount of	\$9,000.00
Bank processes	credit	to 10035692877	in the amount of	\$11,000.00
Bank processes	debit	to 9991113333	in the amount of	\$11,000.00

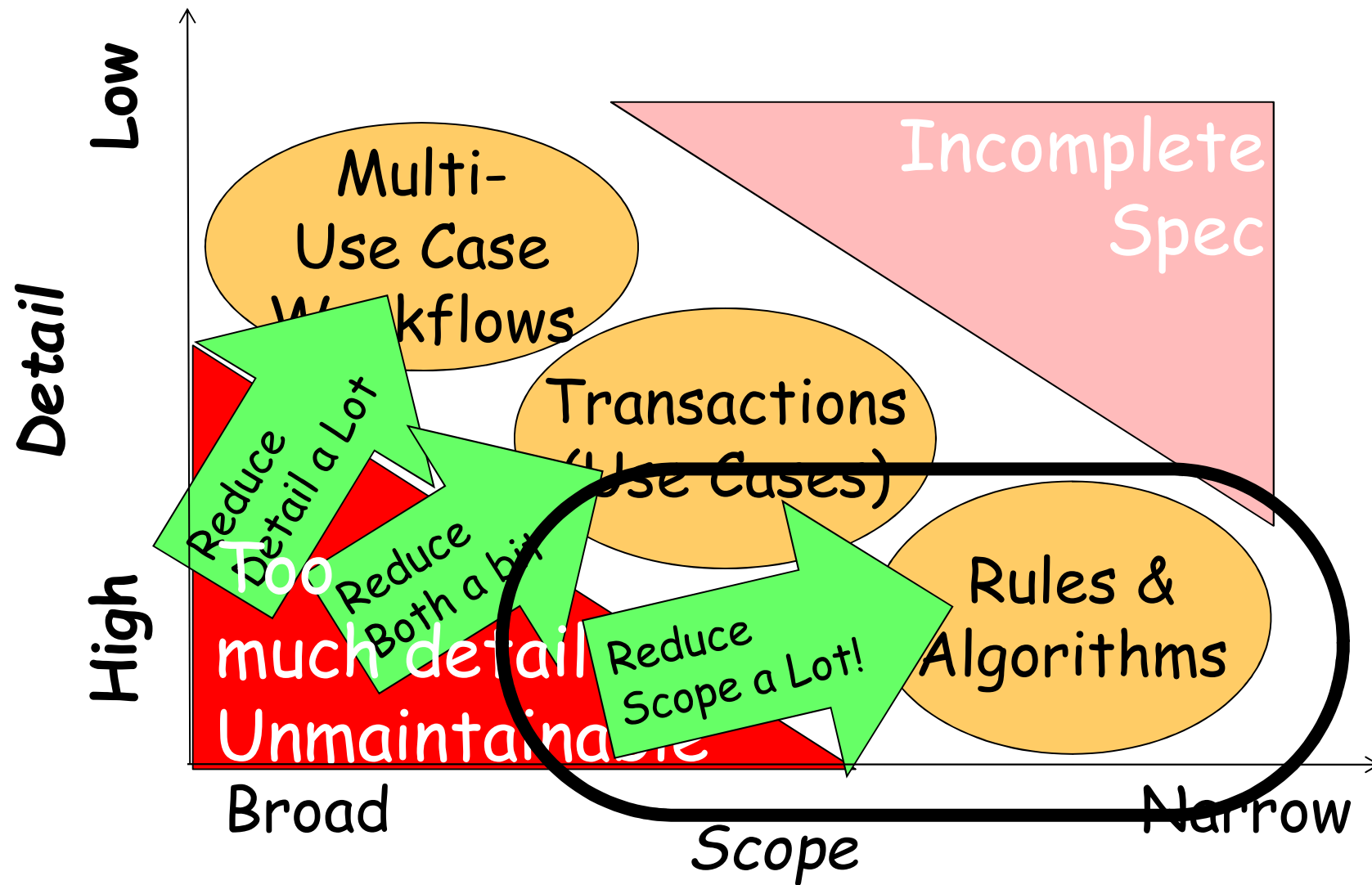
When:  
Transactions  
Are Processed

New notifications sent to customer bobma				
type	account	timestamp	amount	
debit	10035692877	9:30AM, 03/18/2008	\$15,000.00	
credit	10035692877	9:30AM, 03/18/2008	\$11,000.00	

Broad Scope (*Multi-Actor*);  
Minimum Detail (*per Actor/Transaction*);

Then:  
We Expect  
Notifications

# Filling in the Details





# Business Rule Example

## Threshold per Charge Type

### Configuration

CustomerAccounts			
Customer	Account	Label	Added()
bobma	100372	Checking	

CustomerThresholds				
Customer	Account	Charge Type	Threshold	Added()
bobma	100372	ALL	10,000	OK
bobma	100372	Travel	1,000	OK
bobma	100372	Restaurant	100	OK
bobma	100372	Groceries	264.23	OK

### Process Transaction

NotificationRequired   bobma			
Account	Charge Type	Amount	Notify?
100372	Travel	999.99	No
100372	Travel	1,000.00	Yes
100372	Restaurant	99.99	No
100372	Restaurant	100.00	Yes
100372	Groceries	264.22	No
100372	Groceries	264.23	Yes
100372	Other	9.999.99	No
100372	Other	10,000.00	Yes

Example:

## Business Rule Example

Threshold per Charge Type

When we ask  
NotificationRequired?  
with this transaction:

### Configuration

Given these  
rules

CustomerAccounts			
Customer	Account	Label	Added()
bobma	100372	Checking	

CustomerThresholds				
Customer	Account	Charge Type	Threshold	Added()
bobma	100372	ALL	10,000	OK
bobma	100372	Travel	1,000	OK
bobma	100372	Restaurant	100	OK
bobma	100372	Groceries	264.23	OK

