SOFTWARE ARCHITECTURE

Escuela de Ingeniería Informática

Universidad de Oviedo

Lab 8

BDD and Acceptance tests

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Jose Emilio Labra Gayo
Pablo González
Cristian Augusto Alonso
Jorge Álvarez Fidalgo

Acceptance tests and BDD

- Tests that can be run in front of the client
  - If the tests pass, the product is accepted
- Behaviour-Driven Development (BDD)
  - Variant of TDD
    - Acceptance test driven development
  - Behaviour = User Stories
  - Also known as: *Specification by example*
  - Goal: Executable specifications
- Some tools:
  - cucumber, jBehave, concordion

BDD - User Stories

- Simple
- Readable by domain experts (business people)
- Approved by domain experts
- Other advisable characteristics:
  - Independent (with no strong relationships)
  - Negotiable (with no specific details)
  - Valuable for the customer
  - Estimable (to add them to Sprints)
  - Small (or consider division)
  - Testable (automatic tests)

User story structure

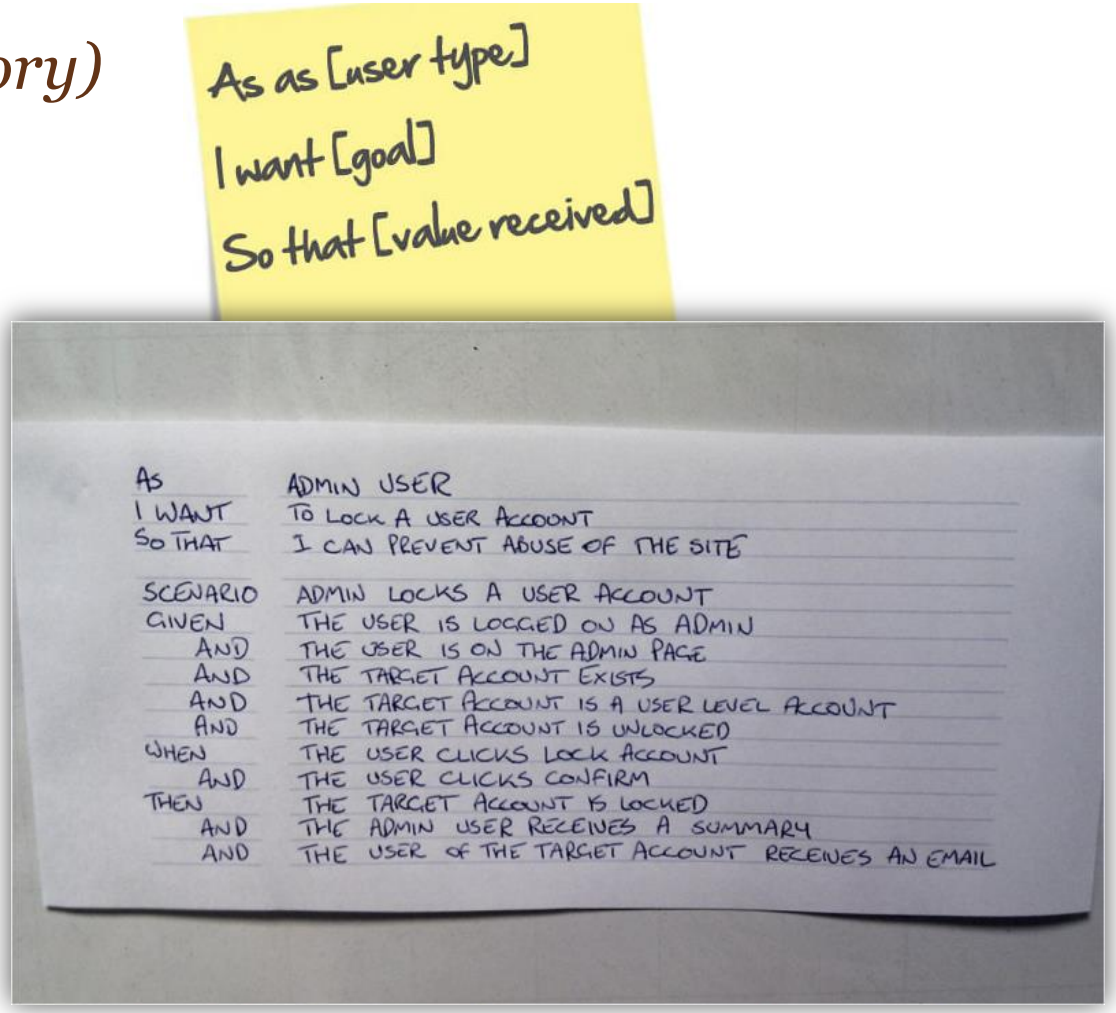
Feature: *Title (one line describing the story)*

