# Testing Flutter (iOS, Android, web, desktop) Applications



**What you'll learn**

- How to define tests using Flutter
- Run the test and push the test report to Xray
- Validate that the test results are available in Jira

**Source-code for this tutorial**

- code is available in GitHub

# Overview

Flutter is an open source framework by Google used for building natively compiled, multi-platform applications from a single codebase.

Flutter transforms the app development process. Build, test, and deploy mobile, web, desktop, and embedded apps from a single codebase.

## Prerequisites

For this example we will use Flutter, that allows the build, test and deploy of mobile, web and desktop applications. We will focus in the testing part of the toolkit.

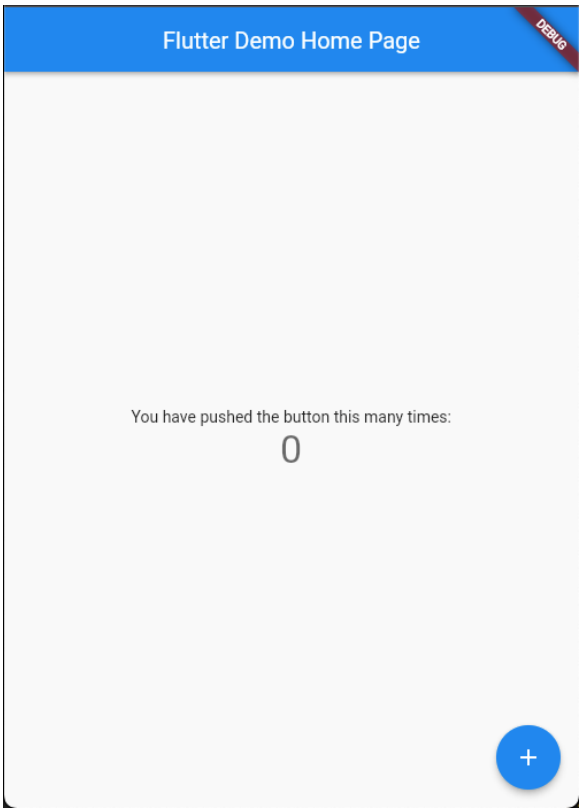
We use the pre-build demo Flutter counter application, that is available in the code and provided by Flutter, and will define unit tests, widget tests and integrations tests to validate the application.

What you need:

- Flutter installed in your machine
- If you want to run in an iOS emulator you will need the emulator and XCode installed
- If you want to run in an Android emulator you will need to install Android Studio also

## Application overview

For the purpose of this tutorial we are using the Flutter counter application that consists in application that will count (and show in the screen) how many times a user pushes the "plus" button.




We only made one change in the generated code that is to include a *`Counter`* class that will be in charge of the increment.

