Why Software Testing Is a Waste of Time

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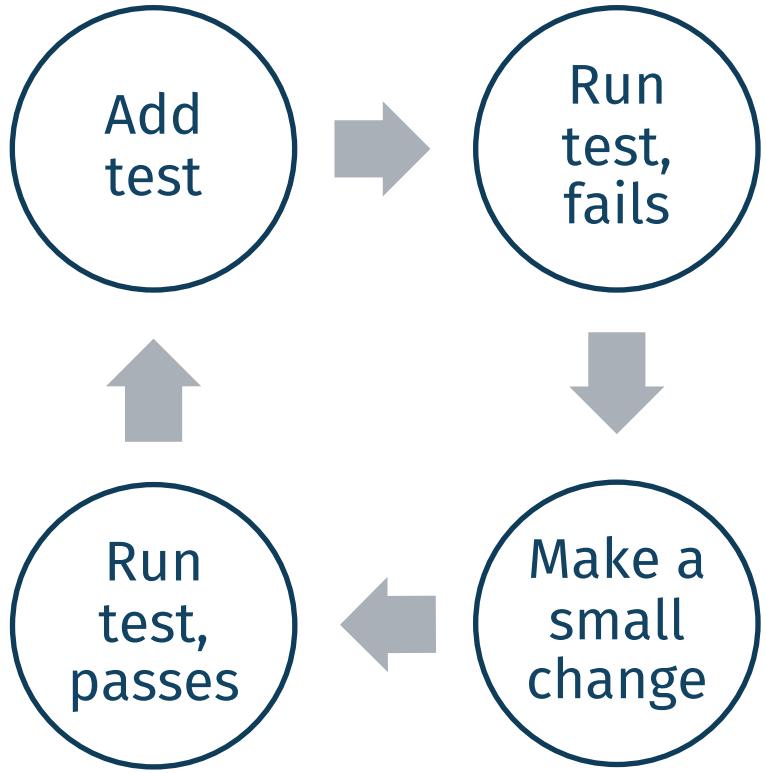
Not testing software

- Empirical data proves improved software quality results in better ROI and lower TCO
  - Source: The Economics of Software Quality by Capers Jones, Olivier Bonsignour
- With systems automatically detecting bugs in production and rolling back, is testing still necessary?
  - Users still experience bugs, even if they are detected
  - Reactive measures only handle issues after they occurred, do not prevent them