The following structure is recommended:

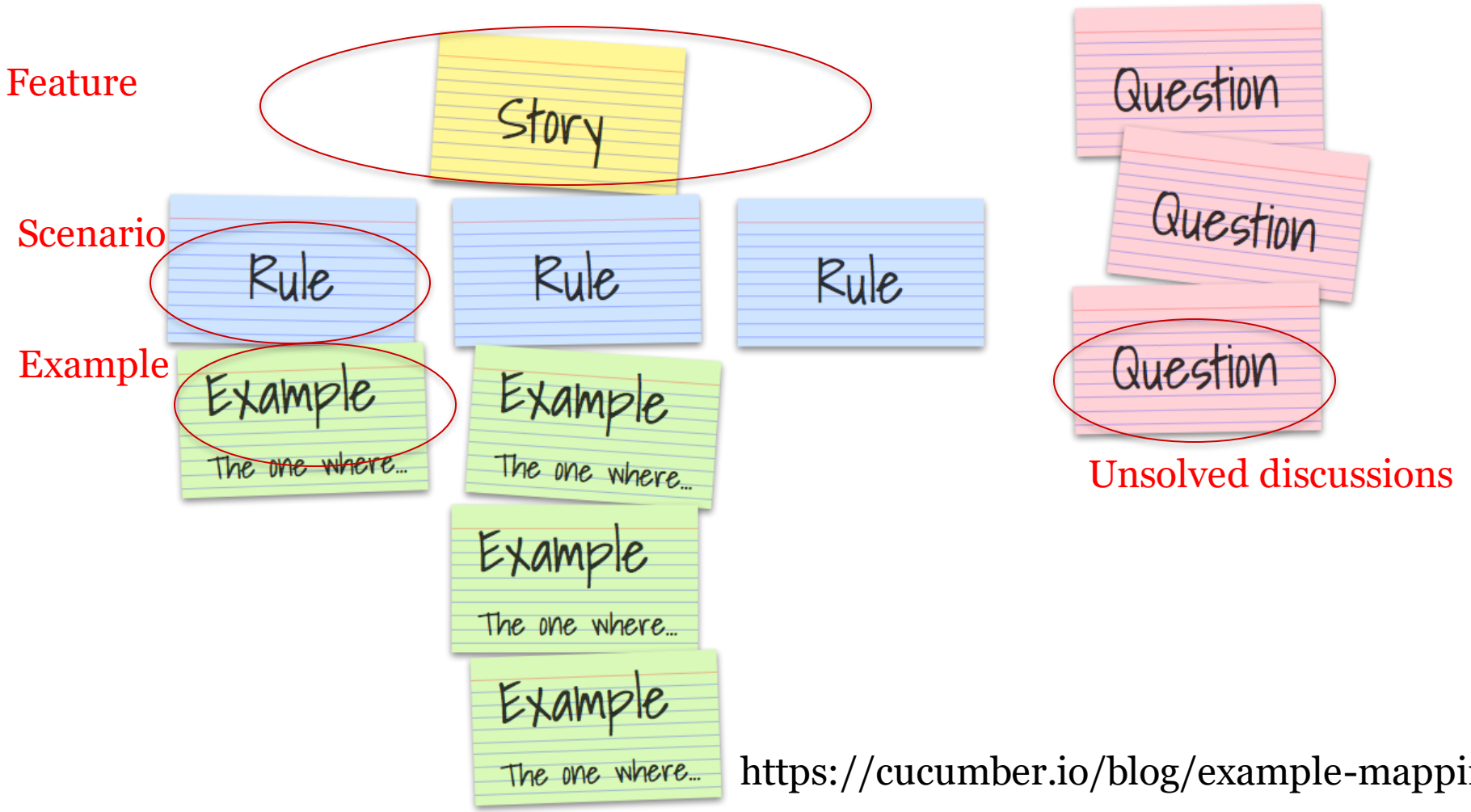
As a [role]
I want [feature]
So that [benefit]

Scenarios

Given [Context]
And [Some more context]
when [Event]
then [Outcome]
And [Another outcome]

