# Addressing Non-Functional Requirements with Agile Practices

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# Who Am I?

- Independent senior consultant
  - Software architecture
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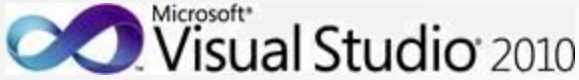


# Agenda

1. Non-functional requirements
   - External and internal quality
2. Functional requirements and agile framework
   - User Story and scenario
3. Non-functional requirements and agile framework
   - Improve external quality using expectations
   - Ensure internal quality using sound engineering practices

# Non-Functional Requirements

## What are they?

- Specify "how well" the "what" must behave
  - Not about new features to deliver, but rather about desirable characteristics of existing features
  - Set constraints that typically cut across functional requirements
- Also known as "technical requirements", “quality attributes” or "quality of service requirements“

# Non-Functional Requirements

## It is all about quality

- Can be divided into two main categories:
  1. **External quality** such as performance, correctness, security and usability, which carry out the software's functions at run time, and as such, is not only visible by stakeholders but also highly desirable
  2. **Internal quality** such as maintainability, modifiability and testability, which is barely visible by stakeholders but simplify how to build the software

# Non-Functional Requirements

## Knowledge is not experience

- I do not intend to tell you how to satisfy the many non-functional requirements
  - It is a skill that one acquires with experience

# Non-Functional Requirements

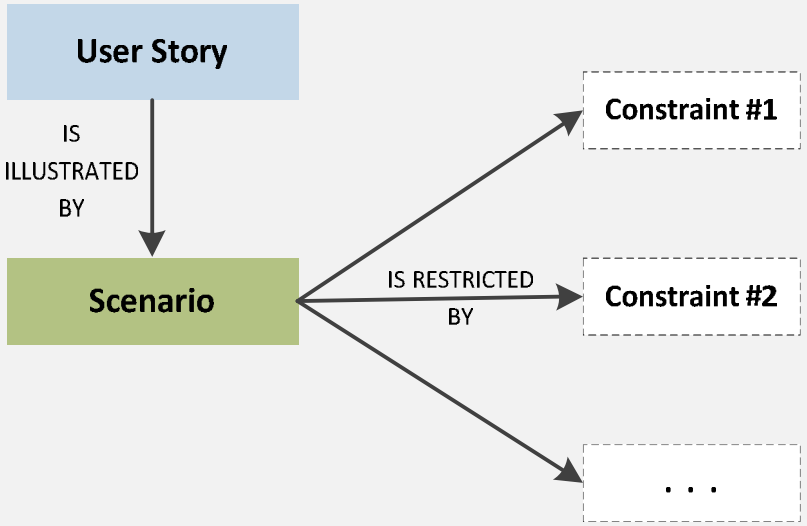
## I aim for a simpler goal

- I will explain how to translate non-functional requirements into constraints
  - Constraints set a limit to comply with
  - Constraints guide your work
  - Constraints help determine whether you have satisfied the non-functional requirements

# Non-Functional Requirements

## Need to review functional requirements

- Constraints weave through the functional requirements



# Functional Requirements

## Express goals with user stories

- A user story is a short description written in everyday language that represents a discrete piece of demonstrable functionality
  - It is a desirable outcome by stakeholders
- Classic template
  - “As a < **role**>, I want <**goal**> so that <**benefit**>”