**main.dart**

```
import 'package:flutter/material.dart';
import 'package:my_app/counter.dart';

void main() {
  runApp(MyApp());
}

class MyApp extends StatelessWidget {
  // This widget is the root of your application.
  @override
  Widget build(BuildContext context) {
    return MaterialApp(
      title: 'Flutter Demo',
      theme: ThemeData(
        // This is the theme of your application.
        //
        // Try running your application with "flutter run". You'll see the
        // application has a blue toolbar. Then, without quitting the app,
try
        // changing the primarySwatch below to Colors.green and then invoke
        // "hot reload" (press "r" in the console where you ran "flutter
run",
        // or simply save your changes to "hot reload" in a Flutter IDE).
        // Notice that the counter didn't reset back to zero; the
application
        // is not restarted.
        primarySwatch: Colors.blue,
        // This makes the visual density adapt to the platform that you run
        // the app on. For desktop platforms, the controls will be smaller
and
        // closer together (more dense) than on mobile platforms.
        visualDensity: VisualDensity.adaptivePlatformDensity,
```

```
      ),
      home: MyHomePage(title: 'Flutter Demo Home Page'),
    );
  }
}

class MyHomePage extends StatefulWidget {
  MyHomePage({Key key, this.title}) : super(key: key);

  // This widget is the home page of your application. It is stateful,
meaning
  // that it has a State object (defined below) that contains fields that
affect
  // how it looks.

  // This class is the configuration for the state. It holds the values
(in this
  // case the title) provided by the parent (in this case the App widget)
and
  // used by the build method of the State. Fields in a Widget subclass are
  // always marked "final".

  final String title;

  @override
  _MyHomePageState createState() => _MyHomePageState();
}

class _MyHomePageState extends State<MyHomePage> {
  Counter _counter = new Counter();

  void _incrementCounter() {
    setState(() {
      // This call to setState tells the Flutter framework that something
has
      // changed in this State, which causes it to rerun the build method
below
      // so that the display can reflect the updated values. If we changed
      // _counter without calling setState(), then the build method would
not be
      // called again, and so nothing would appear to happen.
      _counter.increment();
    });
  }

  @override
  Widget build(BuildContext context) {
    // This method is rerun every time setState is called, for instance as
done
    // by the _incrementCounter method above.
    //
    // The Flutter framework has been optimized to make rerunning build
methods
    // fast, so that you can just rebuild anything that needs updating
rather
    // than having to individually change instances of widgets.
    return Scaffold(
      appBar: AppBar(
        // Here we take the value from the MyHomePage object that was
created by
        // the App.build method, and use it to set our appbar title.
        title: Text(widget.title),
      ),
      body: Center(
        // Center is a layout widget. It takes a single child and
positions it
        // in the middle of the parent.
        child: Column(
          // Column is also a layout widget. It takes a list of children
and
          // arranges them vertically. By default, it sizes itself to fit
```

```
its
          // children horizontally, and tries to be as tall as its parent.
          //
          // Invoke "debug painting" (press "p" in the console, choose the
          // "Toggle Debug Paint" action from the Flutter Inspector in
Android
          // Studio, or the "Toggle Debug Paint" command in Visual Studio
Code)
          // to see the wireframe for each widget.
          //
          // Column has various properties to control how it sizes itself
and
          // how it positions its children. Here we use mainAxisAlignment
to
          // center the children vertically; the main axis here is the
vertical
          // axis because Columns are vertical (the cross axis would be
          // horizontal).
          mainAxisAlignment: MainAxisAlignment.center,
          children: <Widget>[
            Text(
              'You have pushed the button this many times:',
            ),
            Text(
              _counter.getValue().toString(),
              // Provide a Key to this specific Text widget. This allows
              // identifying the widget from inside the test suite,
              // and reading the text.
              key: Key('counter'),
              style: Theme.of(context).textTheme.headline4,
            ),
          ],
        ),
      ),
      floatingActionButton: FloatingActionButton(
        // Provide a Key to this button. This allows finding this
        // specific button inside the test suite, and tapping it.
        key: Key('increment'),
        onPressed: _incrementCounter,
        tooltip: 'Increment',
        child: Icon(Icons.add),
      ), // This trailing comma makes auto-formatting nicer for build
methods.
    );
  }
}
```

The *`Counter`* class will have an `increment()`, `decrement()` and `getValue()` methods available:

**counter.dart**

```
class Counter {
  int value = 0;

  void increment() => value++;

  void decrement() => value--;

  int getValue() => value;
}
```

# Implementing tests

Flutter allows several types of tests, such as:

- Unit tests, that validate a single function, method or class.
- Widget tests, that validate a single widget (referred as component tests in other UI frameworks).
- Integration tests, that validate a complete application or a large part of an application.

If you have doubts regarding Flutter and Flutter tests please check the documentation.

For the purpose of this tutorial we have defined one test of each type to demonstrate how we can integrate those with Xray.

## Unit Test

Unit tests are the closest ones to the code and they validate a unit of code, in this case a method: *`Counter.Increment()`*

These tests are executed with the build and do not require the application to be running.

**unit_test.dart**

```
// Import the test package and Counter class
import 'package:my_app/counter.dart';
import 'package:test/test.dart';

void main() {
  test('Counter value should be incremented', () {
    final counter = Counter();

    counter.increment();

    expect(counter.getValue(), 1);
  });
}
```

We are calling the method directly and validating that the value was incremented.