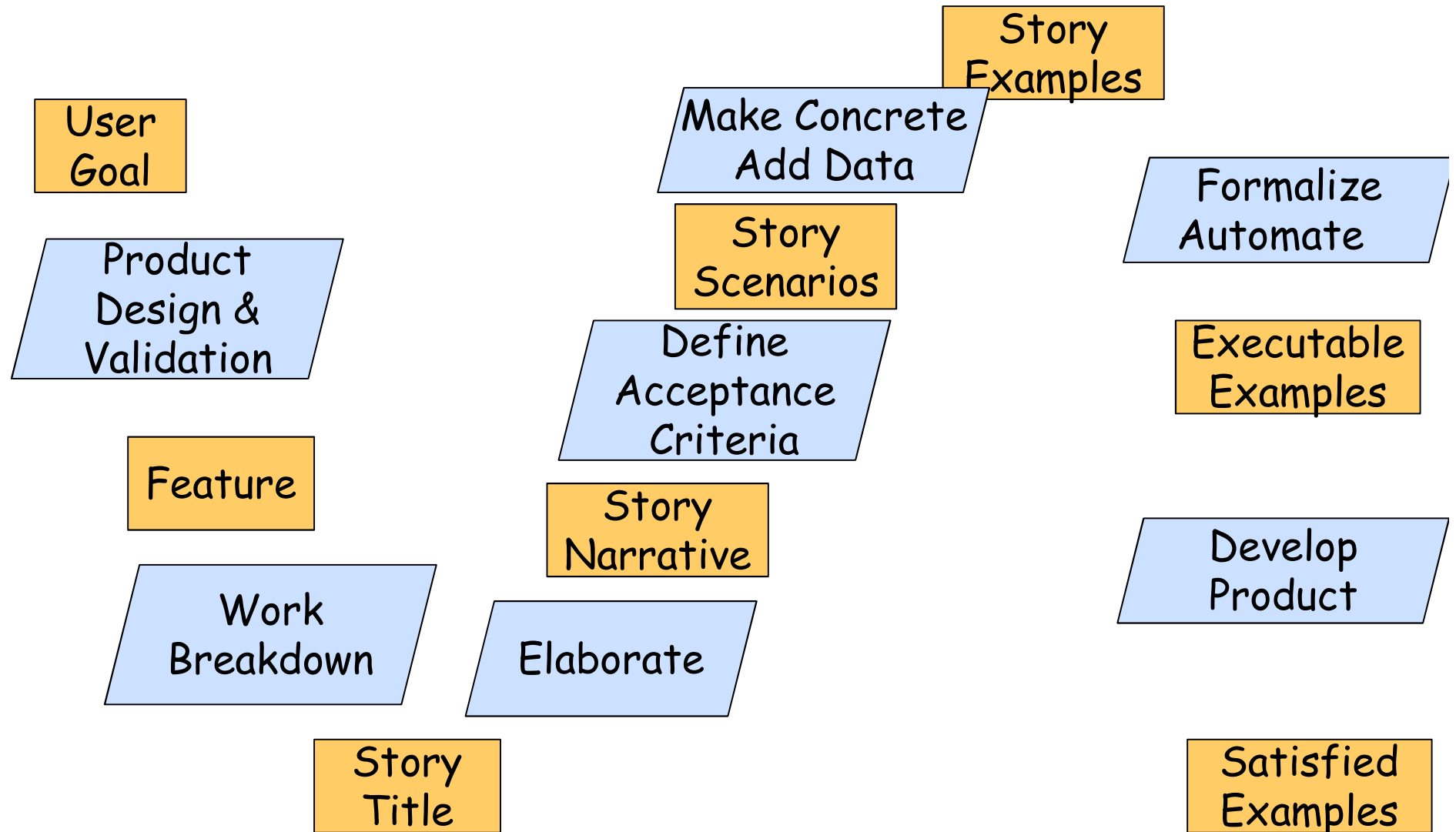
### Process Transaction

NotificationRequired		bobma	
Account	Charge Type	Amount	Notify?
100372	Travel	999.99	No
100372	Travel	1,000.00	Yes
100372	Restaurant	99.99	No
100372	Restaurant	100.00	Yes
100372	Groceries	264.22	No
100372	Groceries	264.23	
100372	Other	9.999.99	
100372	Other	10,000.00	