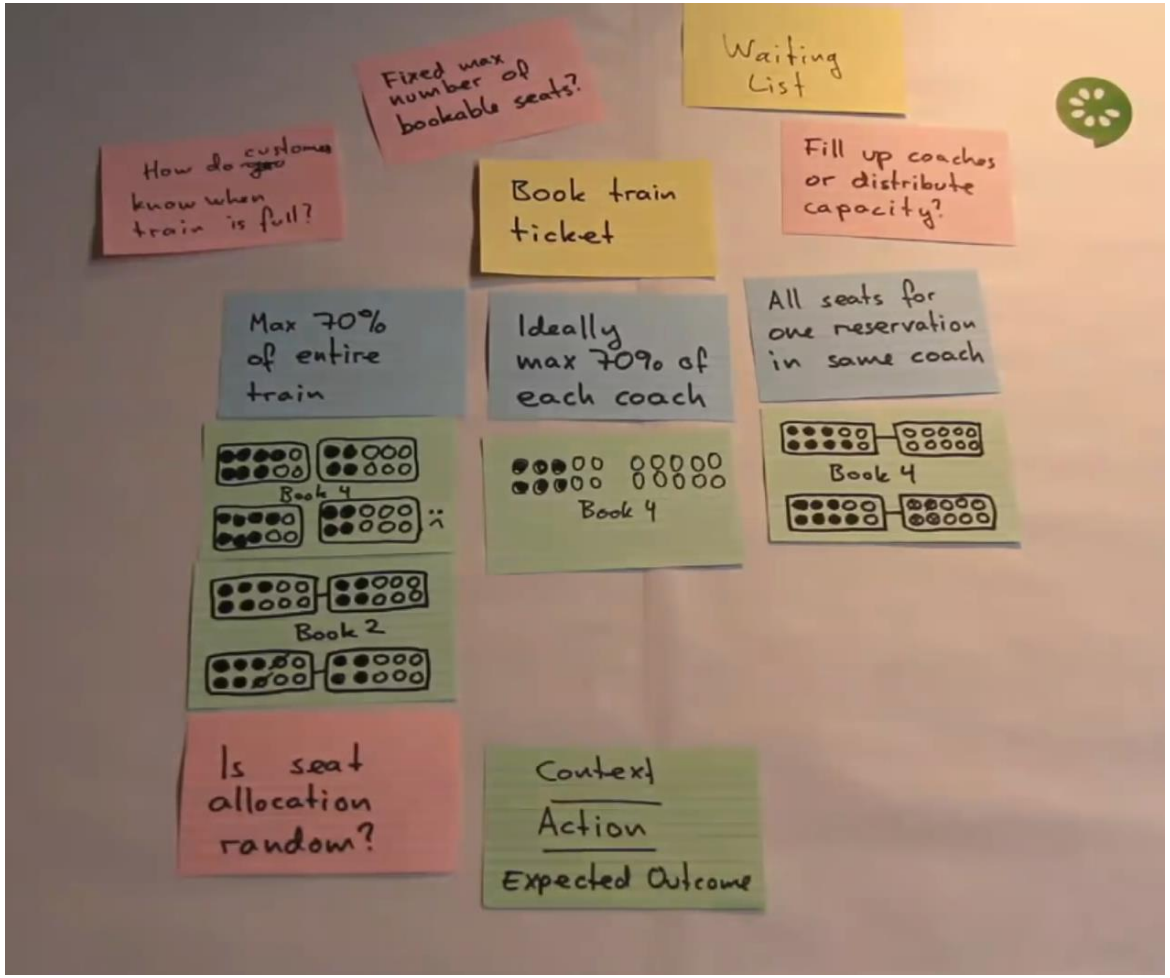


BDD – Example Mapping



https://cucumber.io/blog/example-mapping-introduction/

BDD – Example Mapping



Introducing example mapping [video]

BDD using Cucumber

Cucumber = developed in Ruby (2008)

- RSpec (Ruby), jbehave (Java)
- Based on Gherkin
  - internal language to define user stories
- Web: `http://cukes.info`
- Support for multiple languages

Java: cucumber-jvm

- `https://github.com/cucumber/cucumber-jvm`

BDD using cucumber

- Features define some functionality
  - Gherkin language
    https://cucumber.io/docs/gherkin/
  Can be used in several languages
- User stories are linked to step definitions
  - Step definitions can be run to validate user stories

BDD using cucumber

Feature: Describes a system feature

- A feature can have several scenarios
- Scenario:
  - How must the system behave in some context
    - *Given*: Prepares scenario
    - *When*: Interact with the system
    - *Then*: Checks the state
    - *Examples*: Specific data

BDD

- Step by step guide to a user story
  - Install Cucumber
  - Write a first scenario in Gherkin
  - Write steps definitions in a chosen programming language
  - Run cucumber

BDD with cucumber

- Depends on programming language/environment
  - Java/Javascript/Python/...
  - Installation: https://cucumber.io/
- React: https://github.com/Arquisoft/lomap_0
  - jest-cucumber: Module to define user stories in Gherkin
    - And convert them to executable tests by Jest

```
$ npm install --save-dev puppeteer jest-cucumber
```

  - jest-puppeteer. Module to run the tests in a browser
    - It could be configured to use Selenium.

