PV168

Testing

Why test?

- Does it make sense to test your code?
  - Related to UX, nobody likes buggy software
  - Related to your team, nobody likes to change untested software
  - Your future self will thank you

Testing

- Similar to sience
  - We have some assumptions about our code
  - We try to prove them
  - We investigate discrepancies and anomalies

How to properly test?

- Jurassic Park testing
  - don't think about yourself as perfectionst
  - you can make mistake and you can't know everything
  - complex systems will fail
  - tests are not just some confirmation you **MUST** have

Few testing methods - Boundary values

- Just below nominal value
- Nominal value
- Just above nominal value
- MIN and MAX

Equivalence Partitiong

- dividing input data in data classes
- for password input 4 - 10 characters
  - (1..3), (4..10), (10..MAX)

Use-case testing

- use real data examples
- imitate user actions
- happy path

Decision table

- many conditions, rules control

TICKET					
Local	X	X			X
Student		X			
Elderly			X	X	X
Disabled				X	
Discount 10%	X				
Discount 50%		X	X		
Discount 100%				X	X

State transition

- STATUS - many options
- ACTION - change trigger
- TRANSITION - from one state to other

- test every status, every action, every transition -> every path

Pairwise testing

Parameter name	Value 1	Value 2	Value 3	Value 4
Enabled	True	False	-	-
Choice type	1	2	3	-
Category	a	b	c	d

Pairwise testing

Enabled	Choice type	Category
True	3	a
True	1	d
False	1	c
False	2	d
True	2	c
False	2	a
False	1	a
False	3	b
True	2	b
True	3	d
False	3	c
True	1	b

https://eviltester.github.io/TestingApp/apps/7charval/simple7charvalidation.htm

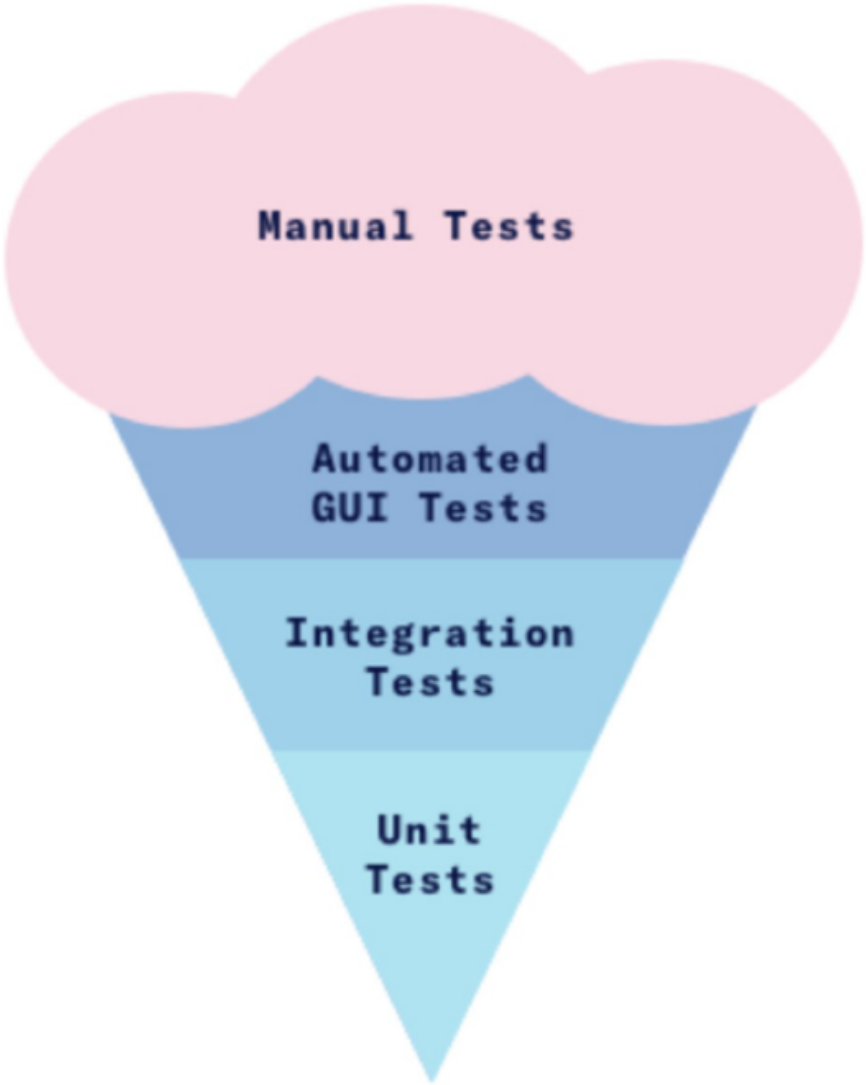
Test Categories

- **End-To-End** Tests
  - User behaviour simulation (full application stack)
  - Hard to automate, slow, costly maintenance
- **Integration** Tests
  - Testing interoperability of components
  - Faster and less complex than full-stack tests
- **Unit** Tests
  - Testing components in isolation
  - Super-fast and easy result interpretation