Once the code is done we execute it using the following command:

```
flutter test test/unit_test.dart
```

In order to integrate with Xray we want to extract the Junit report, for that flutter needs to use the `junitreport` Dart package. We need to specify it in the execution command that we are going to generate a Junit report, the execution command will be:

```
flutter pub get junitreport
export PATH="$PATH":"$HOME/.pub-cache/bin"
flutter pub global activate junitreport
junitReportFile="./junit-unit-report.xml"
flutter test --machine test/unit_test.dart | tojunit --output
$junitReportFile
```

The first three lines are there to install and activate the package, the last two lines will execute the tests and generate the "`junit-unit-report.xml`".

In the report we will find the result of the tests.

**junit-unit-report.xml**

```
<?xml version="1.0" encoding="UTF-8"?>
<testsuites>
  <testsuite errors="0" failures="0" tests="1" skipped="0" name=".Users.
cristianocunha.Documents.Projects.flutter.SF_flutter_demo.my_app.test.
unit" timestamp="2022-10-12T08:25:01">
    <properties>
      <property name="platform" value="vm"/>
    </properties>
    <testcase classname=".Users.cristianocunha.Documents.Projects.flutter.
SF_flutter_demo.my_app.test.unit" name="Counter value should be
incremented" time="0.027"/>
  </testsuite>
</testsuites>
```

## Widget Test

The next tests we have defined are the widget tests, tests that will validate a widget (component), for that we have defined the following test:

**widget_test.dart**

```
// This is a basic Flutter widget test.
//
// To perform an interaction with a widget in your test, use the
WidgetTester
// utility that Flutter provides. For example, you can send tap and scroll
// gestures. You can also use WidgetTester to find child widgets in the
widget
// tree, read text, and verify that the values of widget properties are
correct.

import 'package:flutter/material.dart';
import 'package:flutter_test/flutter_test.dart';

import 'package:my_app/main.dart';

void main() {
  testWidgets('Counter increments smoke test', (WidgetTester tester) async
{
    // Build our app and trigger a frame.
    await tester.pumpWidget(MyApp());

    // Verify that our counter starts at 0.
    expect(find.text('0'), findsOneWidget);
    expect(find.text('1'), findsNothing);

    // Tap the '+' icon and trigger a frame.
    await tester.tap(find.byIcon(Icons.add));
    await tester.pump();

    // Verify that our counter has incremented.
    expect(find.text('0'), findsNothing);
    expect(find.text('1'), findsOneWidget);
  });
}
```

Flutter have available special classes to assist on the validation of widgets, the *`testWidgets()`* function allows to define a widget test and creates *`WidgetTester`* to work with.

We use the *pumpWidget()* method of the *WidgetTester* to build and render our widget (MyApp), next we validate that the application will start up showing 0 in the counter.

We then tap in the plus icon and validate that the counter have now 1.

The widget tests loads a specific widget and, usually, do not require the application to be executed, if your widget depends on other widgets or resources they must be initialized also. In our case our counter application is simple enough that does no have any dependency.

Once the code is ready we execute the tests using the following command:

```
junitReportFile="./junit-widget-report.xml"
flutter test --machine test/widget_test.dart | tojunit --output
$junitReportFile
```

The JUnit report is generated and look like the below one.

**junit-widget-report.xml**

```
<?xml version="1.0" encoding="UTF-8"?>
<testsuites>
  <testsuite errors="0" failures="0" tests="1" skipped="0" name=".Users.
cristianocunha.Documents.Projects.flutter.SF_flutter_demo.my_app.test.
widget" timestamp="2022-10-12T08:25:16">
    <properties>
      <property name="platform" value="vm"/>
    </properties>
    <testcase classname=".Users.cristianocunha.Documents.Projects.flutter.
SF_flutter_demo.my_app.test.widget" name="Counter increments smoke test"
time="1.067"/>
  </testsuite>
</testsuites>
```

## Integration Test

The next level of tests are the integration tests and the way we will execute those tests will vary depending on the platform you are testing against. The goal of these tests is to verify that all the widgets and services being tested together work as expected.