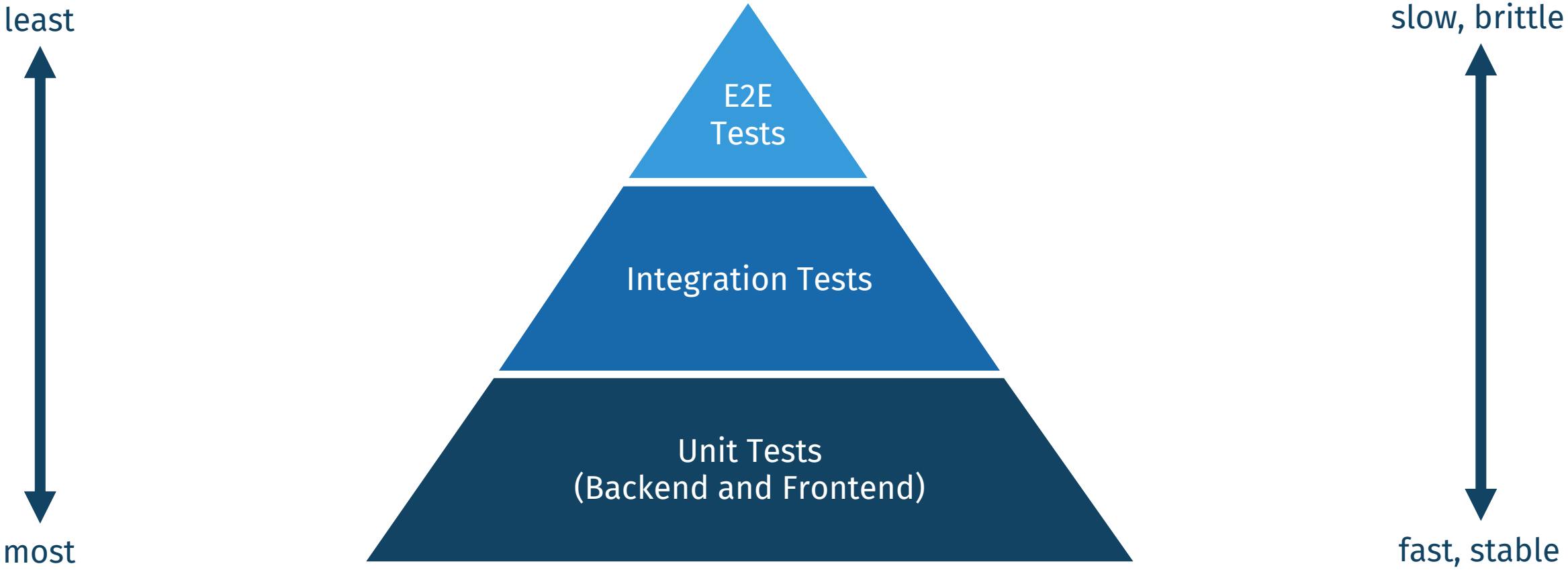
Not doing Test-driven development

- As smallest code change is written that makes a test pass, there are less tendencies to overengineer solutions
- Code is automatically written to be testable
- Testable code usually results in good architecture
- According to a report, doing TDD reduced percentage of bugs by **80%**



- Learn more: IBM Test-driven development

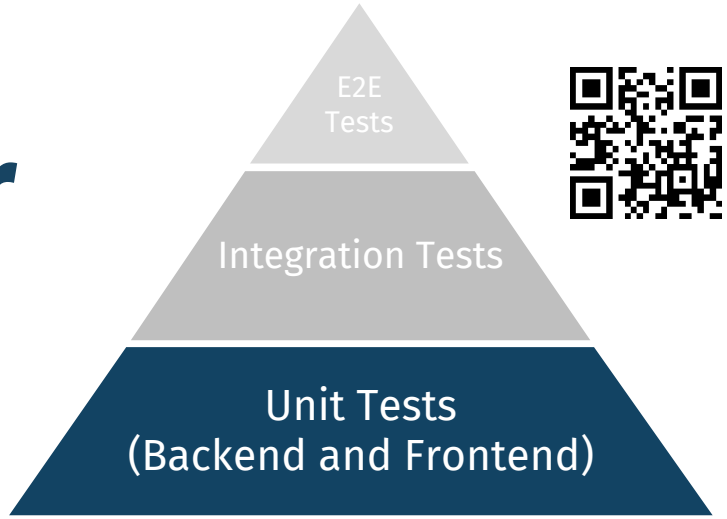
Not following the test pyramid



Video: Netflix moving away from having 100% E2E tests

Martin Fowler: The Practical Test Pyramid

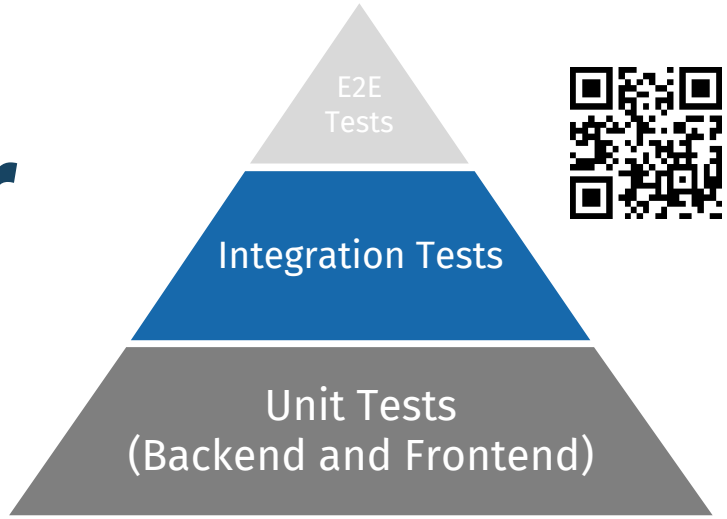
Example: °C to °F Converter



Unit Tests (Backend)

Input °C	Expected Output °F
-274	Error: Temperature too low
-273	-459
-272	-458
-1	30
0	32
1	34
100	212

Example: °C to °F Converter



Integration Tests (Backend API)