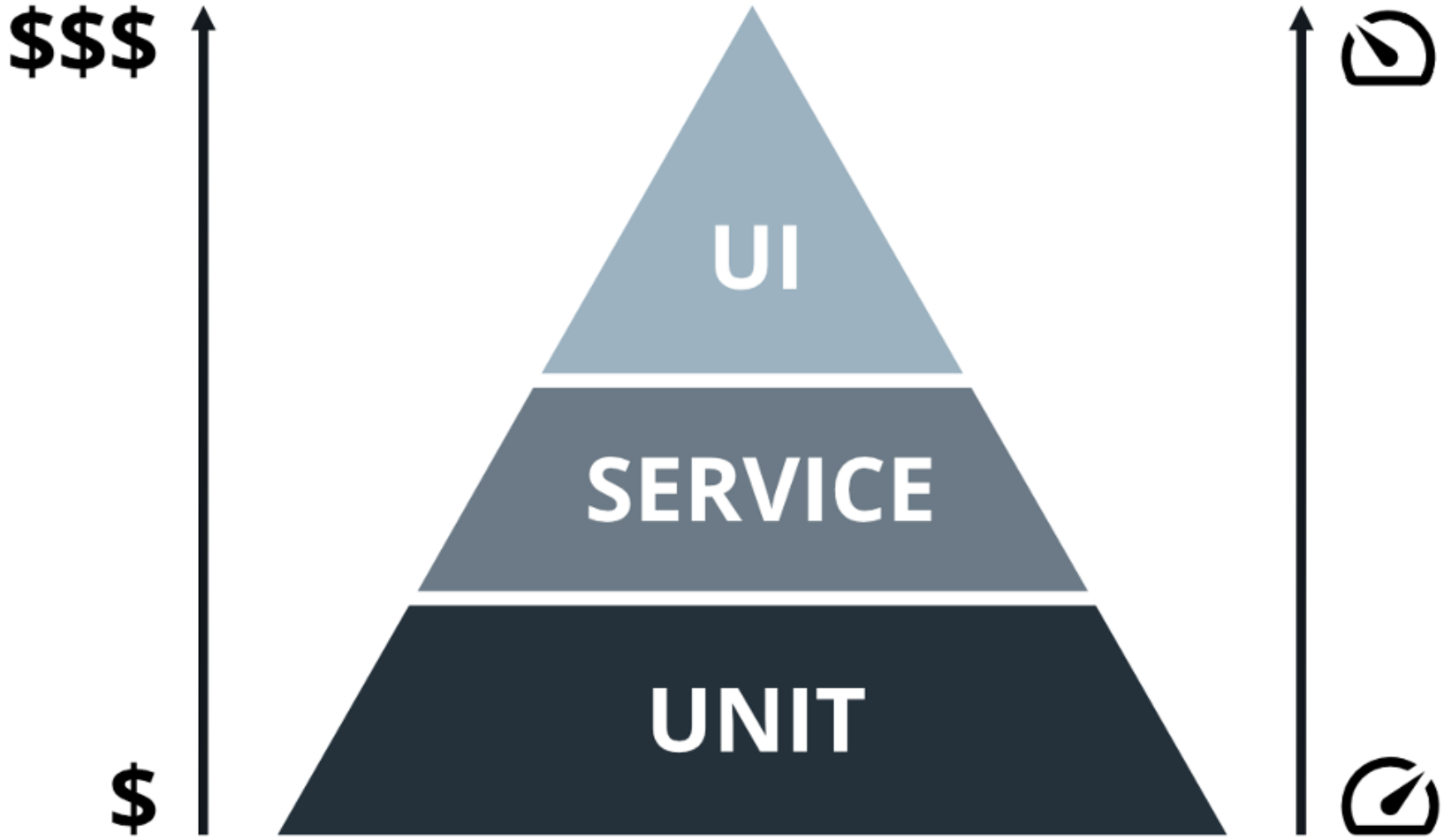
Black-box vs White-box Testing

- **Black-box** Testing
  - Only using public API of Unit/Component (without seeing the internals)
  - Concentrating on scenarios (implementation details are irrelevant)
  - Default option (for **new code**)
- **White-box** Testing
  - Test-cases are driven by the internals of Unit/Component
  - Enforces internal data structures and design