# Functional Requirements

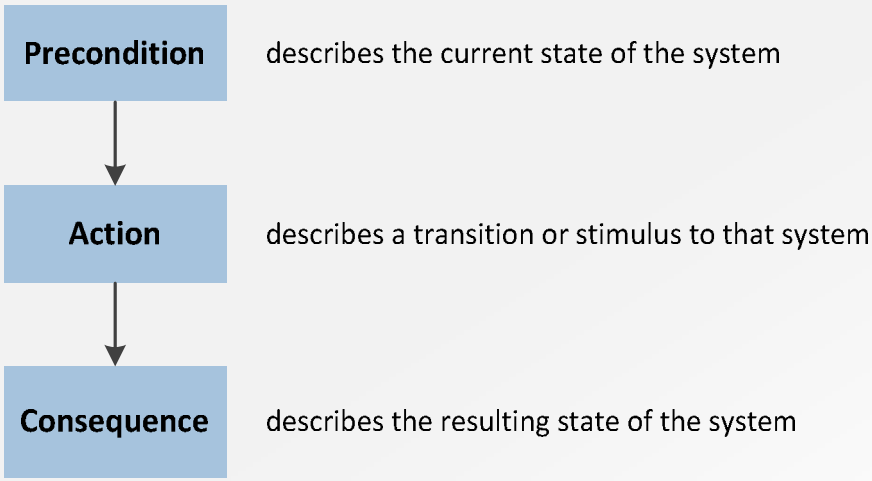
## Example: User stories for a Transit Authority

- As a <**student**>, I want <**to buy a pass valid only on school days**> so that I can <**go to school**>
- As a <**worker**>, I want <**to buy a monthly pass**> so that I can <**go to work**>

# Functional Requirements

## Illustrate User Story with scenarios

- A scenario is a concrete example written in everyday language
- It describes a significant exercise that is required for the fulfillment of a user story



# Functional Requirements

## Confirm success criteria with scenarios

- Scenarios establish the conditions of acceptation
- Scenarios are concrete examples that says in the words of the stakeholders how they plan to verify the desirable outcome
- Scenarios enables the team to know when they are done
- Scenarios are a specification as important, if not more important, than stories

# Functional Requirements

## Express scenarios with formality

**Given** one precondition
  **And** another precondition
  **And** yet another precondition
**When** an action occurs
**Then** a consequence
  **And** another consequence

# Functional Requirements

## Express scenarios with formality

**Given** an empty shopping cart is created

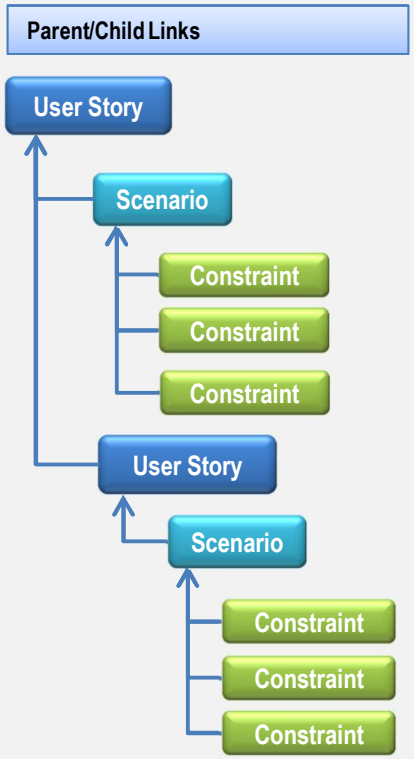
**And** a monthly student pass is added to shopping cart

**When** buyer checkout the shopping cart

**Then** a 76 dollars sale occurred

# Functional Requirements

## Store requirements in a database




Create a web
of
interconnected small pieces
of
requirements

# Non-Functional Requirements

## Two categories of constraint

- External quality
  - **Expectations** impose conditions that sets a limit to comply during software execution
- Internal quality
  - **Practices** ensure that the software construction is done correctly

# External Quality

## What is it?

| Non-Functional Requirement | Definition |
|---|---|
| Correctness | Ability with which the software respects the specification. |
| Performance | Ease with which the software is doing the work it is supposed to do. Usually it is measured as a response time or a throughput. |
| Reliability | Ability with which the software performs its required functions under stated conditions for a specified period of time. |
| Robustness | Ability with which the software copes with errors during execution. |
| Scalability | Ability with which the software handles growing amounts of work in a graceful manner. |
| Security | Degree to which the software protects against threats. |
| Usability | Ease with which the software can be used by specified users to achieve measurable goals. |