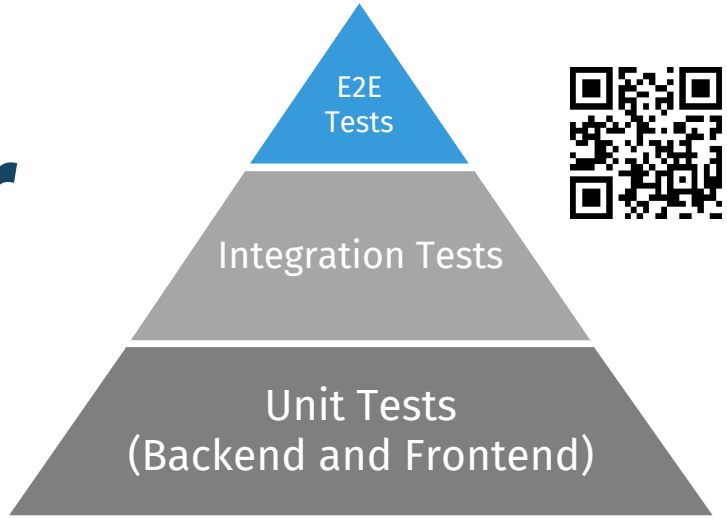
Request:
`GET http://localhost:8000/tempconverter/-273`

Expected Response:
`200 OK { "temperatureFahrenheit": -459 }`

Request:
`GET http://localhost:8000/tempconverter/-274`

Expected Response:
`422 Unprocessable Entity { "errorMessage": "Temperature too low!" }`

Example: °C to °F Converter



E2E Tests (web frontend making requests to backend)

Temperature in °C:

0

Convert

Temperature in °F:

32

Temperature in °C:

-274

Error

Temperature too low!

OK

Not enough automation

- Executing repetitive tests by hand
  - time-intensive
  - error-prone
  - limits flexibility in timing for releases
  - slow feedback loop
- Automation frees up time, enables focus on test activities that require critical thinking, like exploratory testing

Charlie Chaplin - Modern Times (1936)
© Roy Export S.A.S

Too much automation

- With enough effort, **any** test case can be automated
- Does **not** mean it is **worth** automating everything, for example:
  - Code that only runs once
  - Tests without predictable results
  - Code without logic, like getters and setters

Not running tests often enough

- If only run once a week or day, finding the code changes causing failures takes more time
- For direct feedback, run tests with every pull / merge request
- Additionally running tests nightly on the main branch is recommended

Running too many tests

- Only execute tests impacted by the code change
  - especially in development and in a pull / merge request
  - shortens development feedback loop
- For example: don’t run backend tests when only frontend was changed
- **Java**: use Gradle Build Cache and Gradle Enterprise Predictive Test Selection
- **Jest**: use `--changedSince`
- **nx**: use affected
- Learn more: Martin Fowler - The Rise of Test Impact Analysis

Flaky Tests

- Require re-running tests multiple times
- Repetitive investigation efforts to determine if flaky or legitimate failure
- With many flaky tests, team starts losing trust in test results
- Mitigation strategy: Prevent flaky tests from being introduced in pull / merge requests
  - Run new or changed tests 3, 10 or 50 times (depending on resources)
  - Alternatively run all tests multiple times nightly
- Stable testing environment necessary
- Learn more:
  - Flaky Tests at Google and How We Mitigate Them
  - Test Flakiness – One of the main challenges of automated testing

Not doing Data-Driven Testing

```java
@Test
@DisplayName("1 + 1 = 2")
public void testAddOneAndOne() {
    assertEquals(2, add(1, 1));
}

@Test
@DisplayName("1 + 2 = 3")
public void testAddOneAndTwo() {
    assertEquals(3, add(1, 2));
}

@Test
@DisplayName("1 + 0 = 1")
public void testAddOneAndZero() {
    assertEquals(1, add(1, 0));
}
```

```java
@Test
@DisplayName("1 + -1 = 0")
public void testAddMinus() {
    assertEquals(0, add(1, -1));
}

@Test
@DisplayName("0 + -1 = -1")
public void testAddMinusNegative() {
    assertEquals(-1, add(0, -1));
}

@Test
@DisplayName("0 + 0 = 0")
public void testAddZero() {
    assertEquals(0, add(0, 0));
}
```

Not doing Data-Driven Testing

Alternative?

```
@Test
public void testAdd() {
    assertEquals( 2, add(1,  1));
    assertEquals( 3, add(1,  2));
    assertEquals( 1, add(1,  0));
    assertEquals( 0, add(1, -1));
    assertEquals(-1, add(0, -1));
    assertEquals( 0, add(0,  0));
}
```