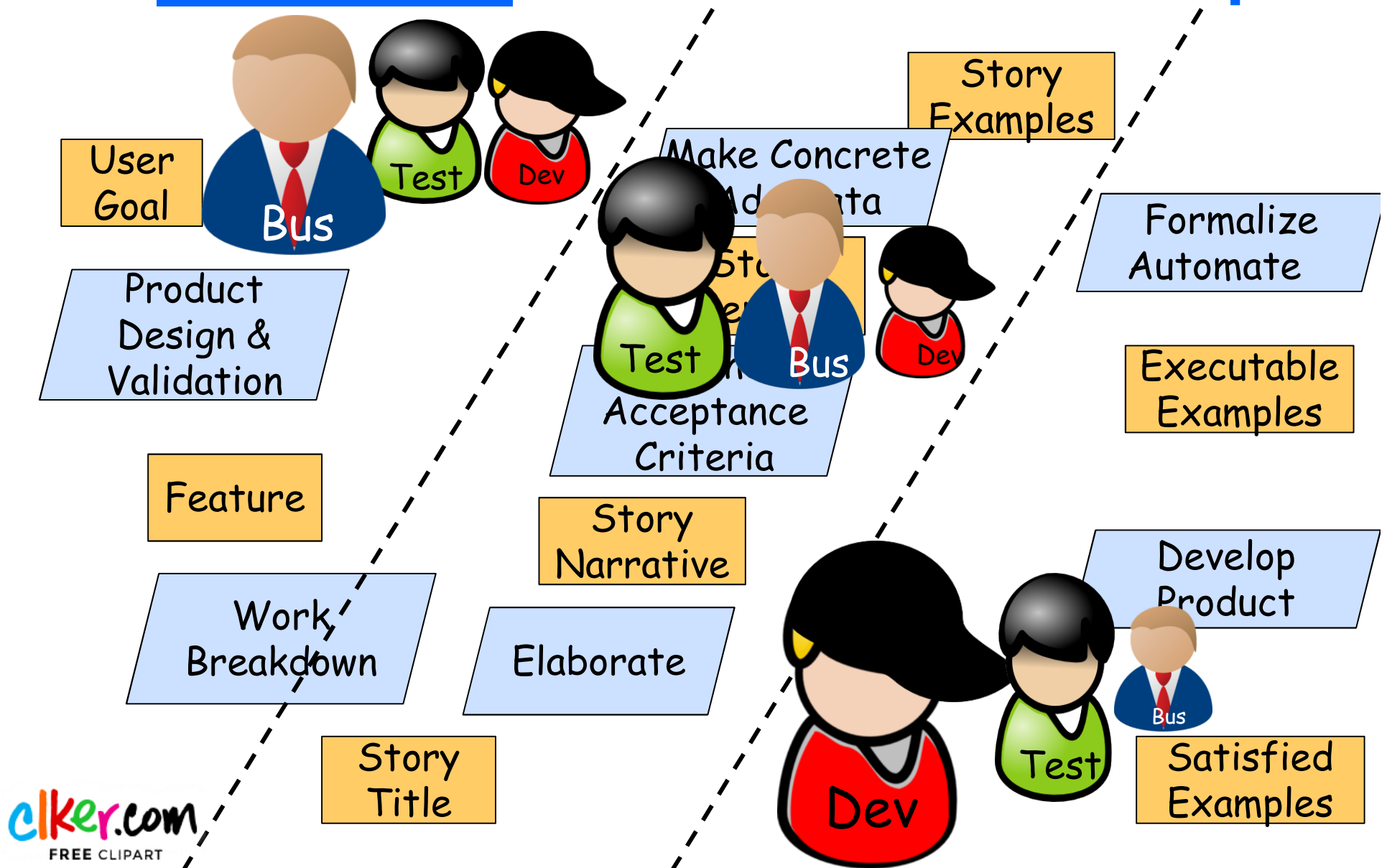
Narrow Scope (Single Rule)  
High Detail (Everything that matters)