# External Quality

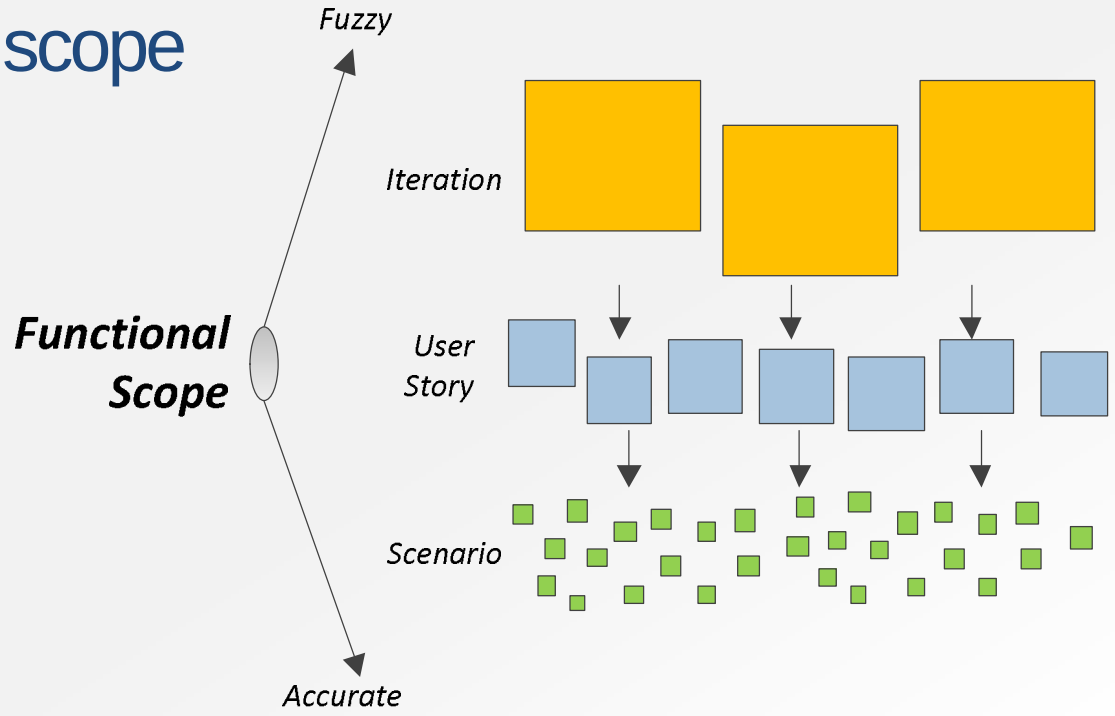
## Expectations should be SMART

- **S**pecific
  - It should target a piece of functionality that is small, consistent and simple
- **M**easurable
  - It imposes a limit that is measurable, otherwise how would you know when you've addressed it
- **A**ttainable
  - It is recognized as achievable by the team
- **R**elevant
  - It is directly related, connected, and pertinent to the non-functional requirement
- **T**raceable
  - It is linked with a requirement and a target that justifies why it exists