As we want to target an Android device we have also installed Android Studio so that we have emulators available. Before executing the Integration Tests we need to start the emulator, please check Flutter documentation on Integration Tests to have more details about this.

Our Integration Test will initialize *IntegrationTestWidgetsFlutterBinding*, that is a singleton service that executes tests on a physical device, and use *WidgetTester* to interact and test widgets. This test will follow the same approach as the Widget Tests but now we are executing the application in a device and run the tests against it.

**integration_test.dart**

```
import 'package:flutter_test/flutter_test.dart';
import 'package:integration_test/integration_test.dart';

import 'package:my_app/main.dart' as app;

void main() {
  IntegrationTestWidgetsFlutterBinding.ensureInitialized();

  group('end-to-end test', () {
    testWidgets('tap on the floating action button, verify counter',
        (tester) async {
      app.main();
      await tester.pumpAndSettle();

      // Verify the counter starts at 0.
      expect(find.text('0'), findsOneWidget);

      // Finds the floating action button to tap on.
      final Finder fab = find.byTooltip('Increment');

      // Emulate a tap on the floating action button.
      await tester.tap(fab);

      // Trigger a frame.
      await tester.pumpAndSettle();

      // Verify the counter increments by 1.
      expect(find.text('1'), findsOneWidget);
    });
  });
}
```

To execute the test run a command that will execute the application on the target device and perform the tests against it.

```
junitReportFile="./junit-integration-report.xml"
flutter test --machine integration_test | tojunit --output $junitReportFile
```

> Remember that you need to have the emulator or driver running before executing the tests, please check more information here.

This command will also generate a JUnit report as we can see below.

**junit-widget-report.xml**

```
<?xml version="1.0" encoding="UTF-8"?>
<testsuites>
  <testsuite errors="0" failures="0" tests="1" skipped="0" name=".Users.
cristianocunha.Documents.Projects.flutter.SF_flutter_demo.my_app.
integration_test.integration" timestamp="2022-10-12T14:14:34">
    <properties>
      <property name="platform" value="vm"/>
    </properties>
    <testcase classname=".Users.cristianocunha.Documents.Projects.flutter.
SF_flutter_demo.my_app.integration_test.integration" name="end-to-end test
tap on the floating action button, verify counter" time="1.61"/>
  </testsuite>
</testsuites>
```

---

# Integrating with Xray

As we saw in the above example, where we are producing JUnit reports with the result of the tests, it is now a matter of importing those results to your Jira instance. You can do this by simply submitting automation results to Xray through the REST API, by using one of the available CI/CD plugins (e.g. for Jenkins) or using the Jira interface to do so.

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## API

### API

Once you have the report file available you can upload it to Xray through a request to the REST API endpoint for JUnit. To do that, follow the first step in the instructions in v1 or v2 (depending on your usage) to obtain the token we will be using in the subsequent requests.

#### Authentication

The request made will look like:

```
curl -H "Content-Type: application/json" -X POST --data '{ "client_id":
"CLIENTID","client_secret": "CLIENTSECRET" }'  https://xray.cloud.getxray.
app/api/v1/authenticate
```

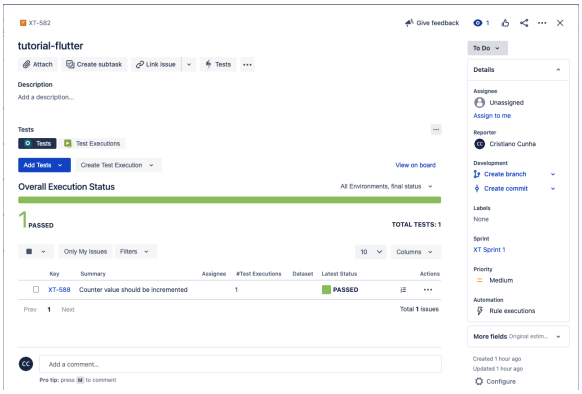
The response of this request will return the token to be used in the subsequent requests for authentication purposes.