Then: The  
answer should be

# Each Life Cycle of an Example

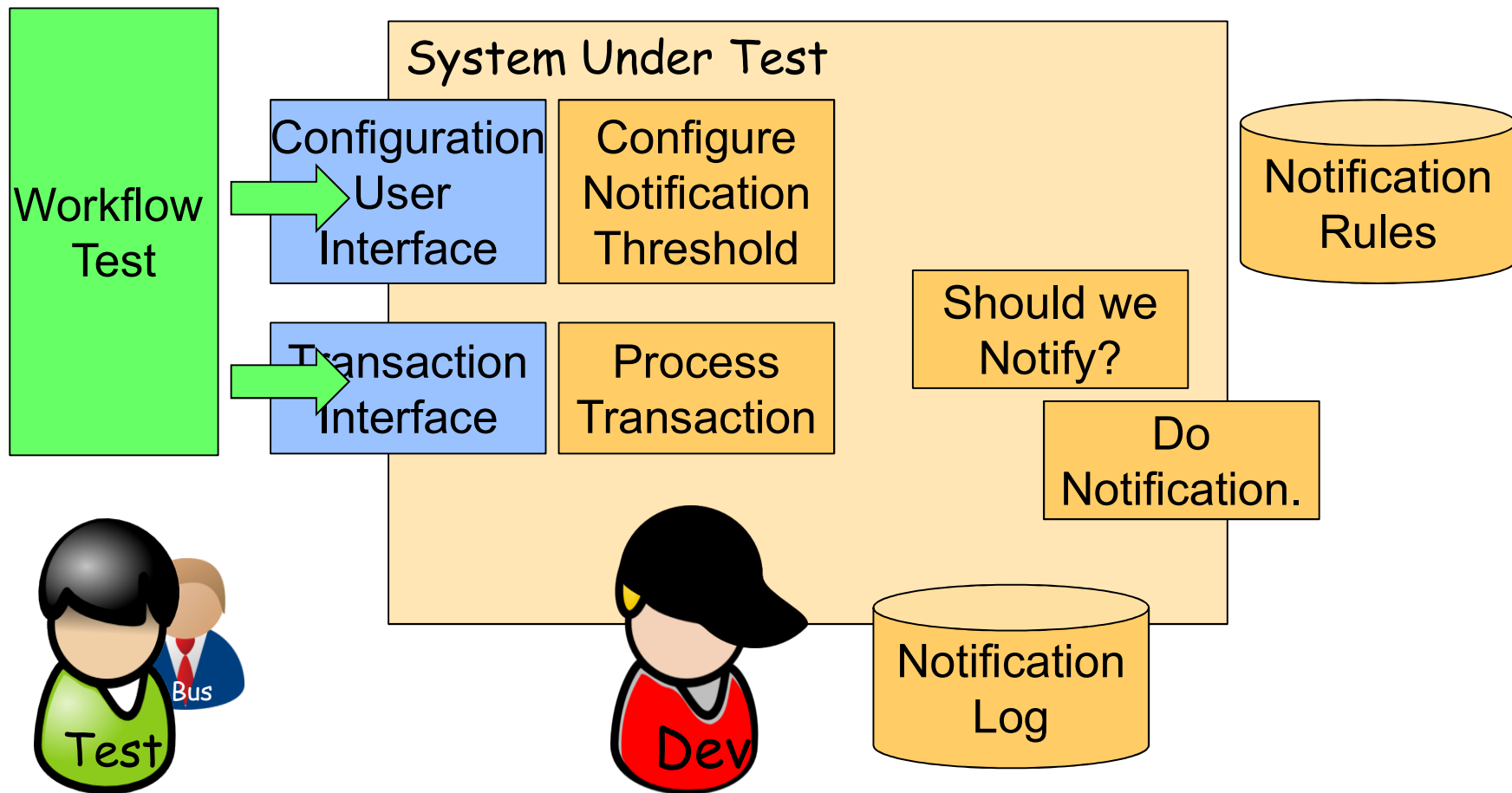


# Who Does Activities on an Example

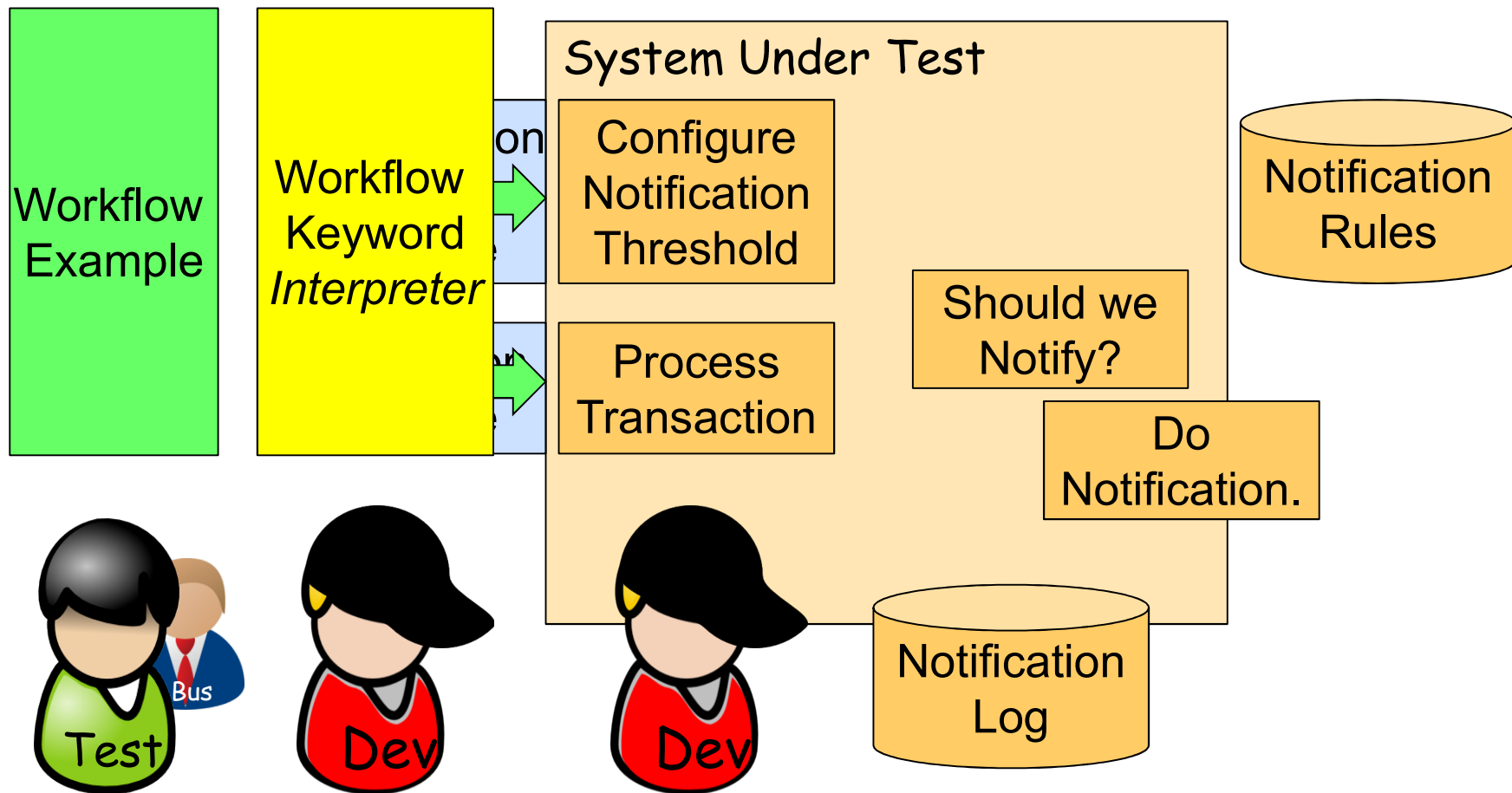




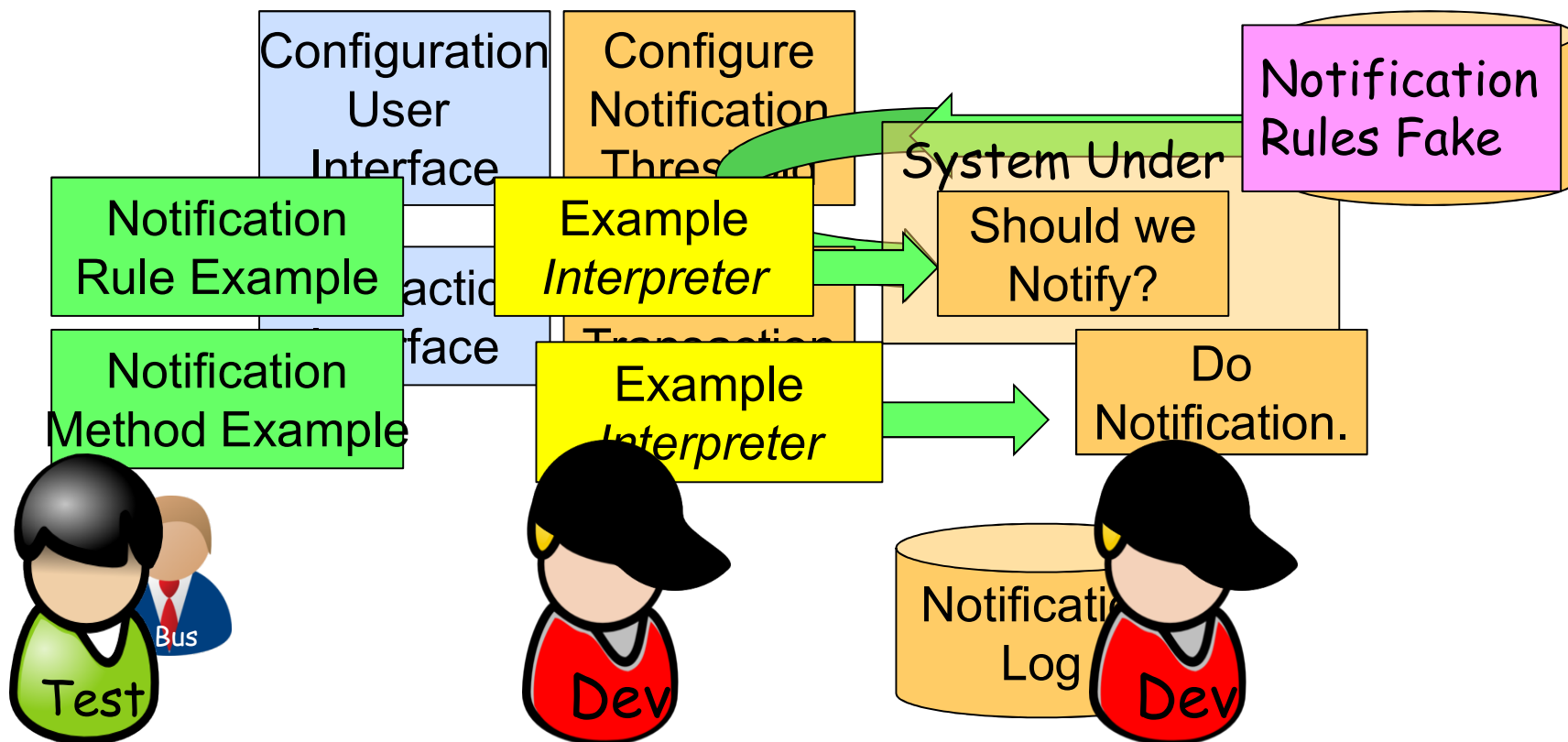
# Test-After Architecture



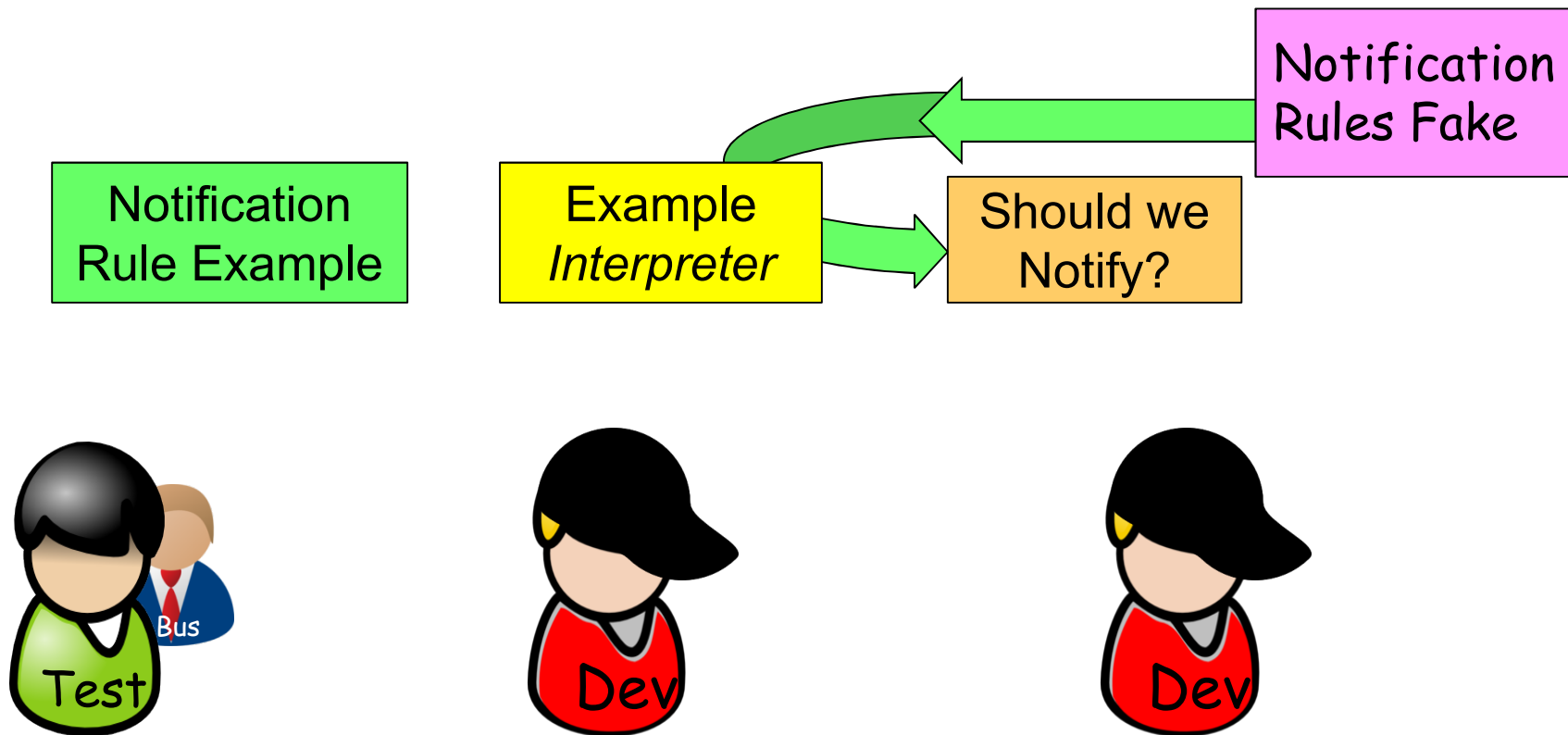
# Example-Driven Architecture



# EDA – Business Rules



# EDA – Business Rules



*"Strategy without tools is  
the slowest route to victory.*

*Tools without Strategy is  
the noise before defeat."*

*Sun Tzu*

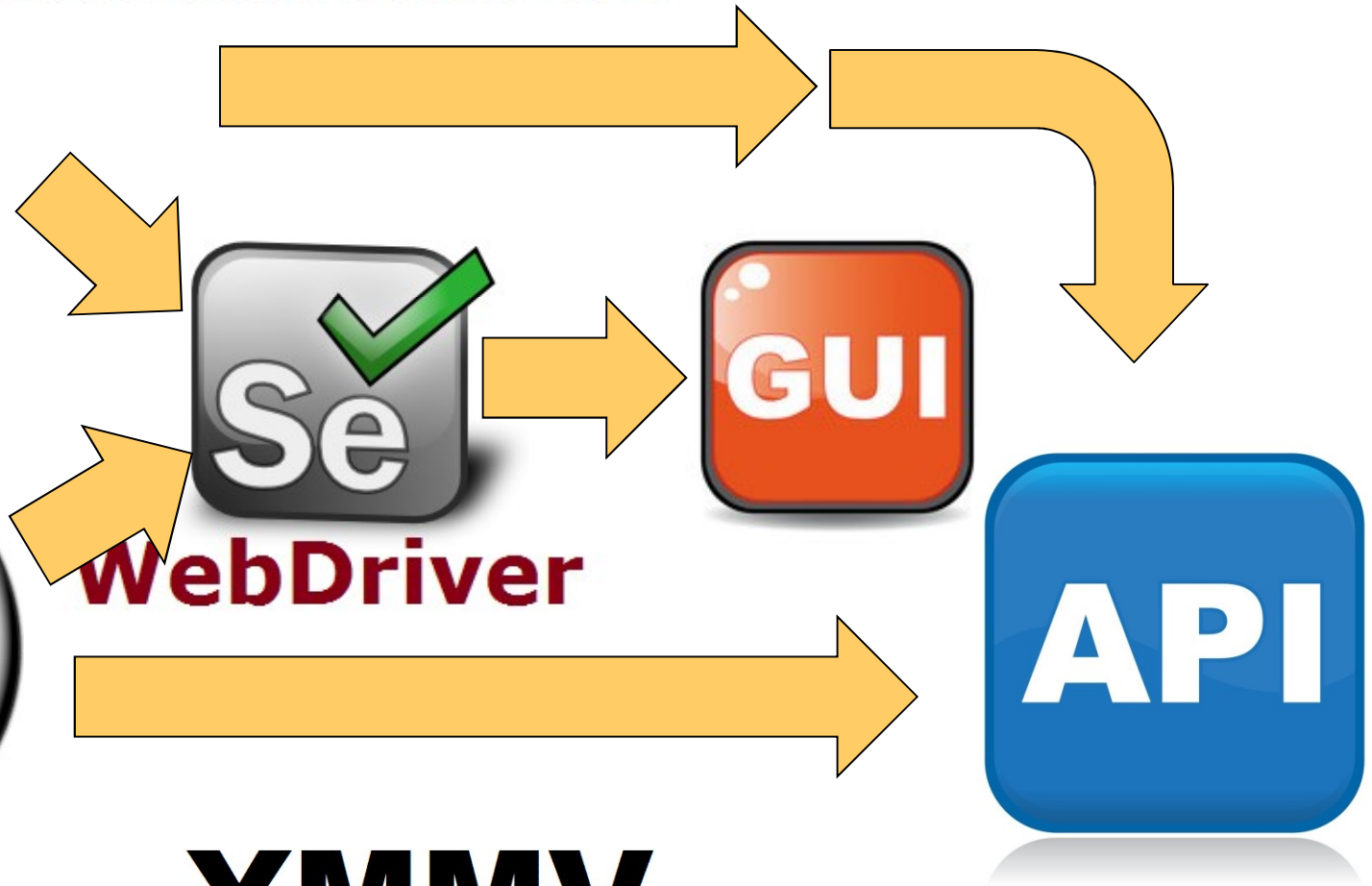
*As adapted by  
Gerard Meszaros*