# Expectation

## The most important element is the ‘measure’

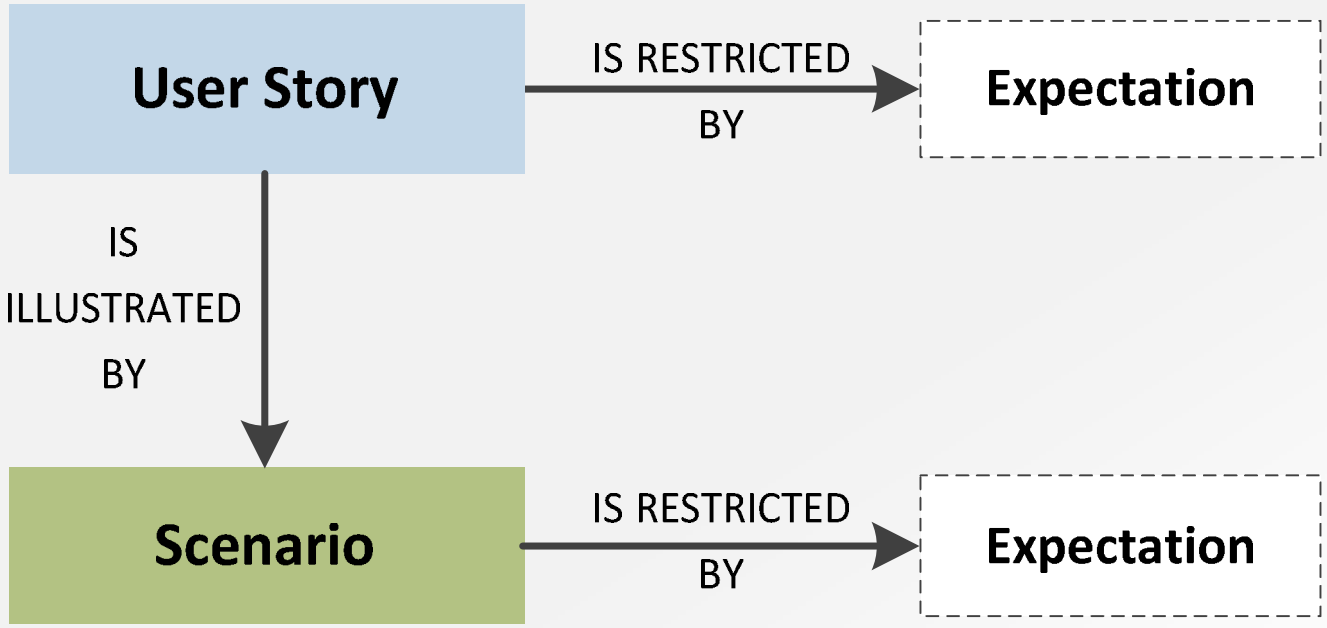
- Easier to express if you
  - Reduce the scale of what needs to be measured
  - Reduce functional scope



# Expectation

## Reduce the functional scope to a scenario

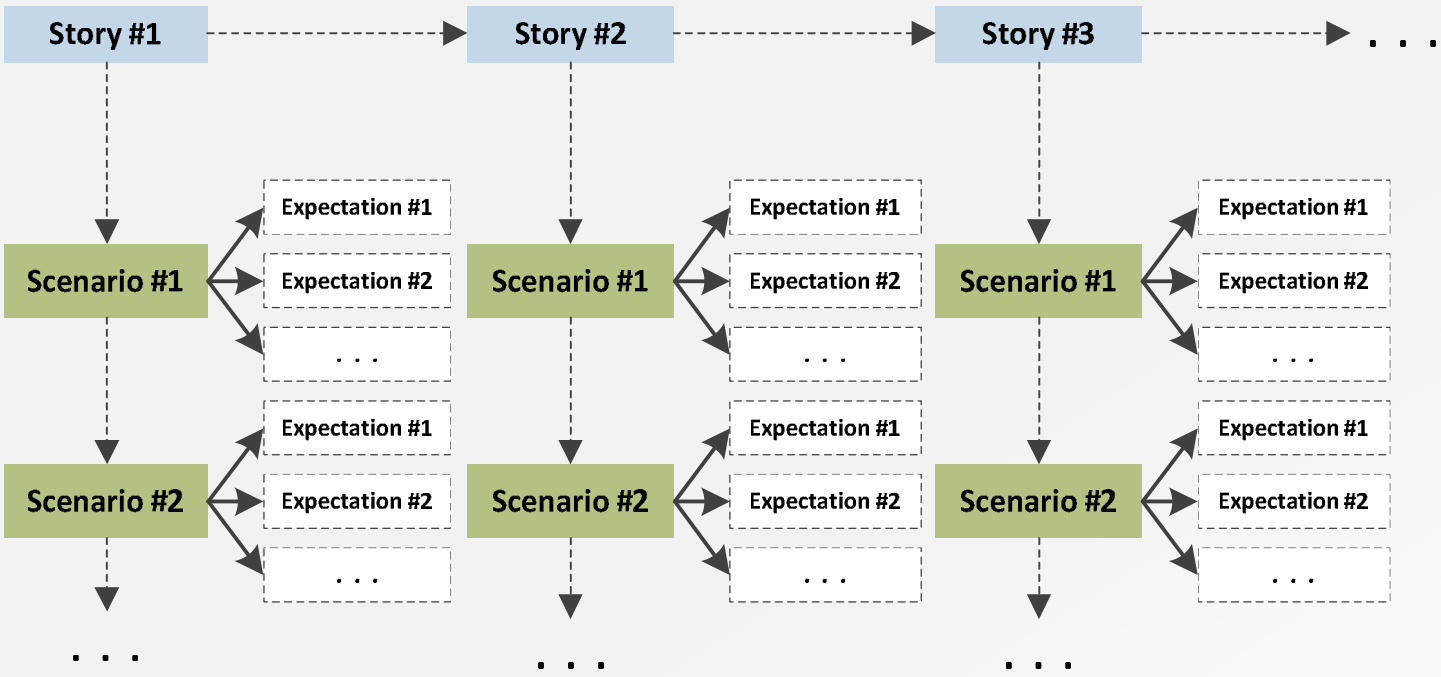
- An expectation is addressed side by side with its linked functional scope