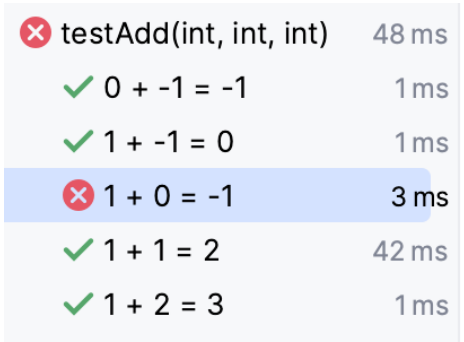
```
org.opentest4j.AssertionFailedError:
Expected :0
Actual   :-1

    at org.junit.jupiter...
    at AddTest.testAdd(AddTest.java:30)
```

???

Not doing Data-Driven Testing

JUnit 5 with @CsvSource

```
@ParameterizedTest(name = "{0} + {1} = {2}")
@CsvSource({
        "1,  1,  2",
        "1,  2,  3",
        "1,  0,  1",
        "1, -1,  0",
        "0, -1, -1",
})
void testAdd(int a, int b, int result) {
    assertEquals(result, add(a, b));
}
```




```
org.opentest4j.AssertionFail
Expected :-1
Actual   :1
<Click to see difference>
```

Not doing Data-Driven Testing

JUnit 5 with @MethodSource

```
@ParameterizedTest(name = "{0} + {1} = {2}")
@MethodSource("addProvider")
void testAdd(int a, int b, int result) {
    assertEquals(result, add(a, b));
}
static Stream<Arguments> addProvider() {
    return Stream.of(
            arguments(1,  1,  2),
            arguments(1,  2,  3),
            arguments(1,  0,  1),
            arguments(1, -1,  0),
            arguments(0, -1, -1)
    );
}
```

Not doing Data-Driven Testing

Spock Data Tables

```
@Unroll
def "#a + #b = #result"() {
    expect:
    add(a, b) == result

    where:
    a | b  || result
    1 | 1  || 2
    1 | 2  || 3
    1 | 0  || 1
    1 | -1 || 0
    0 | -1 || -1
    0 | 0  || 0
}
```

Not doing Data-Driven Testing

Jest .each

```
it.each`
  a    | b     | result
  ${1} | ${1}  | ${2}
  ${1} | ${2}  | ${3}
  ${1} | ${0}  | ${1}
  ${1} | ${-1} | ${0}
  ${0} | ${-1} | ${-1}
  ${0} | ${0}  | ${0}
`('returns $result when $a is added to $b', ({a, b, result}) => {
    expect(add(a, b)).toBe(result);
});
```

Too much logic in tests

Test for method `getPeopleBornIn` which returns list of `Person` objects from database in random order

```
List<Person> people = repo.getPeopleBornIn("Las Vegas");
boolean jamesSmithFound, maryMillerFound = false;
for (Person person : people) {
    String first = person.getFirstName();
    String last = person.getLastName();
    if (first.equals("James") && last.equals("Smith")) {
        assertTrue(!jamesSmithFound, "Duplicate entry for James Smith");
        jamesSmithFound = true;
    } else if (first.equals("Mary") && last.equals("Miller")) {
        assertTrue(!maryMillerFound, "Duplicate entry for Mary Miller");
        maryMillerFound = true;
    } else {
        fail("Unexpected person in the list: " + first + " " + last);
    }
}
assertTrue(jamesSmithFound, "James Smith not found");
assertTrue(maryMillerFound, "Mary Miller not found");
```

Too much logic in tests

Test using Streams instead

```
List<Person> people = repo.getPeopleBornIn("Las Vegas");

assertEquals(2, people.size(), "Unexpected number of people in the list");
assertTrue(people.stream()
                 .anyMatch(person -> person.getFirstName().equals("James") &&
                                    person.getLastName().equals("Smith")),
        "James Smith not found");
assertTrue(people.stream()
                 .anyMatch(person -> person.getFirstName().equals("Mary") &&
                                    person.getLastName().equals("Miller")),
        "Mary Miller not found");
```

Too much logic in tests

Test using AssertJ (Java) or assertpy (Python)

```java
import static org.assertj.core.api.Assertions.*;

List<Person> people = repo.getPeopleBornIn("Las Vegas");
assertThat(people)
    .extracting(Person::getFirstName, Person::getLastName)
    .containsExactlyInAnyOrder(
            tuple("James", "Smith"),
            tuple("Mary", "Miller")
    );
```

```
java.lang.AssertionError:
Expecting actual:
  [("Mary", "Miller"), ("James", "Smit")]
to contain exactly in any order:
  [("James", "Smith"), ("Mary", "Miller")]
elements not found:
  [("James", "Smith")]
and elements not expected:
  [("James", "Smit")]
```