# Tools

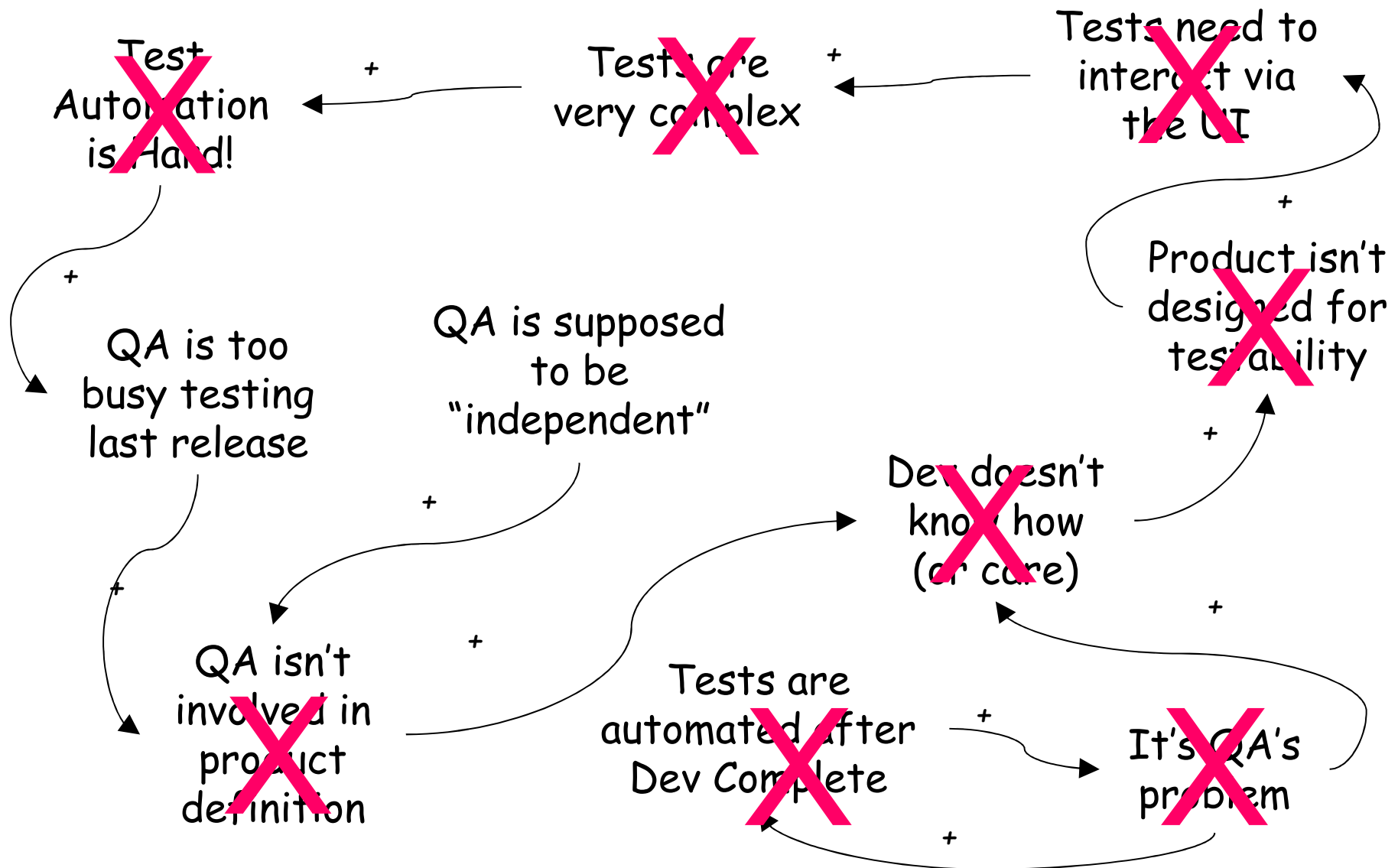
## robotframework

A generic test automation framework

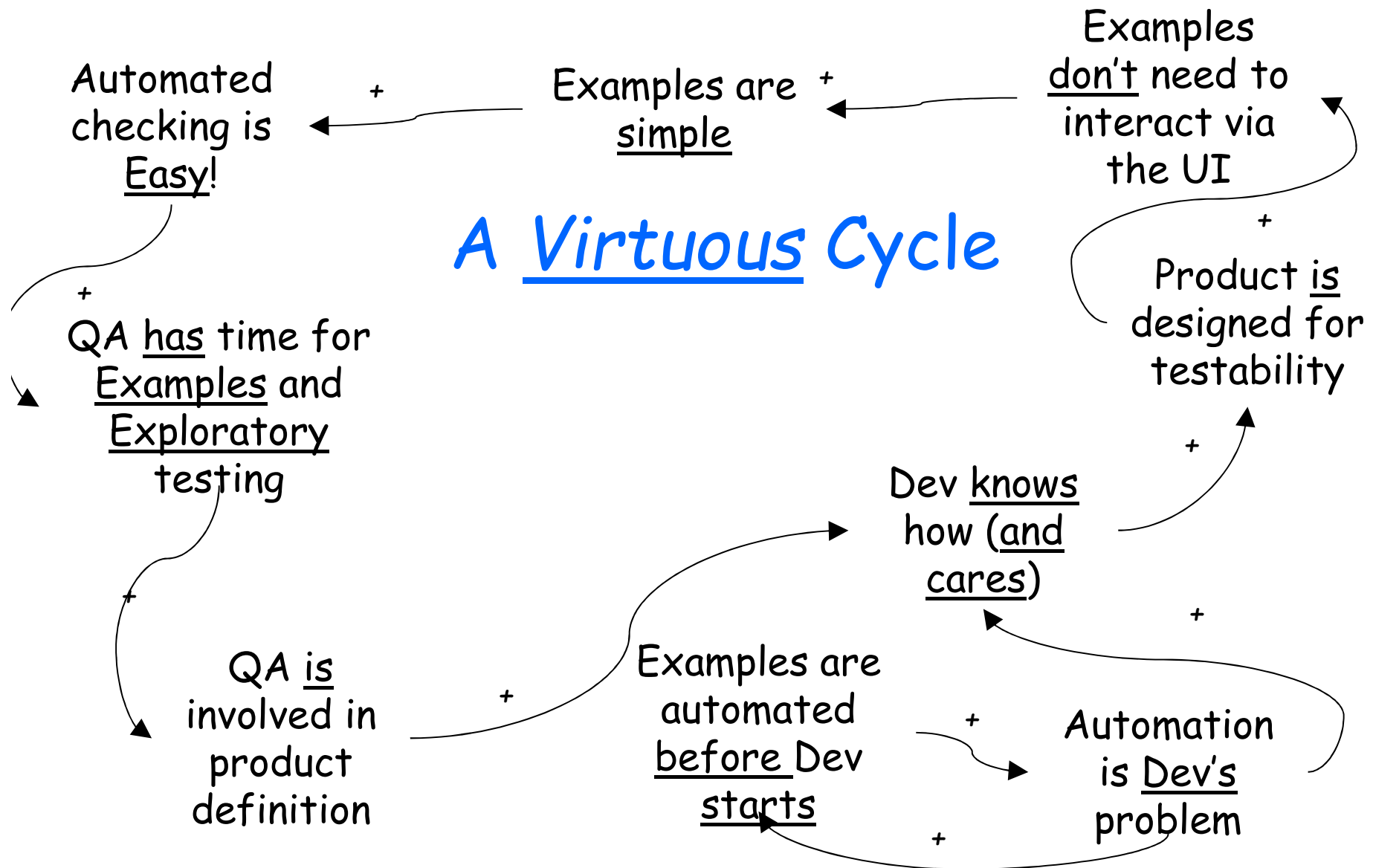


**YMMV**  
*Your Mileage May Vary*

## After State – Back to Our Systems Diagram



## After State – Back to Our Systems Diagram



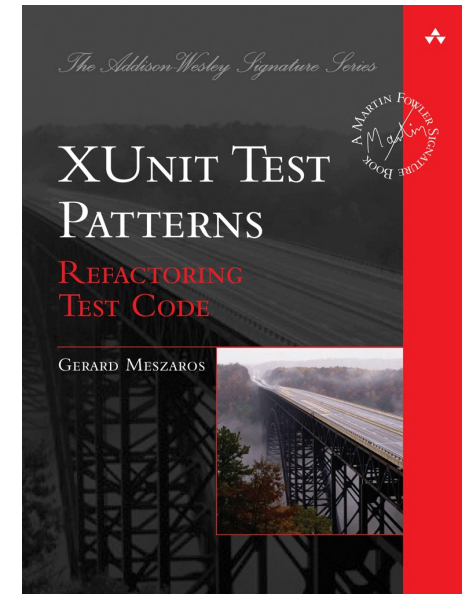


# Thank You!

**Gerard Meszaros**

**singapore2016@gerardm.com**

**<http://www.xunitpatterns.com>**



**Jolt Productivity Award  
winner - Technical Books**

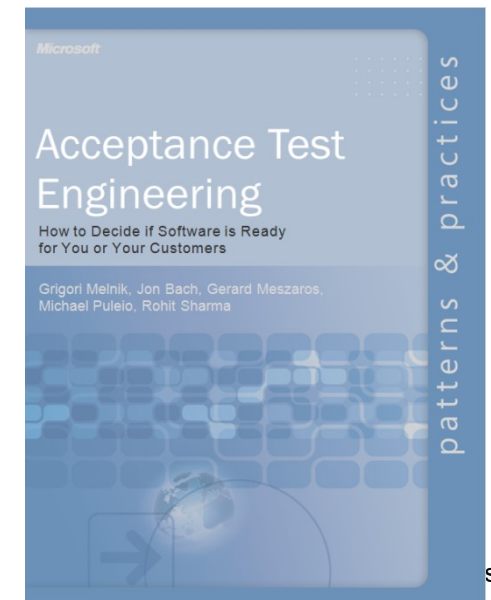
**Slides:**

**<http://singapore2016.testAutomationpatterns.com>**

**Call me when you:**

- **Want to transition to Agile or Lean**