# Expectation

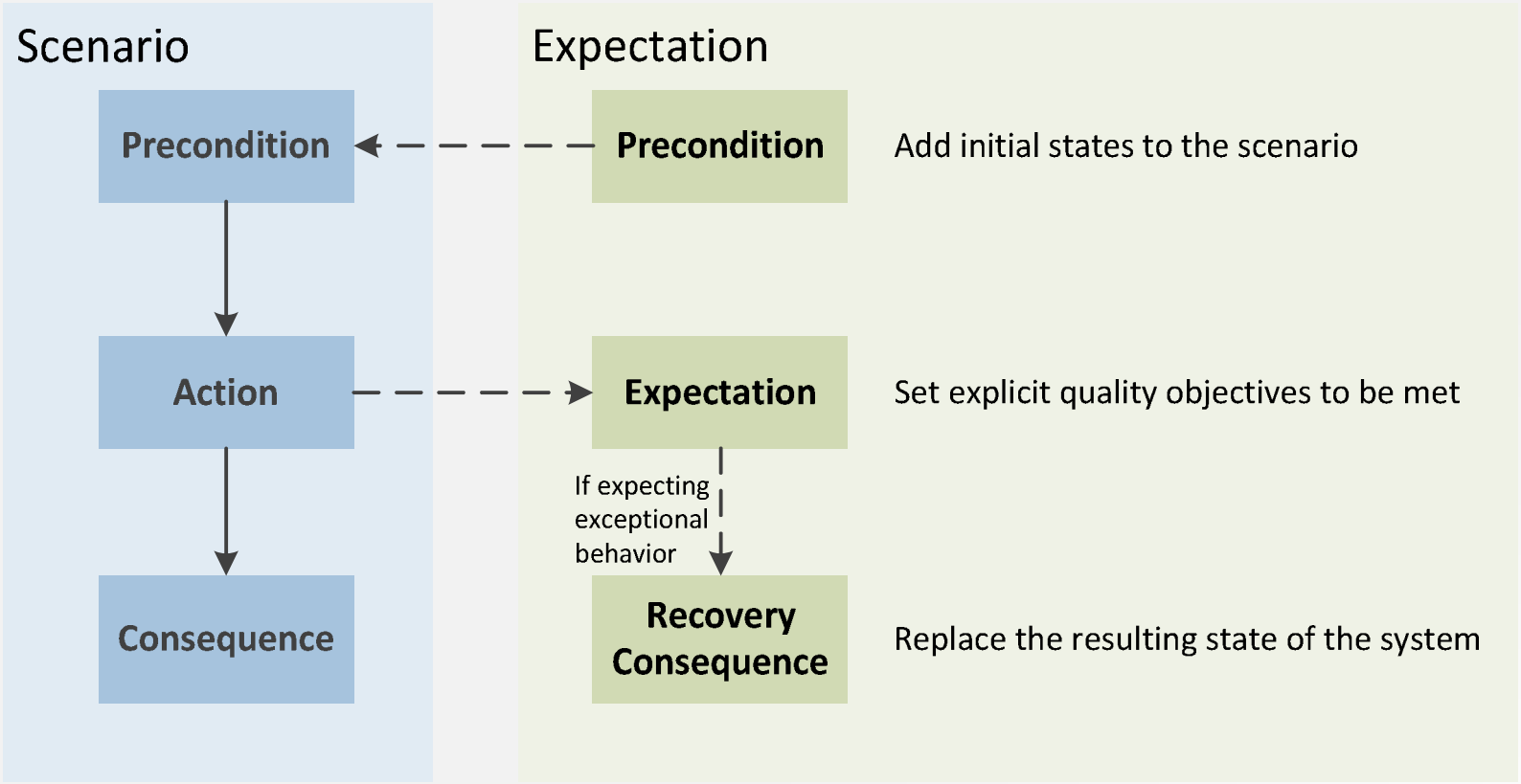
## Reduce the functional scope to a scenario