#### JUnit XML results

Once you have the token we will use it in the API request with the definition of some common fields on the Test Execution, such as the target project, project version, etc.

```
curl -H "Content-Type: text/xml" -X POST -H "Authorization: Bearer
$token"  --data @"junit-unit-report.xml" https://xray.cloud.getxray.app/api
/v2/import/execution/junit?projectKey=XT&testPlanKey=XT-582
```

With this command, you will create a new Test Execution in the referred Test Plan with a generic summary and one test with a summary based on the test name.

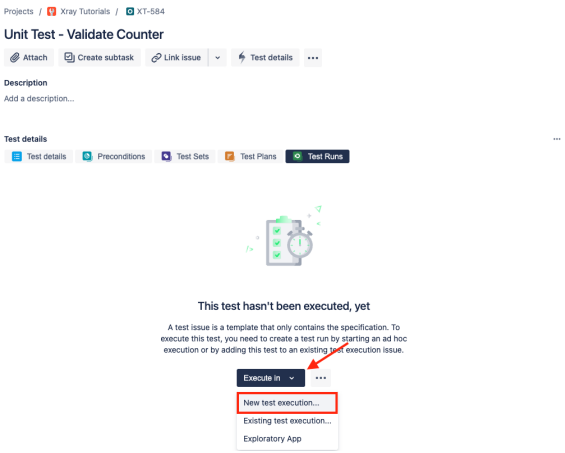



# Jira UI

## Jira UI

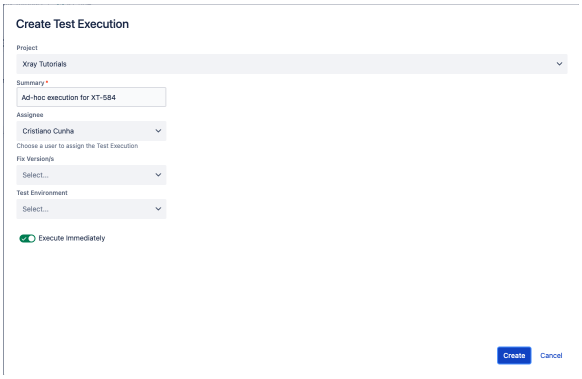
1

Create a Test Execution for the test that you have



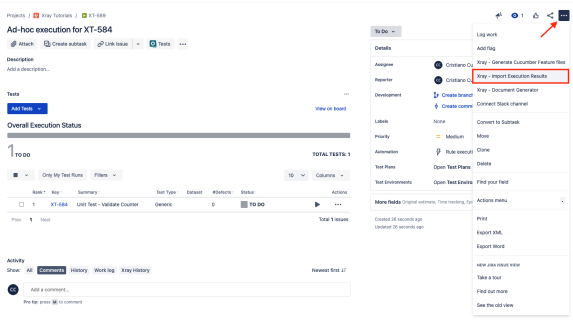

2

Fill in the necessary fields and press "*Create*."



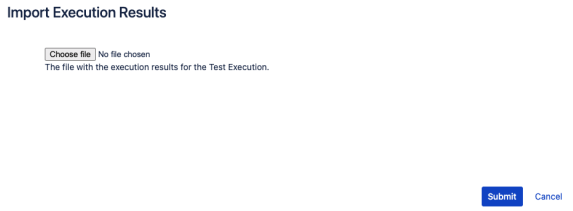
3

Open the Test Execution and import the JUnit report.