(Mis)using BDD

- Critically evaluate if the effort for writing and maintaining the necessary glue code is worth it

> What many didn't realise was that Cucumber was now taken **out** of its **intended context: Collaboration**.
> When Cucumber is adopted **solely** as a tool to **write automated tests without any input from business analysts** they tend to become **imperative** and **lose** their documentation value.
> This also makes them **slow** and **brittle**.
>
> - Aslak Hellesøy (Creator of Cucumber)

> If your scenario starts with “When the user enters ‘Smurf’ into ‘Search’ text box…” then that’s **far too low-level**.
> However, even “When the user adds ‘Smurf’ to his basket, then goes to the checkout, then pays for the goods” is also **too low-level**. […]
> You’re looking for something like, “**When the user buys a Smurf.**”
>
> - Liz Keogh (BDD Expert)

Inefficient E2E tests

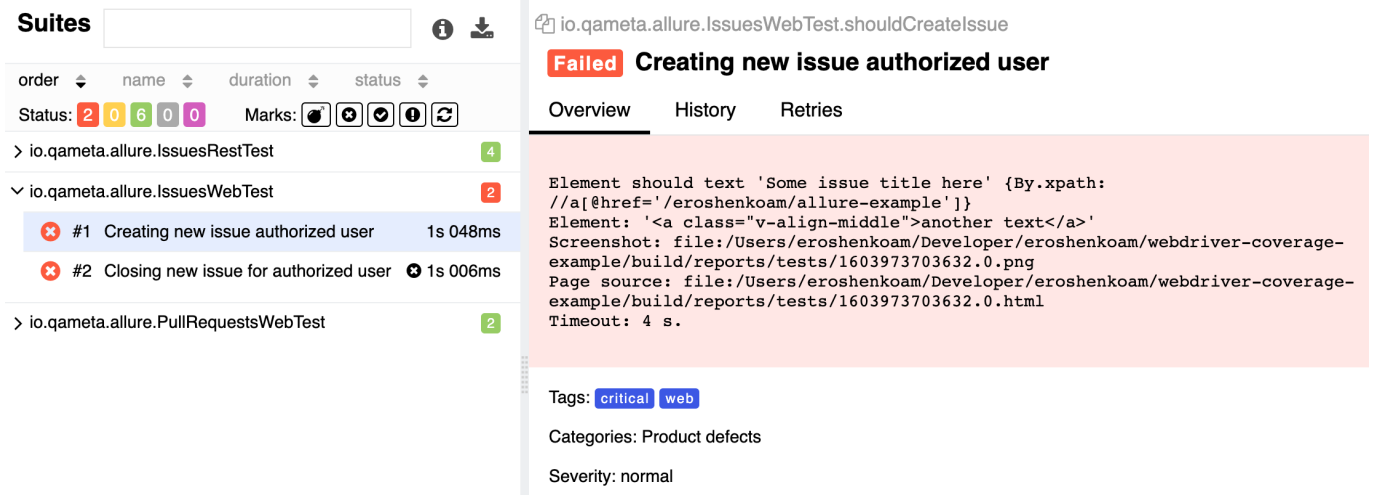
- Do not create test data through the UI, use fixtures to setup necessary test data beforehand
- Use deep links to navigate directly to the page to be tested
- Start the test with the test user already logged in
- Make it possible to run each test spec independently
- Do not wait in predefined time intervals, wait for a condition to be fulfilled with a timeout
- Ideally, each E2E test spec should not take longer than one minute

Not running tests in parallel

- Easiest way of speeding up automated test execution
- Run each E2E test spec and browser combination in parallel on the same machine
  - Optionally across multiple machines
  - WebdriverIO does this by default
  - Cypress officially only supports it through their cloud and only across multiple machines
- JUnit, other testing frameworks and Gradle can be easily configured to run in parallel

Incomplete test failure reports

- Include as much information as possible
- Include detailed request / response data in logs
- Directly attach application logs to test failures
- In E2E tests, directly link to screenshots, videos and page source where failures happen
- Reduces time needed for investigations
- Use reporting frameworks like Allure:



Slides:

https://bit.ly/sqd2024