Testing ice cream cone

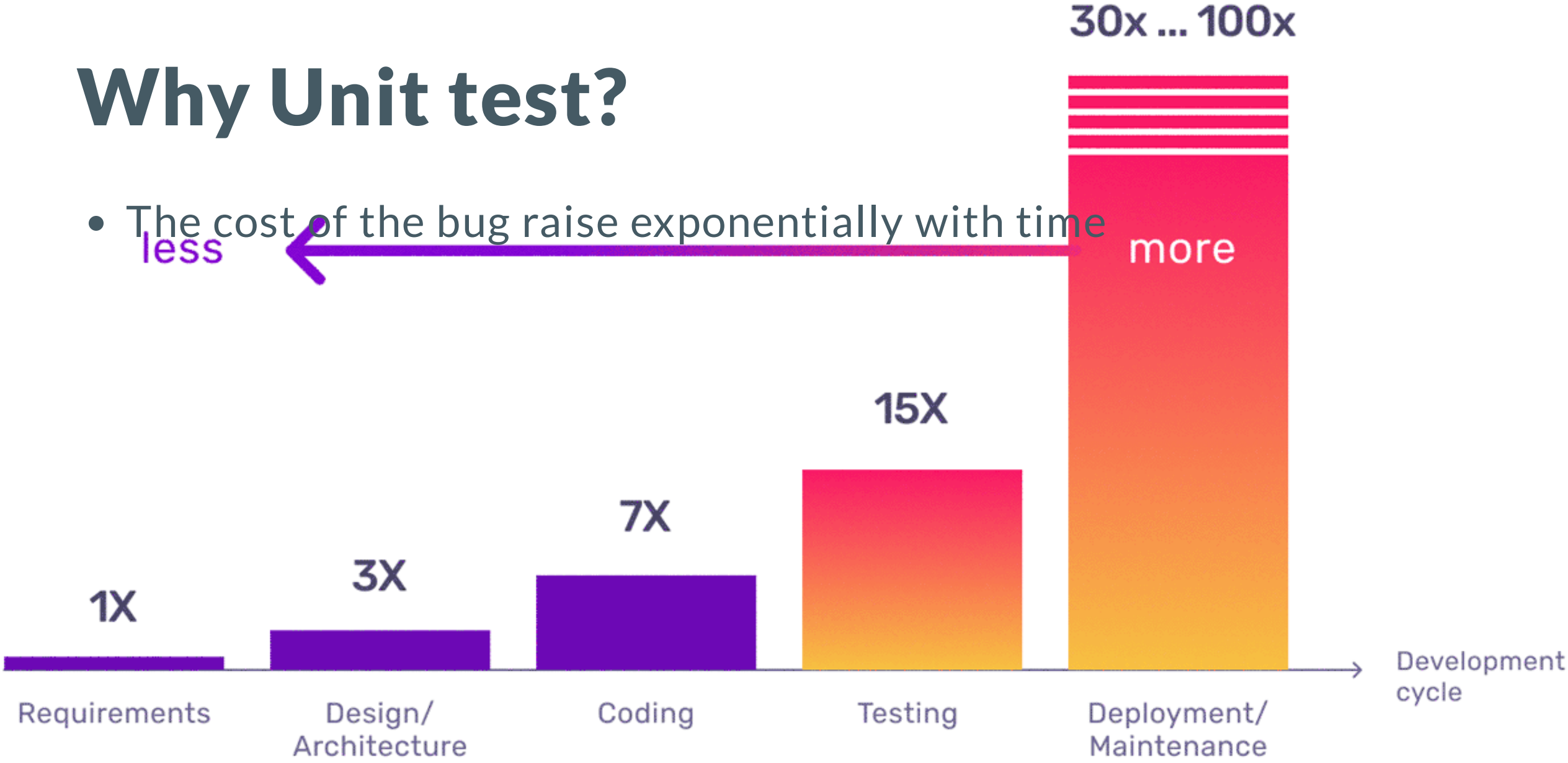


Testing Pyramid



Why Unit test?

- The cost of the bug raise exponentially with time



Code Coverage

- Percentage of production code covered with tests
- Ideally close to 100%
  - Might be difficult to achieve
- Demanding particular coverage (e.g. 80%) leads to problems
  - Cheating with poor tests to fulfill metrics
- Even 100% coverage may not be enough
  - Quantity cannot trump quality

When to Write a Test

- Test-first development
  - Write code after writing Unit/Integration tests
  - Leads to loosely-coupled, reusable and **testable** code
  - Ideally follow TDD
- Test-last (if ever) development
  - Write all the code, then (maybe) some tests
  - Unfortunately still very common in the industry (school-style)
  - Leads to compact, highly-cohesive, hard-to-test code

Test Anatomy

- **Given** (Arrange)
  - With certain environment
- **When** (Act)
  - Certain action is performed
- **Then** (Assert)
  - Assert expected outcome

Test Isolation

- Tests don't interfere with each other
- Each test responsible for **Setup** and **Teardown**
- Share only stateless and expensive resources
- Higher testing level leads to lower restrictions
  - Strict test order is not acceptable at Unit level
  - ... but might be OK at Integration level

JUnit5 Framework

- Annotation driven (mostly at method level)
- `@Test` used to mark test methods
- `@BeforeEach` / `@AfterEach` for per test setup/teardown
- `@BeforeAll` / `@AfterAll` for shared setup/teardown
  - Must be `static` (once per all tests in single class)
- Highly extendable

Assertions in JUnit5

- Default JUni5 Assertions API
- Assertions based on matchers (e.g. Hamcrest)
- Fluent assertion libraries (e.g. AssertJ)

Component Dependencies

```
Car > Engine > Cylinder
```

- Design for loose coupling and IoC
- Control your objects' dependencies
- Use testing implementations

Test Doubles

“Looks real but actually isn't!”

- **Stub** double
  - Returns predefined values
- **Spy** double
  - Tracks interactions
- **Fake** double
  - Fully functional implementation
  - … **not suitable** for production