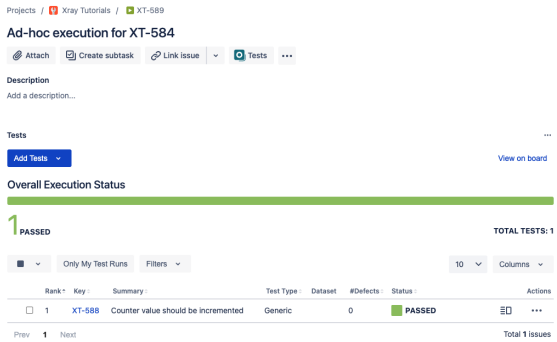

4

Choose the results file and press *"Import."*

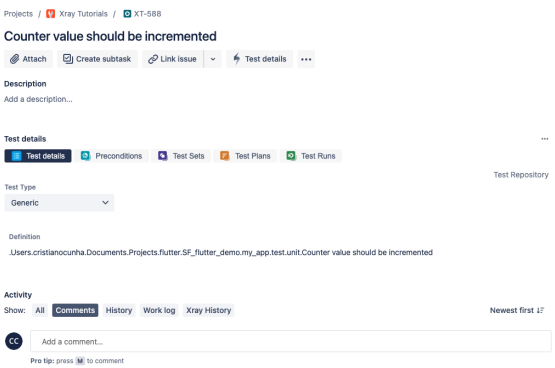



5

The Test Execution is now updated with the test results imported.

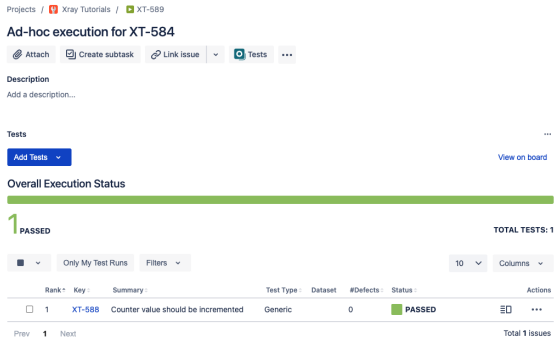



Tests implemented will have a corresponding Test entity in Xray. Once results are uploaded, Test issues corresponding to the tests are auto-provisioned, unless they already exist.

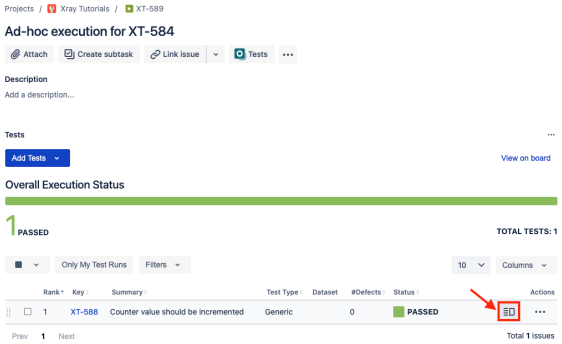



Xray uses a concatenation of the suite name and the test name as the the unique identifier for the test.

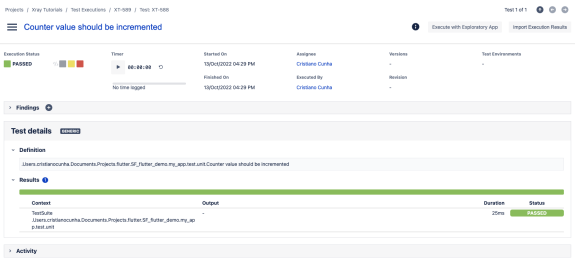
In Xray, results are stored in a Test Execution, usually a new one. The Test Execution contains a Test Run per each test that was executed.




Detailed results, including logs and exceptions reported during execution of the test, can be seen on the execution screen details of each Test Run, accessible through the *Execution details*:




As we can see here:




# Tips

- after results are imported in Jira, Tests can be linked to existing requirements/user stories, so you can track the impact of their coverage.
- results from multiple builds can be linked to an existing Test Plan in order to facilitate the analysis of test result trends across builds.
- results can be associated with a Test Environment, in case you want to analyze coverage and test results by that environment later on. A Test Environment can be a testing stage (e.g. dev, staging, preprod, prod) or an identifier of the device/application used to interact with the system (e.g. browser, mobile OS).

# References

- https://flutter.dev/
- https://docs.flutter.dev/testing
- https://github.com/TOPdesk/dart-junitreport
- https://developer.android.com/studio/intro