- Linking expectations with scenarios is a processed repeated story after story



# Expectation

## Set Explicit Quality Objectives



# Expectation

## Set expectations with formality

**Given** one precondition
  **And** another precondition
  **And** yet another precondition
**Expect** a quality objective
**Then** a consequence
  **And** another consequence

# Expectation

## Set expectations with formality

**Scenario**

Given buyer is a student
When buyer request the list of transit fares
Then

| Id | Name | Price |
|---|---|---|
| 002 | Student Monthly Pass | 76 |
| 100 | One Day Pass | 6 |
| 202 | Student Booklet of 10 Single tickets | 15 |
| | | 15 |

**Expect** response time less than 5 seconds

# Expectation

## Set positive expectations (Happy path)

**Scenario**

Given buyer is a student
When buyer request the list of transit fares
Then

| Id | Name | Price |
|---|---|---|
| 002 | Student Monthly Pass | 76 |
| 100 | One Day Pass | 6 |
| 202 | Student Booklet of 10 Single tickets | 15 |
| | | 15 |

**Given** buyer is logged in

**Expect** buyer to be authenticated positively

# Expectation

## Set negative expectations

**Scenario**

Given buyer is a student

When buyer request the list of transit fares

Then

| Id | Name | Price |
|---|---|---|
| 002 | Student Monthly Pass | 76 |
| 100 | One Day Pass | 6 |
| 202 | Student Booklet of 10 Single tickets | 15 |

**Given** buyer is not logged in

**Expect** buyer to be authenticated negatively

**Then** event is saved in security database and user is redirected to “Login” page

# Expectation

## Omit implicit expectations

**Scenario**

Given buyer is a student
When buyer request the list of transit fares
Then

| Id | Name | Price |
|---|---|---|
| 002 | Student Monthly Pass | 76 |
| 100 | One Day Pass | 6 |
| 202 | Student Booklet of 10 Single tickets | 15 |
| | | 15 |