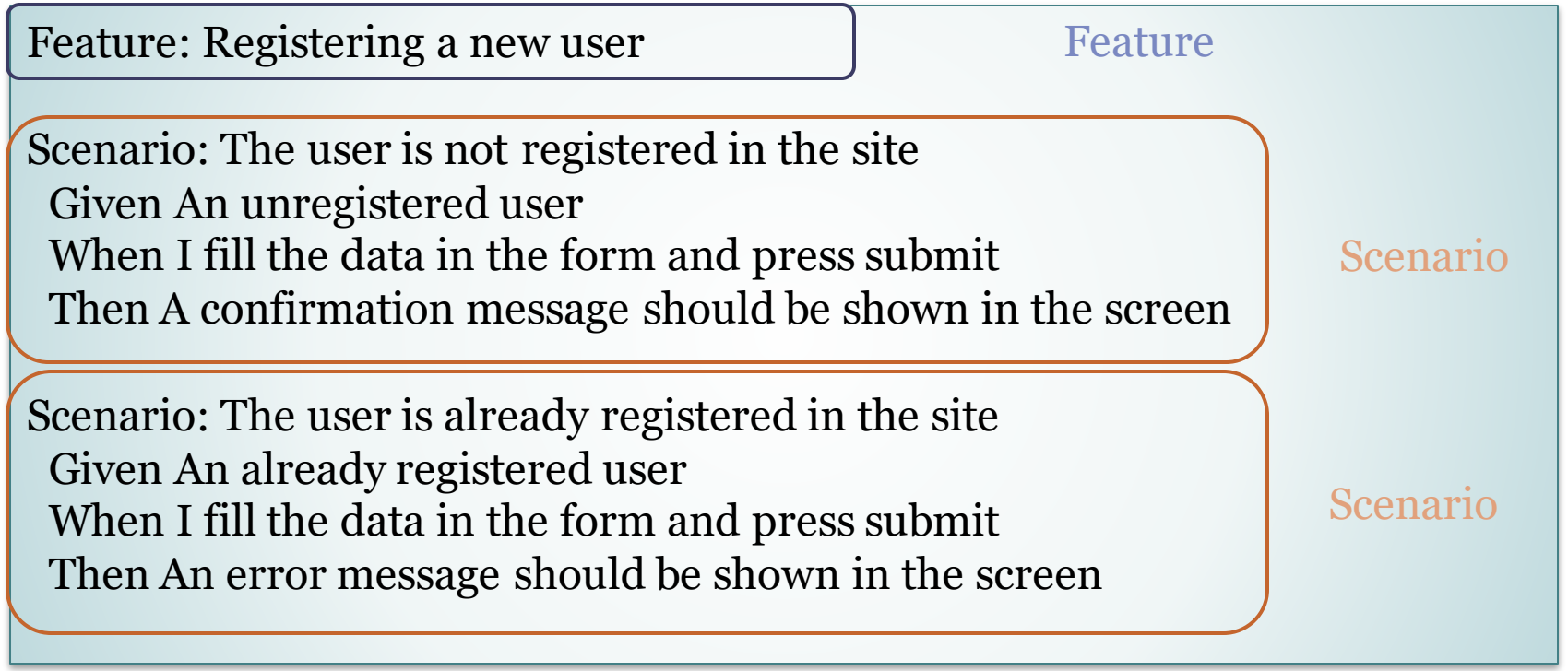
```
$ npm install --save-dev puppeteer jest-puppeteer
```

  - expect-puppeteer: Module with high level selectors for e2e tests

```
$ npm install --save-dev expect-puppeteer
```

BDD

- User Story example using Node.js



e2e/features/register-form.feature

BDD

webapp/e2e/steps/register-form.steps.js

```
test('The user is not registered in the site', ({given,when,then}) => {
  let username;
  let password;

  given('An unregistered user', async () => {
    username = "pablo"
    password = "pabloasw"
    await expect(page).toClick("button", { text: "Don't have an account? Register here." });
  });

  when('I fill the data in the form and press submit', async () => {
    await expect(page).toFill('input[name="username"]', username);
    await expect(page).toFill('input[name="password"]', password);
    await expect(page).toClick('button', { text: 'Add User' })
  });

  then('A confirmation message should be shown in the screen', async () => {
      await expect(page).toMatchElement("div", { text: "User added successfully" });
  });
})
```