- **Want to do Agile or Lean better**
- **Want to teach developers how to test**
- **Need help with test automation strategy**
- **Want to improve your test automation**

**Available on MSDN:**



---

# Tools Selection

- **Tools must support the strategy**
  - Support business/testers to write specs/tests in business language
    - » **More or less “natural” language**
  - Let them write specs *before* the specs are automated or the system is built
    - » **This disqualifies Capture & Replay tools**
  - Can be automated by technical people, later
    - » **Separation of business skills from technical skills**
    - » **e.g. Table or Keyword-based tools**
  - Can be run by anyone, especially developers
    - » **This disqualifies expensive tester-specific tools**

---

# Business Rules Tools - A Sampling

- **Fit**
  - Column Fixture
- **SLIM (Fittesse)**
  - Decision Table
- **Robot Framework**
  - Parameterized Testcase

---

# Workflow Spec Tools (my fav's)

- **Gherkin (Given-When-Then terminology)**
  - Cucumber (various tech-specific implementations)
  - JBehave (Java/JVM specific)
  - SpecFlow (.Net)
- **Other GWT (Given-When-Then terminology)**
  - Robot Framework GWT
    - » <https://blog.codecentric.de/en/2009/11/givenwhenthen-and-example-tables-using-the-robot-framework/>
- **Robot Framework**
  - Keyword-based Testcases

Resource: Agile Alliance Functional Testing Tools program

---

# More Complete Survey of Tools

- **Agile Alliance Functional Testing Tools program Yahoo! group**
  - <https://groups.yahoo.com/neo/groups/aa-fft/info>
- **Agile Alliance Functional Testing Tools spreadsheet**
  - [https://docs.google.com/spreadsheet/ccc?key=0Apag\\_J97l3CTdHR0WS1sZGFVaFA0dEpXYWRqLXBxV3c#gid=1](https://docs.google.com/spreadsheet/ccc?key=0Apag_J97l3CTdHR0WS1sZGFVaFA0dEpXYWRqLXBxV3c#gid=1)