**Given** the server is down

**Expect** the query to return 0 transit fare

**Then** user is redirected to “Server unavailable. Please try later” page

# Expectation

## Specific for one scenario

**Set expectations with measurable quality objectives**

**Given** 10 different users accomplished the scenario

**Expect** 8 users to complete the scenario with success

# Expectation

## Specific for one user story

**“As a user, I want to log in so that I can do transaction”**

**Given** 10,000 buyers are logged in

**And** new user is not logged in

**Expect** new user to be unable to complete the story

**Then** new user is redirected to “Server unavailable. Please try later” page

# External Quality

## Test Expectations with Proven Practices

- **Accessibility:** Verify visual impairments, mobility difficulty, hearing inability and cognitive disabilities
- **Correctness**: Determine if the software respects the specification (Acceptance testing)
- **Performance**: Measure response time and inspect throughput
- **Reliability**: Seek for extraordinary resource consumption over a specified period of time (memory, CPU, disk space)

# External Quality

## Test Expectations with Proven Practices

- **Robustness**: Determine ability of the software to function correctly in the presence of invalid inputs or stressful environmental conditions
- **Scalability**: Verify software behavior under both normal and anticipated peak load conditions (Load testing)
- **Security**: Perform intrusion detection and vulnerability scanning
- **Usability**: Conduct heuristic evaluation, consistency inspection and activity analysis to verify if users achieve specified goals

# External Quality

## Less is more

- Negotiate with stakeholders to reduce number of expectations
  - Is it « really, really » a desirable outcome?
- Try to target a specific iteration for testing a non-functional requirement
  - Benefit: Transform from a recurrent concern to a one-time concern

# Non-Functional Requirements

## What about User Story?

- Cannot be satisfied in a finite period of time
  - The “what” that needs to be restricted is not concrete enough
  - The functional scope is fuzzy because it is an iteration
- Can easily induce technical debt
  - Once the story is completed, you must put it back in the backlog to make it available again for a future iteration
  - Complicates the management of the backlog unduly

# Non-Functional Requirements

## Two categories of constraint

- External quality
  - **Expectation** imposes conditions that sets a limit to comply during software execution
- Internal quality
  - **Practice** that ensure the software construction is done correctly

# Internal Quality
## What is it?

| Non-Functional Requirement | Definition |
|---|---|
| Simplicity | Ease to understand or explain |
| Maintainability | Ease to change and evolve with minimal effort |
| Testability | Ease to confirm conformance by observing a reproducible behavior |
| Portability | Ease to reuse for multiple platforms |
| Extensibility | Ease to takes into consideration future changes |

# Internal Quality

## Ensure quality using sound practices

- Practices define how the software construction is done
  - It preserves the sustainability of the source code for future developments

# Internal Quality
## Explicit Engineering Practices

| Non-Functional Requirement | Practices (to be applied for each scenario) |
|---|---|
| Simplicity | **Self-documenting code**: Practices that ensure code is its own best documentation by allowing useful information, such as programming constructs and logical structure, to be deduced from the naming convention and code layout convention. |

- The naming and code layout convention guide the team during software construction

# Internal Quality

## Confirm practice with collaborative construction

- Pair programming
  - Two teammates work together at one workstation
    - Driver
      - Type at the keyboard
      - Focus his attention on the task at hand
      - Use the observer as a safety net and guide
    - Observer
      - Look at what is produced by driver
      - Consider the constraints imposed by the practices
      - Offer ideas for improvements
  - The two teammates switch roles frequently

# Internal Quality

## Confirm practice with collaborative construction

- Peer review (aka formal inspection during construction)
  - Well-defined roles
    - Moderator, author, reviewers, scribe
  - Planning
    - Inspection is scheduled by moderator (according to predefined selection criteria)
  - Preparation
    - Reviewer works alone to scrutinize the work product under review
    - Reviewer uses a checklist to stimulate their examination
  - Inspection
    - Moderator chooses someone other than the author to present the work product
    - Author is a « fly on the wall » and scribe records reworks as they are detected
    - Constructive feedbacks, « I propose to replace with … »,
  - After inspection
    - Moderator ensure that all rework is carried out promptly by the author