BDD [Configuration]

- e2e/jest-config.js
  - Configure jest to execute the tests in the E2E folder
  - Tells Jest the name pattern of the test files (note that they do not have a default name, so by default, they will not be found)
  - Hint: you can use the **testTimeout** option if your tests take longer than 10s (default).

```
module.exports = {
    testMatch: ["**/steps/*.js"],
    testTimeout: 30000,
    setupFilesAfterEnv: ["expect-puppeteer"]
}
```

BDD [Browser Configuration]

- register-form.steps.js (beforeAll)
  - Configures how to launch the browser to perform the tests
  - We use **puppeteer** for this task
  - Can be also configured with other browsers.
  - We use **headless=true** (by default) to run the tests in the CI system but we can change it to false to run them locally.
  - The **slowMo** parameter is useful to slowdown the tests and see what is happening

```
beforeAll(async () => {
  browser = process.env.GITHUB_ACTIONS
    ? await puppeteer.launch()
    : await puppeteer.launch({ headless: false, slowMo: 50 });
  page = await browser.newPage();

  await page
    .goto("http://localhost:3000", {
      waitUntil: "networkidle0",
    })
    .catch(() => {});
});
```

BDD [Configuration - Launching the system]

- webapp/e2e/test-environment-setup.js
  - Configures how to launch the test environment (the backend part)
  - We will use this script in the package.json test:e2e script.

```
const { MongoMemoryServer } = require('mongodb-memory-server');

let mongoserver;
let userservice;
let authservice;
let gatewayservice;

async function startServer() {
    console.log('Starting MongoDB memory server...');
    mongoserver = await MongoMemoryServer.create();
    const mongoUri = mongoserver.getUri();
    process.env.MONGODB_URI = mongoUri;
    userservice = await require("../../users/userservice/user-service");
    authservice = await require("../../users/authservice/auth-service");
    gatewayservice = await require("../../gatewayservice/gateway-service");
}

startServer();
```

BDD [Configuration - Launching the system]

- webapp/package.json
  - Configures how to launch the system
    - For testing this app we need the backend and the webapp
  - We use the start-server-and-test library
    - This library accepts pairs of parameters (run command, url to test)
  - In order to execute the E2E tests we must build the production version with **npm run build** and then run **npm run test:e2e**

```
"test:e2e": "start-server-and-test
  'node e2e/test-environment-setup.js' http://localhost:8000/health
  prod 3000        # Equivalent to npm run prod and http://localhost:3000
  \"cd e2e && jest\"" # Runs the tests
```

BDD

- Result

```
 PASS  steps/register-form.steps.js (15.182 s)
  Registering a new user
    ✓ The user is not registered in the site (9898 ms)

Test Suites: 1 passed, 1 total
Tests:       1 passed, 1 total
Snapshots:   0 total
Time:        15.36 s
Ran all test suites.

 INFO  Gracefully shutting down. Please wait...
```

Other example cucumber + selenium + java Spring boot from previous years:

https://github.com/arquisoft/votingSystem0

Browser-based tests

- Browser automation
  - https://cucumber.io/docs/reference/browser-automation
- Several systems
  - Selenium WebDriver - http://docs.seleniumhq.org/
  - Capybara - http://teamcapybara.github.io/capybara/
  - Watir - https://watir.com/
  - Serenity - http://serenity-bdd.info

Selenium

- Selenium IDE: Allows to record actions
  - Firefox and Chrome plugins
- Generates code to execute those actions
- Travis configuration
  - https://lkrnac.net/blog/2016/01/run-selenium-tests-on-travisci/

Bibliography and links

- User Story Mapping by Jeff Patton
  - **User Story Mapping: Discover the Whole Story, Build the Right Product, 1st Edition**
    https://www.amazon.com/User-Story-Mapping-Discover-Product/dp/1491904909
- User stories
  - Scrum. Historias de Usuario (Fernando Llopis, Universidad de Alicante)
    https://fernandollopis.dlsi.ua.es/?p=39
  - User stories with Gherkin and Cucumber (Michael Williams)
    https://medium.com/@mvwi/story-writing-with-gherkin-and-cucumber-1878124c284c
  - Cucumber 10 minutes tutorial (JS)
    https://docs.cucumber.io/guides/10-minute-tutorial/
- Browser based tests
  - Automated UI Testing with Selenium and JavaScript
    https://itnext.io/automated-ui-testing-with-selenium-and-javascript-90bbe7ca13a3