# Internal Quality

## Other examples of engineering practices

| Non-Functional Requirements | Practices (to be applied for each scenario) |
|---|---|
| Maintainability | **Continuous Integration**: Practices of applying quality control for each new checked in code by verifying if it integrate with success in the development branch. |
| Testability | **Red-Green-Refactor**: Practice that promotes the notion of writing test first when programming a piece of code and that relies on the repetition of a very short development cycle divided into three stages (the red, the green and the refactor stage). |
| Portability | **Multi-target compiling**: Practices that verifies compilation on every platform. |

- Each scenario is not « Done » until each practice is confirmed

# Internal Quality

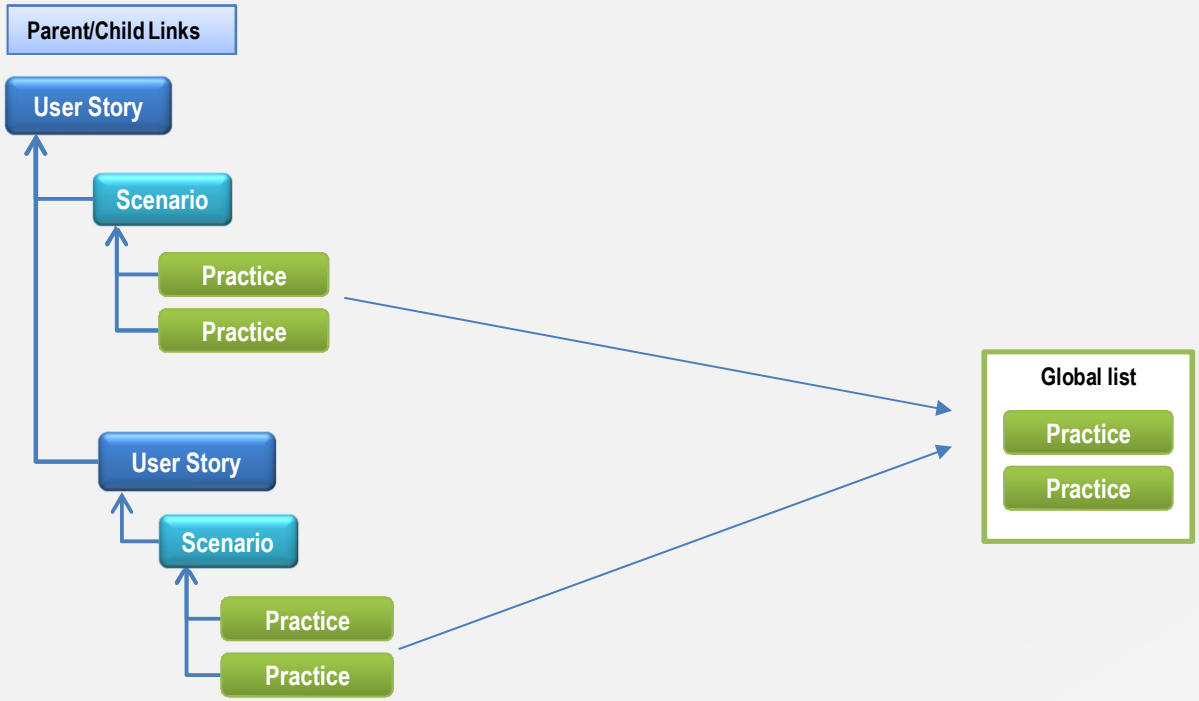
## Engineering practices and user story

| Non-Functional Requirements | Practices (to be applied for each user story) |
|---|---|
| Maintainability | **Branching and merging** : Practices to merge with the main branch (and tagged appropriately for traceability) source code from the development branch. |
| Portability | **Multi-target deploying**: Practices that verifies the automated build can deploy on every platform. |

- Each user story is not « Done » until each practice is confirmed

# Internal Quality

## How to store practices description in TFS



# Resources

- My website
  - http://mariocardinal.com
- Book
  - **Title**:  Agile Specification
  - **Author**: Mario Cardinal
  - **Publisher**: Addison-Wesley
  - **Publication Date**: Spring 2012

# Q & A